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California's Plan for Fuel Standards and Clean Vehicles: Impact on Emissions, the Economy, and Public Health

Assembly Committee on Transportation

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ASSEMBLY COMMITTEE ON TRANSPORTATION

HEARING ON

**CALIFORNIA'S PLAN FOR FUEL STANDARDS
AND CLEAN VEHICLES: IMPACT ON
EMISSIONS, THE ECONOMY, AND PUBLIC HEALTH**

February 14, 1994
State Capitol
Sacramento, California



**HONORABLE RICHARD KATZ
CHAIRMAN**

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Honorable Martha Escutia
Honorable Robert Frazee
Honorable Jan Goldsmith
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Informational Hearing

ASSEMBLY TRANSPORTATION COMMITTEE

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CHAIRMAN KATZ: Let me make some brief comments and then we're going to go on with the schedule as it's outlined on the agenda. The only change in the agenda is we're going to move Secretary Strock up after Doctor Currie, trying to accommodate his schedule. He's promised me that right after he does that, he's going to go resolve the smog check problem.

California has traditionally led the country in cleaning up air emissions. We continued this tradition with the implementation of the clean diesel program last fall, with our heavy vehicle smoke reduction program, and with other vehicle-related clean-up programs. We're considering today two programs which are crucial to cleaning up our air. The low-emission, zero-emission vehicles or ZEV program as it is known, and the Phase II reformulated gasoline, or RFG program.

Last year, the Committee stopped a bill which would have rolled back the clean diesel regulation. We held firm not only because clean diesel improved air quality, but because we believe that changing regulatory course in mid-stream is unfair and harmful to the business climate in California. Unfortunately, the

implementation of clean diesel brought much controversy and pain. We in the Committee were aware of that and concerned about it. This hearing is designed to prevent future controversy about the ZEV program or the RFG program. California's plan to require 2% of the vehicles to be zero-emission by 1998 has already been endorsed by the northeastern states and has led to vigorous job creation activities in our state. But that requirement is under attack. We want to hear from those who are creating jobs to meet the mandate and those who oppose the mandate.

What the Committee must consider is where is the future of the auto industry. This is really what I believe this debate is about. I believe to some extent it's about batteries and electric cars, but the greater reality in my mind at least is: where's the future of the auto industry--in Detroit or in California? The sub-text that underlines this discussion is where are we going to be building the transportation vehicles of the future. Most of us on the panel, frankly all of us, would vote for that to be California. The question is: How do we get there? If we hold firm on the ZEV mandate we will likely bring that next generation of automobile development to California. And again the question has to be asked--and that is part of the hearing today: What message are we sending to the business community that is now investing in low-polluting or zero-polluting vehicles if that mandate is changed mid-stream? Even more immediately important to our constituents is the transition to Phase II reformulated gas in '96. RFG's an extraordinarily effective way to clean up the air. If the transition is rocky, it will make the clean diesel troubles

look like a Sunday picnic. We need to hear from the regulators and from the industry about the transition. How can we ensure that we will not experience the transition pains that we saw with clean diesel?

For both these regulations we need to ask: If we delay or change them, what other steps must we take to meet the steps towards deadlines to clean up the air? It's my belief that the alternatives to these regulations would be harmful to our state, both from an air standpoint and a business standpoint. California is at a turning point. We can clean up our air and rebuild our economy if we have the courage to stay on the course. I, frankly, reject those who would try and convince us that you have to choose between clean air and jobs. To me, that is like choosing to eat on Monday and breathe on Tuesday. We have to find a way to have both clean air and jobs. I think these regulations are one way to get there. I think that the work that has been done, and we will hear about today, is part of getting us there.

There will be bills that we will hear later in the year. I know Mr. Richter has a bill; I assume there will be others. We will be working out bill schedules with Assemblyman Sher's committee. We will not do joint hearings of the committees, but we will work with the authors to ensure that we have as many witnesses as possible and we make it as easy as possible for people to testify here in Sacramento.

That is essentially what this hearing is about today. Again, what we're interested in hearing is from those involved in this effort, both those who think it's going in the right direction or

those to think it's not. What I'm trying to avoid is having someone else sit here in 1996 or 1997 and hear from everyone who says: We would have loved to have met those 1998 deadlines, but it's just too late now. If only someone had said something to us in '94 or '95, or had asked what we could have done back then. We're trying to avoid that happening this time by getting ahead of the curve and saying: This is a mandate for 1998. What is it going to take to meet it? What is it going to take to make it practical? What's the impact on jobs for Californians in meeting that mandate?

Are there Committee members who wish to make statements? If not, we will start with the agenda. We will start with Dr. Malcolm Currie, who is the Chairman Emeritus of GM Hughes, and the Co-chairman of Project California. We will follow that with Jim Strock, Secretary of Cal-EPA. Then go on with the rest of the panels as outlined in the agenda.

Dr. Currie, I appreciate your being here and appreciate your juggling your schedule. I know it wasn't easy.

DR. MALCOLM CURRIE: Thank you very much Mr. Chairman and members of the Assembly Committee on Transportation for this opportunity to appear before you on this very important issue regarding California's clean air standards and the related enormously promising electric vehicle industry. In these brief remarks, I would like to emphasize just four major points.

First, the California Air Resources Board regulations relating to the so-called zero-emission vehicles, and ultra-low emission vehicles have acted as a powerful stimulus for investment

in entrepreneurial activities across the state in both large and small companies for the creation of new jobs in California. Pragmatically, no matter how the regulations happen to come about, they have in fact constituted a very powerful socio-economic instrument for the development of our state's economic environment as well as our quality of life.

Second, tough goals drive technological progress, invention and competition. They drive entrepreneurial activities like those now taking place in California, which you'll hear about here, which are a direct result of government leadership in establishing these goals. An exciting and revolutionary industry is being born which uniquely fits our state's industrial and intellectual capabilities. I believe that a large consumer-driven market will evolve over the next decade or so from what is now an initially legislatively driven market.

Third, powerful, traditional automobile manufacturers apparently view all of this as a threat rather than as an opportunity. Together they are using implied economic coercion and fear to scuttle California's clean air rules to stem the tide, and to postpone indefinitely the advent of this very large industrial transformation. I'll indicate why I believe this is unnecessary and why, in fact, it is detrimental to their own interests.

Finally, at the end of the day, we must ask ourselves: What is best for California? California should not fold on this issue. It should not give up its internationally-recognized, role-model position. In doing so we would not only lose this leadership, but

would also be relinquishing an important economic opportunity for industry and jobs and would be sending a negative signal which would further impair our state's business climate.

In making these points, Mr. Chairman, I have no personal ax to grind. I act as an individual seeking what is best for rebuilding California's future. As an industrialist, I participated in the automotive industry as well as in the aerospace defense industry. I also have been heavily involved in defense diversification and in fact, personally started the group that developed the propulsion system for GM's Impact electric vehicle that since has grown into a very large activity here in California. I also act as co-chair of Project California. We're handing out some information on Project California.

Project California is a state-wide program whose goal is to create new industries and jobs by establishing California as a world leader in advanced transportation and related telecommunications systems for people, goods, services and information. These objectives also contribute directly to our state's environmental and societal goals. Project California is guided by a select panel of 26 distinguished leaders in industry, academe, government and labor from across the state. It is bipartisan and its ambitious action agenda received the endorsement of California's political leadership with the recent signing of a California declaration of leadership in advanced transportation and related telecommunications. This was signed by the Governor, by the Speaker of the Assembly, by the President Pro Tempore of the Senate, and by the minority leaders. This

constitutes a landmark commitment by California. The bottom line, of course, is not just advanced transportation, but advanced infrastructure which will attract new industry and an improved environment. The bottom line also is jobs. Project California through extensive studies of markets and technologies through surveys, through studies of policy impediments and incentives, and study of the practical creation of self-reinforcing industrial clusters in California projects a realistic attainment of some 200,000 direct jobs by the year 2000 in various areas of advanced transportation and some 400,000 jobs plus a 200,000 tertiary jobs by the year 2010. This is based on a fairly conservative market share. These are good jobs at good wages. The development of an active and growing electric vehicle and alternative fuel industry cluster in California is a significant part of this vision. Project California projects an electric vehicle and related market of several billion dollars in California alone by around the turn of the century and some 75,000 jobs which are electric vehicle-related by year 2010. A major part of the job creation strategy is to build directly on the large anchor market in California.

As I mentioned earlier with the stimulus provided by the car regulations, the technologies are evolving very rapidly in batteries, fly-wheel storage systems, fuel cells, motors, high-powered semiconductor electronics, and materials. First generation commuting electric vehicles having ranges of around 80 miles exist now, and super low-emission hybrid electric vehicles with ranges of hundreds of miles within a few years are being

developed. In addition, the utilities are actively working to establish a dispersed infrastructure for charging vehicles which will create customer confidence and acceptance in the first generation limited-range vehicles. CALSTART, which you'll hear from, is an important facilitator in all of these industrial activities.

Now let me just return very briefly to two of the points that I made earlier. Frankly, as a businessman, I have not always supported specific air quality regulations in California which sometimes seem to be expensive ways to achieve improved air quality, per se. However in the case of the particular clean car regulations which are the subject of this hearing, environmental and economic policies obviously are closely linked together. Now we can argue endlessly. For example, whether electric power plant emissions should be taken into account analytically in defining tail pipe standards. We can argue whether scrapping all the earlier vehicles, pre-1980 or pre-1978 could achieve a similar environmental result more cheaply. But I think this is the key point, and that is, that this bold and admittedly somewhat arbitrary mandate will have both a positive economic, as well as an environmental impact on the state. It is entirely reasonable to view this mandate as a broader socio-economic instrument for the development of California. And indeed this is taking place. The fact that its intention and goal is broader than environmental alone should be understood and should be encouraged.

Now let's look for a moment at this from the point of a large auto manufacturer. They recognize that the consumer acceptance of

first-generation electric vehicles that is the exact size of the market and the exact rate of growth of that market is uncertain at this time; but we don't know that accurately. Further, if they approach it traditionally and design new vehicles from the ground up in traditional ways and then tool up to produce them and then amortize the large investment over the relatively few vehicles, this obviously leads to high unit costs in the beginning. No question about that. It is then, predictably concluded that this is a bad business deal--at least from a pure financial viewpoint. Given this scenario, as a businessman, I'd agree. With this conclusion the reaction is then band together to launch a massive well-funded campaign to defeat the CARB mandates or to try to postpone them indefinitely, promising to continue to work on technologies for the future "when the world is ready". Further, as part of their united campaign they make economic calculations using fairly static models and ascribe an enormous added consumer costs or implicit taxes and subsidies and losses of jobs as the price we all have to pay for their having to respond to the regulations. Based on previous precedents, this is a tried and true formula for rejecting new developments. This is in fact what is happening and what this particular hearing is all about.

But let me just suggest for a moment a different kind of approach more in tune with our times. For example, an enlightened automotive leader might ask the following questions: How can we meet this challenge and creatively turn it into a great opportunity instead of a potentially costly threat? How can I use it to my competitive advantage? How can I meet the requirements

gracefully in a drastically reduced investment? For example during this transition period, from a legislative-driven market to a consumer-driven market, can I advantageously evolve by converting one or two of my existing great-looking, fully-tooled and mass-produced models to electric propulsion in limited quantities? Can I assemble them or help an entrepreneurial organization to assemble and test them for me in California? Can I thereby gain a competitive image and position and at minimum investment understand factors involving consumer acceptance and the evolution of the marketplace? Can I also thereby get a jump on my competition from Europe and Japan where intensive work on electric vehicles is occurring? I can only note that anything new which disrupts the past has historically always had to overcome the entrenched interests and entrenched methods of thinking. That is why new companies grow and older ones that can't adapt decline. There are many examples of this obviously around us in our rapidly changing world.

So in closing, Mr. Chairman, let me just say that in my professional technical and business judgment, we are on the threshold of a new industry in which California can participate and realize great economic as well as environmental benefit. California is uniquely positioned to leverage its tremendous investment in aerospace and defense and other high technology industries, in its laboratories, universities and manufacturing capacities. We need this kind of positive uplift and vision in California. I can tell you first hand that there are today well over a hundred firms directly involved across the state in

electric vehicle technologies. They are building promising enterprises as you'll hear this afternoon. I can tell you that this also is an important contribution to so-called defense conversion. An enlightened public policy by Californians for California is providing a powerful kick start for this activity. We should not retreat from our position before the eyes of the world. They're all focused on California on this. In the face of external business interests, we're doing business in a traditional way and not contributing to our state's economy. We should not waste the investments already made and the positive momentum we now have and which we badly need in California at this time. The state and its industry need consistent policies. We need a firm sense of consistency of purpose from our government leaders. We need to stay the course that we have set. This would just be a hell of a time to blow this opportunity. Thank you very much, Mr. Chairman.

CHAIRMAN KATZ: Dr. Currie, thank you. Is there any doubt in your mind that without the '98 deadline those 100 companies wouldn't be here doing that business in California?

DR. CURRIE: That's correct. They wouldn't be making the investments. It's in the anticipation of a new threshold of a new industry that causes private sector investment. I think Mike Gage here next on our panel will quantify those investments.

CHAIRMAN KATZ: There's a familiar ring. As you were going through it I was thinking about, having sat through--having chaired this committee since 1985, the comments about they're too expensive, they're unreliable, consumers don't want them, makes me

think back to the hearings we did on airbags. We did them ten years after they were available. We were doing them in the mid-eighties. They've been available since 1974. It seems to me certainly that we're sort of running through all that again.

DR. CURRIE: The birth of a new industry is very difficult at best, historically. It takes advocacy; it takes a little bit of patience; it takes over-coming, as I mentioned in my prepared remarks, entrenched interests and huge entrenched investments. So it's no wonder I sympathize. But again I point out there's more than one way to skin a cat. I just don't think they've looked at that yet.

CHAIRMAN KATZ: It's an analogy that makes me a little nervous. One of the complaints or charges that we hear most often in terms of the business climate in California in making California business friendly is regulations that change mid-stream. They get hard for the business community to count on. I would assume that's got to be a consistent argument, whether it's a regulation designed to spur an industry or it's a regulation designed to control an industry. I would assume that changing the '98 ZEV requirement mid-stream sends a terrible message to those 100 and other companies.

DR. CURRIE: That's absolutely true, Mr. Chairman. There's nothing more disasterous to the private sector and private sector investment than stop and start and muddle around. I think we have to be constant on this one and stay the course.

ASSEMBLYMAN PETE KNIGHT: Thank you Mr. Chairman. You indicated that California should be a leader and certainly I think

California is a leader in industry and in a number of other areas such as regulations associated with business. Are there any regulations or are there any controls on this industry that you can see that might be, should be enacted or removed in order to support this kind of an industry? In other words, your charter should be developing an electric car. But I assume there are other controls.

DR. CURRIE: This CARB clean air regulation involving both ZEVs and ultra-low emission vehicles has unleashed a tremendous amount of entrepreneurial energy across the state--entrepreneurial activities, private investment. First of all, that has to be maintained. Now, this private investment..

ASSEMBLYMAN KNIGHT: But in that charter are there other conditions that impede that kind of development?

DR. CURRIE: No. I think as long as we stay the course on that one, it'll come into being.

ASSEMBLYWOMAN BETTY KARNETTE: You mentioned Europe and Japan. Do you have any information on how far along they are right now?

DR. CURRIE: Both Europe and Japan are looking on California. California has become kind of their center of the world as far as this burgeoning new industry is concerned. Every automobile company in Europe and Japan, as far as I know, have intensive internal efforts onn electric vehicles, or hybrid electric vehicles in this category. You will see them start appearing in Europe, imminently.

ASSEMBLYWOMAN KARNETTE: Could that be a potential market for

us?

DR. CURRIE: Absolutely. The whole strategy here is to make use of the anchor market which exists in California because we have a requirement for these automobiles. We have a requirement for clean air here in California. Then export this technology. There is no reason why we can't be an exporter from California after we build a solid industrial base, based on our own anchor market.

ASSEMBLYWOMAN KATHLEEN HONEYCUTT: I'm all for unleashing private entrepreneurial spirit in California, but there has been some concern that private and business rate-payers would subsidize it [break in tape] ...\$2.2 billion. I just want you to elaborate a little bit on this.

DR. CURRIE: I just don't know where those numbers came from. I'd have to see how they were calculated. Typically, large bureaucracies have a way of setting up mathematical models that can predict disaster. You give me the answer and I'll develop the analyses to justify your answer. So, I don't know where this is coming from. I can tell you that there's a lot of private investment taking place here. I don't know of any particular subsidies. There will be a few at the federal level on the price of cars up to \$4,000, I think. But it's fairly minor. Now the electric utilities will need to build a new kind of infrastructure. That infrastructure for charging electric vehicles and that will have to be dispersed geographically. But in my mind, that's a very legitimate investment on their part because they are distributing the power.

ASSEMBLYWOMAN HONEYCUTT: I guess what I was referring to was the Public Utilities Commission portion of the proposal where the rate-payers and not the shareholders would fund the purchase of batteries (break in tape) ...research (break in tape) I didn't see any shareholder matches from private enterprise.

DR. CURRY: Private enterprise is investing. In the course of the panel, we'll bring that out. The distribution of electric power, for example, is a legitimate charge in the base rate of utilities. But it's not anything like the numbers that you just quoted. I don't know where that came from.

CHAIRMAN KATZ: Let me next turn to Jim Strock who is Secretary for California Environmental Protection Agency. Just so people know how we're going to go, I'm going to bring up groups of three after Mr. Strock. First, Mike Gage, Bill Craven and Barbara Levin. The second group would be Joe Barrington, Jim Quillen and Carl Perry. The third group Andrew Card, Greg Dana and David Montgomery, to complete the first part of this hearing on the zero-emission mandate.

JAMES STROCK: I will certainly keep my comments brief, Mr. Chairman. [break in tape] ...As you review the status of the reformulated gasoline rule and the low- and zero-emission vehicle requirements of the coming years. I would like to discuss briefly three issues. One is the environmental aspects of these rules, the second are the economic aspects, and the third are the regulatory next steps. Governor Wilson remains fully committed to the reformulated gasoline rule, as well as the low- and zero-emission vehicle regulations and schedule. The environmental

challenge of clean air apparent to all of us here can best be met through advancements in transportation technology. There is also, as Dr. Currie pointed out, a tremendous economic opportunity. The Governor would like to work with you to assured continued progress in both of these areas.

First as to the economy. Because of the scope of the air quality challenge, some understandably flinched at any proposed decisive action, but that would be a grave mistake. Those who would compromise the vehicle emission's limits should answer the question, "How would they propose to cut emissions?" Because if progress is not made from advanced transportation technologies the difference will have to be made up from additional restrictions on emissions from so-called stationary sources. That's a bureaucracy term for factories, dry cleaners, foundaries, print shops, bakeries, oil refineries and the like. Indeed the jobs of Califonrians could be placed unnecessarily at risk.

The second issue though, is the economic opportunity these present because as Dr. Currie pointed out, these regulations not only avoid unnecessary economic costs, but they could help us seize tremendous new economic opportunities. These technologies would build upon the state's competitive advantages in various areas--the high-tech academic and industrial base, the large state markets, and most importantly, the innovative and industrious individuals who come here from across the world. Recently, as the Committee is no doubt aware, the Ozone Transport Commission created by the federal Clean Air Act voted to adopt much of California's advanced transportation air regulations for the New

England and Northeastern states. When one looks to the future, whether to New England or New Delhi, low- and zero-emissions vehicles will certainly have a place and as far as possible, they ought to come from California. I would also add, as you will hear today, a tremendous number of leadership people in industry and outside who focus on the bottom line, will discuss the whole series of potential job-creating aspects of keeping these regulations on course.

Finally, Chairwoman Schafer will speak in greater detail about the regulatory under-pinning for this regulation running the gamut from the reformulated gasoline on all the way to zero-emission vehicle mandates. ARB is currently planning, and she'll discuss in more detail, the next in a series of technical reviews of the ZEV regulations this spring. Governor Wilson recognizes that the most important work in this quest and at this point will not come from lawyers and lobbyists, as important as they are, but by engineers and scientists and hard-headed business leaders who require certainty for investment purposes. I know that many of those who will testify today are also planning to testify at the technical review by the Board; and they are certainly well able to have confidence that the technical review will be just that--a review based upon technical merit and analysis. With that Mr. Chairman, thank you for the opportunity to testify. I'd be pleased to answer questions or refer difficult ones to Ms. Schafer.

CHAIRMAN KATZ: I understand that. Mr. Secretary, I appreciate your coming. Just to restate this--I think it was

important. Your comment in your being here is indicative of the Governor's commitment. I believe you said this so no one misunderstands--that the Governor is committed to both the ZEV requirement and the reformulated fuel requirement and the time lines that are laid out as we have them in law today.

MR. STROCK: Yes, he's committed to the regulations. As you know, Mr. Chairman, those regulations, I think, were wisely drafted to take into account new information as it comes and they provide the kind of flexibility that is needed also with the certainty of the

CHAIRMAN KATZ: I appreciate that. I think that's an important message, consistent with what Dr. Currie was saying earlier that people understand that we are committed to moving ahead. And that the Governor is committed to moving ahead. Even though there will be some debate about that through the course of this year, I appreciate the Administration being out front like that.

Questions from Committee members.

ASSEMBLYMAN BRUCE MCPHERSON: Are there any indications that the ARB is going to change its standards of regulations in any way as regard to this? Is there anything pending?

MR. STROCK: Not to my knowledge. Again, Mr. McPherson, to be clear. What the ARB does as part of the regulation this year will be to have a technical review, to hear from many of the people here today on all sides who have technical data as to the feasibility, for example, of the various technologies for batteries. They will hear from those and consider on the record

of how they will proceed.

CHAIRMAN KATZ: Anybody else? I guess they decided to leave the tough ones for Ms. Schaefer when she comes up. Mr. Secretary, I know you have a busy schedule and I appreciate your being here. I'm going to be here so you can have the feds this afternoon.

Now, if I can have the first grouping that I mentioned earlier, to come up. Mike Gage, who's the President of Calstart, Bill Craven, who's the Vice President of Horizon Battery, and Barbara Levin, Special Projects Coordinator for Ovonics Battery. I believe the slides are Mr. Gage's. Mr. Gage, welcome back. There's so many new members here who may not be aware that Mr. Gage once occupied a seat up here. He was a former of this body before he saw the wisdom of moving from Napa to Los Angeles which, frankly, escapes most people. Welcome, Michael.

MIKE GAGE: Thank you Mr. Chairman. I'd like to compliment you on the economic stimulation this committee hearing has brought forth today.

CHAIRMAN KATZ: Southwest Airlines also thanks everyone, I think.

MR. GAGE: Mr. Chairman and Members of the Committee. This slide may say best why CALSTART exists and why the over one hundred companies that are actively involved in CALSTART are actively working toward a new industry. Two-thirds of the problem comes out of the tailpipe. Not only is this a problem in California; its a global problem with cars expected to double in the next 20 years around the globe. Not only are cars increasing geometrically, but the number of miles driven is increasing

dramatically again around the globe. But even in the U.S., up to 50 billion miles each year. That sort of potential market is what caused the board of directors of CALSTART to come together, a true public/private cooperative effort from the state's Energy Commission, to public transit agencies, to the utilities, to the aerospace industry, to small entrepreneurs, to the Natural Resources Defense Council, and the International Association of Machinists. We come together in a collaborative effort to create a new industry for the state of California. Our participants are from all over the state. We started with 40. We've grown in one year to over 85 in the greater Los Angeles area, in broader Southern California, and across northern California, actively growing... Well, we doubled last year; we believe we'll double again in size this year because of the effort and the interest.

CALSTART is about creating a technologies industry, if you will, a components and subsystems industry in the State of California. These 20 components were part of the showcase electric vehicle that rolled out in showcase those California technologies around the world. In addition, we've rolled out an electric mass transit bus and we're moving toward rolling out this most advanced electric bus in the nation by June or July of this year.

In addition, we're even developing what's called a "running chassis". A common platform for many different vehicles, many different skins and interiors to go on that is dramatically driving down the cost of entry into the EV market. But we don't just deal with EV's. We're also dealing with hybrid electric

vehicles and natural gas vehicles as we move forward in advanced transportation industry for the state.

All sorts of technologies are coming out of this ZEV mandate. The ones you've seen today--a fuel-celled bus that was produced by a Vancouver business with the help of San Diego and southern California businesses. Flywheels or mechanical batteries that may, frankly, jump over chemical batteries very soon--looking very promising. But battery development of a dozen different kinds is escalating dramatically, not just at the US Battery Consortium, but in fact, outside of the Advanced Battery Consortium that is controlled and dominated by the big three. It just happened that we got into the defense conversion business. We didn't expect to be defense converters; we wanted to tap the defense and aerospace industry for their knowledge base and their skills. Well, it turns out that we're probably converting more technologies from the defense and aerospace industries to commercial applications than anyone in the nation. These 16 are examples of current defense applications being converted to advanced transportation technologies.

These are our program areas in electric vehicles and hybrid electric vehicles, natural gas vehicles in our research and development arena and in services that we're providing to all of these businesses that have an active interest in advanced transportation.

You've heard from Dr. Currie about the projections of the numbers of jobs related to advanced transportation. Seventy-four thousand by the year 2010 in EVs alone, over 400,000 in advanced

transportation. Those are real numbers. We can attest from a recent survey of our participants. They believe they will hit the 900,000 number by the year 1998. But CALSTART to date--this slide was made a week ago and it's already out of date because with additional information in, it turns out there's a quarter of a billion dollars already invested in the electric or advanced transportation arena--not just electric, but natural gas and hybrid--already to date.

Mr. Chairman, we polled our 90 companies that are actively involved and we only received responses from 33 of them--about 1/3 responded--and they showed us that to date there has been an investment of over 1/4 billion dollars. The jobs created, the single line goes up. Over a thousand jobs saved or created. They estimate that we go up to about 3,000 jobs by 1996, and escalate dramatically to about 9,000 jobs by 1998, and a total investment of about \$800 million by those 33 companies. That's not the total industry in this state.

But it's not just restricted to California, folks. As you can see, all of those red and blue dots are active consortia pursuing advanced transportation technologies. One of the reasons the northeastern states adopted the LEV standards is because they believe it's technology-forcing, as well, and that not all of this development is going to happen in Detroit. In fact, there are electric vehicle prototype developers and producers throughout the nation and I'm going to guess that if you were to hold this hearing six months from now, we'd see twice that number of red dots on the map of the US. So, what's really out there? Well,

General Motors has made, frankly, a stunning good car. The GM Impact is one of the best purpose-built electric vehicles on the road today. This is a Ford EchoStar that uses sodium sulphur batteries. When you hear high prices, it's because a sodium sulphur battery is extraordinarily high-priced. The Chrysler TVan, the Electric Car GEO Prism, and the Electric Car S10 Conversion. And then we move the northeastern states and Selectria's Concept Car and their GEO Storm Conversion. This is a Renaissance Car and Florida's Traffic Car, an \$11,000 electric vehicle. It happens to be a kit car, but nonetheless, when you hear these quantum numbers, you have to ask yourself, who's talking to whom about what.

When you move overseas, it begins to get more interesting. Mercedes is aggressively pursuing electric vehicles. This is their 190E that's electric-powered. Their Vision A which was showcased at the LA Auto Show this year, we're told, will be brought to market by 1997. The BMW E1 is being crash-tested right now; the BMW E2; the Volkswagen City Stormer. We also know that Volkswagen announced at the Detroit show earlier this year that they will be bringing the old Volkswagen Beetle back in a reconfigured way as an electric car. They can do it by 1997 as well. Fiat's Panda Electra, Renault's ____, the Citroen AX. And I might add that Citroen has said they will bring a minimum of 5,000 of these to market by 1995. The Swiss Hosenblitz, the Danish Keewit..

CHAIRMAN KATZ: These are all cars you can put in your pocket, I guess.

MIKE GAGE: Well, a couple of them are. This one you cannot

put in your pocket, Mr. Chairman. It's a very big Mercedes truck. When you move across the ocean to Asia, it gets a little tougher to get information. Nonetheless, we know for example, Honda took their entire Formula One team, stopped Formula One racing and said, "You folks go do electrics". That's what they're doing now. This is their EVX. This is the Nissan FEV. The Toyota Town Van, also electric. The Toyota EV50. I will say that our experience with a lot of offshore folks is they don't show what they're really going to do until they do it. They're very good at that.

You'll hear a lot about cost, Mr. Chairman and Members. This is from the U.S. Department of Commerce. This is the cost curve for the auto industry at the turn of the century as they began. Prices fell 85% in 15 years, but we think a more relevant cost curve today is the cost curve for the micro computer industry where the price falls 80% in six years. Now, you're also going to hear again about expensive these cars are. This happens to be a Mark VII Lincoln motor and a transmission that goes with somewhere between four and six thousand moving parts on traditional internal combustion cars. This is an electric motor with a single moving part and a transmission to go with it would be somewhere between six and eight gears and a gear reduction box. You all have to tell me how this ends up being as expensive as folks suggest it is, because I can't figure it out. General Motors slides that they used to show--they don't show these anymore--shows that the typical driver drives less than 25 miles in any given day. Let's take it up to 75 miles, triple those number of miles. Nonetheless, most EVs today can handle that rate.

Another General Motors slide, again one that they don't show anymore, shows that current California population with no incentives, 17% that they say is a bad number, but almost one-fifth of the California public is actively interested in zero-emission vehicles today with all the down size. Yet if you add a \$5,000 price incentive and a couple of thousand dollars in ownership incentives--by the way, half of which is at least already in place--68% to 70% of the California public take an active interest. Well, again we think there's an active interest out there today. You also hear about what the Ozone Transport Commission did. This is why. If you look at the zero-emission of electric vehicle numbers, the ULEV numbers that happened in 1997 and the LEV numbers that happened 1997, the fed LEV numbers were offered by the auto industry as something that the Ozone Transport Commission should adopt to clean the air. As you can see, the fed LEV at 2001 is not as clean as our basic LEV in 1997.

CHAIRMAN KATZ: Mike, the standard that is required in those years is which number?

MIKE GAGE: Moving across for each emission, and what was offered to the Ozone Transport Commission was fed LEV in the year 2001 not 1997. And it's not nearly as clean as LEV in 1997. Just taking one of our utility service territory, Southern California Edison...

CHAIRMAN KATZ: Mike, just back up for a second. For folks who haven't been as involved, ULEV is ultra-low emission vehicles...

MIKE GAGE: ...ultra-low emission vehicles. We have one, I

believe, certified in the state. I'm sure Jackie Schaefer can testify to that. I believe it's a Dodge Ram Van that is certified as a ULEV and it's natural-gas driven, which we were very supportive of.

ASSEMBLYMEMBER JAN GOLDSMITH: Your numbers on the electric vehicle emissions, does that include the pollution generated by creating the electricity?

MIKE GAGE: That is the pollution generated.

CHAIRMAN KATZ: The vehicle is zero itself, so the numbers on the screen will reflect the overall composite picture.

MIKE GAGE: Looking to just Southern California Edison's territory, assuming a 15,000 ton increase in emissions by 2010 will generate a 48,000 ton reduction, or roughly 46,000 tons out of the air--not a bad exchange ratio.

Let me summarize by saying there are enormous benefits to EVs, but perhaps the best is that there is no deterioration in emissions over time and none of the others can say that. No deterioration in emissions over time. And frankly as we clean up our power plants even more, it just gets better. None of the others can say that.

Finally, the numbers of vehicles and miles driven are increasing geometrically. Electric vehicles are essential to clean--not just California's air--but the world's air. Prices and life cycle costs are dropping, and dropping dramatically. Manufacturers around the world are designing and producing many different types of EVs, hybrid electrics and natural gas vehicles. Technology is improving literally as we speak. It is stunning the

level of innovation going on today driven by this mandate. And we need some consistent policy both from state and federal government. And we know that this state will dramatically benefit from these zero-emission mandates.

Thank you.

CHAIRMAN KATZ: Thank you. For those who are not familiar, CALSTART is not a proprietary company, it does not own technology itself, and benefits as a corporation not at all from the development of the technology in a profit sense.

MIKE GAGE: That's right, Mr. Chairman. We are a public/private non-profit entity here to facilitate the development of an industry in the State of California. That's our role.

CHAIRMAN KATZ: Questions from Committee members. Mr. Hauser.

ASSEMBLYMAN DAN HAUSER: I know you said this, Mr. Gage, but I just want it reenforced for emphasis. Absent the ARB requirement, the jobs that are being created through this program would cease to exist.

MIKE GAGE: Mr. Chairman, I think the fairest way for me to say that is, it is my belief that if the mandate were repealed, the genie's out of the bottle, and the industry will continue to move ahead in other states and in other countries, but it would have a dramatic impact on California jobs. It would throw those businesses that have begun to invest because of this into turmoil. And, yes, I believe it would undermine the efforts to bring it to market and essentially throw it to international

firms.

CHAIRMAN KATZ: Mr. Gage, thank you, appreciate the presentation. Next I'd like to call on Bill Craven who is the Vice President for Horizon Battery which I believe is out of Texas.

MR. BILL CRAVEN: Thank you, Mr. Chairman and Committee members, for having me here today. What I'd like to do is give you a status of where Horizon Battery Technologies, Inc. is today. Then a little history of how we got here, and then I'll conclude with our shared goal.

Where are we today? Last month, Horizon Battery just started limited production of a cost-effective electric vehicle battery in San Marcos, Texas. We're in discussions with several organizations to build the first of many manufacturing facilities for this battery in the State of California. Horizon Battery and the economic development opportunity for California would simply not exist if the mandates were not in place, period.

CHAIRMAN KATZ: Let me ask a question before you move on. If the mandate were delayed or changed, how would that impact your current discussions with California-based companies?

MR. CRAVEN: I can tell you for a fact it would shift as Mike Gage correctly couched it, it would shift the emphasis from the state to where the activities are. We're in discussions also with the East Coast and overseas. But we would like to do, and most intense negotiations are here in California.

The Horizon Battery is an advanced lead acid battery. The price of the battery pack when in full production will be

about \$2,500 per car not \$40,000 as has been bantied about by some other manufacturers or for other technologies. The life will be up to 80,000 miles in its present state. It's a maintenance-free and rapid recharge capability--meaning you can charge this battery up to 50 percent of its capacity within less than 9 minutes and 100% in less than 30 minutes.

The approach to manufacturing is as great and stunning as is the technology itself. The approach was a battery manufacturing that would have zero environmental impact. The only effluence from this manufacturing plant are California drinking water and California air. It's a new manufacturing technology that was developed so we could manufacture in this state--unimpeded. The full-sized plant would directly employ over 300 people. A full-sized plant would satisfy approximately 25,000 electric vehicles per year.

CHAIRMAN KATZ: Let me interrupt you on that point, Mr. Craven. Assuming that you were able to conclude negotiations with one of these companies today, this week, how long would it take to that point? When would you be ready to move to that point--that kind of employment and that kind of commitment in California?

MR. CRAVEN: You're taking away some of my punchline, Mr. Chairman. I will answer that right now. It will take approximately a year and a half to build a full size manufacturing plant. Our goal, therefore, is to conclude negotiations and have the investment in place so we can move forward within the next six months in building that here in California. In order to be ready and have this battery manufacturing in place because electric

vehicles are being built as we saw today. They need batteries now.

CHAIRMAN KATZ: Mr. Knight had a question, I think, on that point.

ASSEMBLYMAN PETE KNIGHT: The 2550 was based on how many units?

MR. CRAVEN: That's based on 17 kilowatt hours. Based on...

ASSEMBLYMAN KNIGHT: No, the number of units produced. \$2,550 per unit based on...

MR. CRAVEN: It would be 400,000 batteries per year.

ASSEMBLYMAN KNIGHT: Have you made any selections yet as to where you would open your plant in California?

MR. CRAVEN: No, sir.

ASSEMBLYMAN KNIGHT: I want to see you afterwards.

CHAIRMAN KATZ: He's got a brochure from the Chamber of Commerce in his pocket.

ASSEMBLYWOMAN NAPOLITANO: I have the perfect plant waiting for you.

MR. CRAVEN: We will certainly take all suggestions. Thank you. And that will be a certain consideration as to... Time is of the essence and we would like to have an existing facility that we could move into. That's in fact what we did down in Texas. We found an existing facility that was making transformers and we even cleaned it up. There were some PCB spills around there. We cleaned it up and now it's a model for the world.

Most of the car manufacturers from around the world have placed orders for our batteries and are in testing this year.

Now a little history. A company called Electro-source was spun out of an aerospace company back in 1987. This company had approximately 20 employees and a technology that was developed by the aerospace industry that looked like it was a promising advanced material for lead acid batteries. Over the next three years, they spent \$20 million and wore off a lot of soles of their shoes trying to develop this technology and market it to the existing battery manufacturers. What they came up against were two issues they were not able to resolve in the time frame. One is the question of it's a good technology, but can it be mass-manufactured? And if it can, can it be mass-manufactured cost-effectively? In 1991 the Electric Power Research Institute came to Electro-source and said, "We need an electric vehicle battery. Will this technology work for it?" Then the Electric Power Research Institute invested in focusing this battery technology for the electric vehicle specifically. In 1993, I joined the company. I had been in electric vehicle industry for about five years. I saw what promise this company held. But the two main issues still were in front of it--manufacturability. In June of last year, BDM International, another aerospace company, half a billion dollars strong, service company around the world, approached Electro-source and said, "We believe you have the technology everybody needs. And we believe we have the manufacturing capability for this technology". They had just come off of building manufacturing plants for airbags which were mentioned earlier in this session.

A deal was made to form a new company--Horizon Battery

Technologies, Inc. It was 50% owned by Electro-source and 50% owned by BDM International. A site was located last August for building this manufacturing plant that people said couldn't be done. In the last five months, we did the impossible because of the mandates that you put before us. We knew that we had to have manufacturing capabilities in place by 1994. We were told by the major auto companies that if we were not in manufacturing, if we did not have manufacturing capabilities proven out, we had batteries and testing by 1994, we would not be considered for 1998 launch of their vehicles. We haven't slept for the past five months to make this happen. We've had over \$50 million invested. And we're not going to stop now. We've grown from ten people when I joined in the beginning of 1993 to over 100 people. Our eyes are focused on this state.

Finally, I'd like to share this goal with you. Our goal is to have electric vehicles on the road by 1998. What we bring to the table is a battery we feel that is not only acceptable, but will make the electric vehicle a practical vehicle that cost-effective and will serve a viable function here in the State of California. We're looking for a place to build a factory here in California. If a hint the regulations are to be delayed or even worse, denied, our focus will shift from California to the other states and other countries that hopefully will be willing to maintain the stand that you stood up and created. We're working with companies like Hughes and US Electric Car here in California. We've already helped create jobs. I ask you to hold the line and we will do the work for you.

CHAIRMAN KATZ: Thank you. Ms. McDonald?

ASSEMBLYWOMAN JUANITA MCDONALD: Mr. Craven, you mentioned that 90% of the battery capacity could be charged in 15 minutes and 100% of the battery could be charged in 30 minutes. How far, then, can we expect the car to travel? Will it be beyond the 100 miles that has been suggested before?

MR. CRAVEN: Yes. Absolutely. I took a worst case scenario because I like to take a conservative view. Then if we do better, everybody is happy. We took one of the first vehicles that were of the old technologies now, called the G-Van which is a full-size service vehicle. It's called an energy hog in our industry and is very inefficient. The range was 60 miles on the batteries that it was produced with. We feel that our technology will not only take that vehicle further in range but that vehicle takes 8 to 12 hours to charge those batteries. You can only therefore charge it twice in a 24-hour period, giving you a distance of 120 miles in a 24-hour period. Now these are used as utility vehicles and the utility industry operates 24 hours a day. With fast charge we are able to show conservatively that you would be able to fast charge that vehicle in 22 minutes and give it an effective 24-hour range of 750 miles. That is correct. Now that is with the assumption that you use it, you bring it to the charger, you charge it in 22 minutes, you get in, and you use it again. That's 750 miles--that's probably the worst case condition with the worst kind of vehicle because of energy consumption.

ASSEMBLYWOMAN NAPOLITANO: What would be the cost of such a battery?

MR. CRAVEN: The cost for a vehicle, a pack, would be approximately \$2,500 or less. And I say price; that's not cost of manufacture; that's the selling price.

ASSEMBLYWOMAN NAPOLITANO: Of the pack, itself?

MR. CRAVEN: Everything you'd need to run the vehicle. That is correct. The batteries, the connectors, ready to go to drop in the vehicle.

ASSEMBLYWOMAN NAPOLITANO: And the life expectancy of that battery is?

MR. CRAVEN: If charged properly and treated properly, up to 80,000 miles.

ASSEMBLYWOMAN NAPOLITANO: You expect that the cost for the manufacture of this particular type of a pack, in say five years, would be considerably less?

MR. CRAVEN: That price is our full manufacturing cost as could see it today. It is anticipated that we can get the price down even further. And I emphasize that that's the price, not the cost of manufacture of the battery, but we feel that we can even do better than that.

ASSEMBLYWOMAN NAPOLITANO: In what span of time?

MR. CRAVEN: It will take us a year and a half to build the first plant once we have the investment place and location site. And it won't be until we go through that exercise of building a full manufacturing plant that we would know how much more we can be able to reduce the cost. So I'd say a year and a half to two years.

ASSEMBLYWOMAN NAPOLITANO: Assuming that I had bought such a

vehicle and I'm traveling, where would I be able to recharge in those 22 minutes?

MR. CRAVEN: That's a good question. For right now, it would require a fast-charge station. A fast-charge station is just like our gasoline station. It would be centrally located where not one person would buy it, but many would share it because it would be more expensive than your plug in your garage which is already there. That is probably a better question for Mike Gage and CALSTART and the people working on the infrastructure. I am very myopic. We're working all in parallel here to make it all work. I know that there are fast-charge stations. We are working with Hughes to make sure that they all are compatible in working with our battery system for when its on the road.

ASSEMBLYWOMAN NAPOLITANO: Are those plugs going to be similar or different than what we utilize now?

MR. CRAVEN: As far as the battery is concerned, we don't care what the plugs are. We're way down the system's stream; we just collect the energy and the plug is up at the front end of the car. Those plugs, from what I've seen, are going to be fairly similar to what we're used to right now. Ergonomics and familiarity of consumer is very important to make electric vehicles work and we don't want to change what people view as being safe and convenient right now.

ASSEMBLYMAN KNIGHT: I think what the question is...what's the amps in a voltage required to charge a battery.

MR. CRAVEN: For a fast charge, you're looking at probably about 500 amps and the voltage is dependent upon the voltage of

the car. For regular charge, which is a three-hour charge that you would in your house, it would take your household current. But a fast charge is a little different and would take a higher current, of course. It's putting all that energy in a faster amount of time.

CHAIRMAN KATZ: At the regular charge is if you have three hours to charge it you just pull it into your garage, stick it in an outlet and it done.

MR. CRAVEN: That's correct. The fast charge is for convenience.

CHAIRMAN KATZ: You can charge it overnight. You come home at the end of the day...

ASSEMBLYWOMAN NAPOLITANO: I understand that, but what would be the charge in electricity for those three hours?

MR. CRAVEN: As in cost? You'd have to ask the California Utilities that question. As far as kilowatt hours, I can tell you that we're talking about 17 kilowatt hours. So it's whatever the price of electricity--let's see, 10, 15 cents per kilowatt hours times 17 kilowatt hours. That would be your price--two dollars?

ASSEMBLYWOMAN NAPILITANO: We're at a level where they charge you extra for utilizing additional kilowatt hours. That means all of us are going to be paying extra for our utility.

MR. CRAVEN: Yes and no, because if you charge in the evening which is the whole... Fast charge will be used for very specific applications and only when I feel is an emergency. Normally, the whole concept of electric vehicles is you use your car as a commuter vehicle during the day and then you charge it at night

because you will have more than enough range to back and forth to work and then you plug it in at night when the utility has plenty of excess electricity available and your rates are the lowest. You fill it up. Now, what happens if there is an emergency. You can go and you have to go across town, or you have to use that vehicle you're in--you have to go somewhere very quickly. You can use a fast-charge facility to go do that. Yes, you might pay a little more for those kilowatt hours in doing that.

ASSEMBLYWOMAN NAPOLITANO: Is that possibly going to be a flex program also so that if you're caught away from an area where you would be able to plug in. Like the methanol cars, you're able to utilize premium for a short period. That would enable you to get out of that situation where you can't get to a station that plugs in or that you can get a fast charge, yet you're able to continue until the next time that you can charge up.

MR. CRAVEN: My belief is that the infrastructure for electricity will be... Well, the land will be covered and you will not be far away from a plug that you will be able to plug in your vehicle. It's just like gasoline. We still run out of gas. Once you do, you're out. You're on the side of the road.

ASSEMBLYWOMAN NAPOLITANO: That's easy to say, but in reality, I have seven cities that I represent. Only three of them, one in each city, has a methanol pump. And I use a methanol car. Only one in every city. I've been to those stations and the pumps do not operate. They're out of order; so what do I do? Do I sit there for somebody to bring me another car? So I have to have an alternative method of being able to continue my work so

that I don't have to expend more fumes into the air by getting another vehicle. That's what I'm attempting to find out.

MR. CRAVEN: I understand and I appreciate you're experiencing the birth of a new industry and the pains that we go through in growing, but as long as we have the goal.

ASSEMBLYWOMAN BARBARA LEE: What are some of the safety concerns, then, and some of the issues we need to at least be aware of with regards to perhaps a faulty battery or a battery just going out in the middle of... Are there any new kind of safety concerns with regard to vehicles that we should begin to think about.

MR. CRAVEN: Yes, there are new safety concerns, but when you're dealing with any fuel, the whole concept of fuel is energy. And whenever you have energy you have safety concerns. There is a wonderful new tape that just came out because of the naivete of people in electric vehicles. When I gave a presentation, for example, to my first grader's class, it started drizzling. I was showing off an electric vehicle. As soon as started drizzling, the teacher told the students to stay away from the vehicle. "Don't touch the vehicle". It took me a heck of a long to try to convince her that it was safe. I was putting my foot in a little puddle and touching the vehicle at the same time and it was OK. Finally she did allow the students to go in. But that's not to say that it's still... Your question is, the safety issues are there. The tape that came out shows firemen that you can, if there's a fire in an electric vehicle, you can spray water on the electric vehicle and the electricity will not follow the water

back to the firemen. There's a good fundamental reason for it. Inherently, I think that electric vehicles are safer than what we're used to dealing with. If you can deal with gasoline, you'll be able to very easily deal with electricity. You've been doing it already. Our battery actually adds to that capability over past batteries in that even though it's a lead acid battery, it uses sulfuric acid. But the acid is absorbed in a fiberglass _____ --sort of like a baby's diaper. You can't shake it out. So if the battery breaks open, all you have is solid sitting there. There is nothing to leak on people or to expose people to that hazard. It's new technology and we'll be able to address those issues that have to be addressed. But they're nothing that we can't overcome.

CHAIRMAN KATZ: Okay. I want to move along now. Ms. Barbara Levin, who is Special Projects Coordinator from Ovonics in Michigan. The next panel is going to be Joe Barrington, Jim Quillan and Carl Perry. I would like everybody to keep in mind that there is a long agenda and try not to repeat what other folks have said before, because I want to give adequate time to everyone who is going to be testifying here today. Ms. Levin, welcome back again.

MS. BARBARA LEVIN: Thank you very much Mr. Chairman and members of the Committee for providing me with this opportunity to be here. As a Michigan citizen, I do want to take this opportunity to pay tribute to the State of California for the leadership and the vision that it has exhibited in trying to address the problems of clean air with your low-emission vehicle

program and in particular you ZEV mandate. I think that the recent efforts of other states to adopt the California program as a region in the northeast and individually attests to the strength of that vision that you have set forth to the nation.

The ZEV mandate, of course, is the most challenging provision of that program and it challenges the technical and the business community to initiate a new era of emission-free vehicles. The challenge is also one of time. It sets a deadline. Deadlines which enable the development of new technology, but which also demand near term results because it is addressing a problem whose solutions are long overdue.

I am here to state unequivocally that the challenge which is embodied in the ZEV mandate to produce electric vehicles which are cost-effective, commercially viable, in time to meet the 1998 deadline can be met, and indeed, with respect to the most important technical component to that challenge--the battery--it has been met. I want to say that our company, Ovonic Battery Company, has produced a different battery from the one that you have just heard about. You have heard about a lead acid battery. It sounds like an excellent battery. But what we have produced is a different technology; it's a much newer technology that will appeal, not only to the fleet operators and the niche markets that are considered the early markets in the near term, but our battery will address the much-wider consumer market of people who want a car that they can take to and from work, that is convenient, that's maintenance-free, that they can charge in the convenience of their home or at work, that has high performance, high

operation, and will give them a practical driving range of 150 to 200 miles between charges.

The Ovonics Battery Company which created this battery was established in 1980. I'd like to give you just a little bit of history on this because this is a relatively new technology unlike lead acid, so the development history is quite important, I think, with respect to the influence of the ZEV mandate. The Ovonics battery was established in 1980 to develop a new rechargeable nickel metal high-dry technology based on new hydrogen storage materials that were created at Energy Conversion Devices which is the parent company of Ovonics Batteries. Ovonics batteries were initially developed and commercialized in small sizes to address the portable electronics market. We provided a drop-in replacement for nickel cadmium batteries that used in cellular phones, computers, and other portable devices. Our strategy, both in terms of development and commercializing, was very successful. Our batteries are now commercially available from our licensees around the world.

Our EV development program was little slower in getting going primarily because of the lack of an electric vehicle market. What happened, though, after the ZEV mandates were promulgated in California, was a lot more people started to pay attention. Then the ULEV's advanced battery consortium, consisting of General Motors, Ford, Chrysler, Apri, and the Department of Energy was formed to address the mandates, to develop Advanced Battery Technology, and that consortium issued their contract to our company in May of 1992. Less than a year and a half into that

contract, we had our first battery in a car in September of 1993. And today, we have Ovonics batteries in a number of electric vehicles, both in the United States and abroad.

I'd like to tell you a little bit about the characteristics of the battery, characteristics which reflect the battery at its current stage of development and which have been demonstrated in the labs and in vehicle performances.

First of all, range. One of the critical criteria for an electric vehicle. Our battery has demonstrated that it can more than double the existing range of existing battery technologies. Most of the existing vehicles on the road are conversion vehicles. Most of them use lead acid batteries. Some use nickel metal high-dry batteries. Our batteries double those ranges. For example, we have on our premises a converted GEO Metro; it's four-passenger car. We get 150 miles on the highway between charges in that car. Of course, any electric vehicle will do better in a ground up designed electric vehicle. We project that our battery will get ranges well in excess of 200 miles on a ground up electric vehicle. Of course, it all depends on the vehicle. When we look at the data that has been published about the GM Impact, a state-of-the-art electric vehicle and look at the ranges that it has achieved, and it has achieved 120 miles. We can very confidently predict that our battery will achieve 250 or more miles on the Impact. Range, of course, isn't the only performance criteria that counts. Acceleration is very important. We can and have demonstrated 0 to 60 miles an hour in less than eight seconds.

Lifetime of the battery. We are very confident, of course. We can't demonstrate this in a car because we've just gotten our batteries in cars. But we've done an awful lot of cycle testing of the battery and we are confident it will last 100,000 miles or more, and certainly the lifetime of most vehicles. We also have the capability for fast recharging. In 15 minutes, you can recharge 60% of the battery, in one hour, 100% of the battery. Of course, you have the option of recharging at home or at work using a standard household outlet. Our battery is totally sealed, maintenance free, and we are very proud of the fact that this is, indeed, a green battery. It contains no toxic materials. It's very safe. And if you wanted to you could dispose of our battery under current EPA standards in a landfill. Of course, you wouldn't want to do that because it's an expensive piece of equipment and it is totally recyclable. So it is a very balanced, high-performanced battery. Let me emphasize once more that this can be the battery for the first generation of vehicles that Mike Gage referred to. The only shortcoming, however, of the Ovonics battery today is the lack of availability in commercial quantities. Whereas we were able to commercialize our battery very rapidly in the small sizes because it addressed a very rapidly growing market, we have had a little more difficulty in acquiring the capital we need to commercialize for electric vehicles because of the uncertainly of the electric vehicle market, particularly in light of recent efforts to roll back the ZEV mandates and to stop their spread to other states. But we have done a lot of cost analysis of the battery based in part on

some of the manufacturing operations already under way at our company. We are confident that in high-volume production, we can produce a car battery for \$3,000-\$4,000 and a battery for an electric fan which would cost \$5,000-\$6,000. Let me again emphasize that this is a battery that would last the lifetime of the vehicle. Much of that cost would be offset.

There is already a federal electric vehicle credit. There are also a tremendous reduction in operating and maintenance expenses. I believe one of the members of the Committee asked about that. If you use a dollar a gallon, it costs approximately \$5 for a gasoline car to go 100 miles, or maybe \$4 depending on the kind of car you're driving. At eight cents a kilowatt hour, it will cost one dollar for an electric vehicle to go 100 miles. If you add that up over the life of the vehicle and assume 100,000 mile lifetime, that amounts to a \$3,00-\$4,000 savings just in fuel costs alone. Of course, there are other maintenance costs which are eliminated in electric vehicles, such as tune-ups, oil changes, etc. Our battery costs were based on the technology as it exists today with some additional technical improvement already under way at Ovonics. History teaches us, as others have pointed out, that with new products the prices drop tremendously as the technologies mature and as the markets grow.

I want to conclude by saying that our battery development program is an excellent example of the dynamic role that the ZEV mandate has played in technology development. As I said, we were able to commercialize very readily with small batteries, but commercializing for the EV market is much more difficult

maintaining the mandate will be critical to the ability of us and other companies developing advanced EV technologies to commercialize in the United States. As other people have pointed out, this technology is coming; there's no doubt about it. The issue is whether America is going to be in the forefront of this new industry or not. Your actions in maintaining or not maintaining this ZEV mandate will have a critical impact on that. Thank you.

CHAIRMAN KATZ: Ms. Levin, thank you very much. Questions from the Committee? You had stated when we talked earlier, on your ability to now take this commercial--it's pretty directly tied to maintaining the ZEV mandate in California?

MS. LEVIN: Well, it's tied to having a market. And certainly having a market in the United States is critical to our being able to commercialize in the United States in any timely fashion.

CHAIRMAN KATZ: You have not decided where to locate, I assume, the commercial manufacturing of the battery at this point?

MS. LEVIN: We are open to locating anywhere that we have the opportunity to establish a facility, to get the capital that we need. We certainly are open to California.

CHAIRMAN KATZ: Thank you, Ms. Levin. Thank you for being here. Let me get the second group of people to come up on this topic. Joe Barrington is the CEO from Group IX systems; Jim Quillen, Executive Secretary/Treasurer of Machinists; Carl Perry, Executive Vice President, U.S. Electric Car. The group that comes after this would be Andrew Card from the American Automobile

Manufacturers, Greg Dana from Automobile Importers, and David Montgomery from DRI McGraw-Hill. We'll start with Mr. Barrington.

MR. JOE BARRINGTON: Good afternoon. Group IX Systems is located in south central Los Angeles. We've been in business for over 20 years, primarily as a supplier of aircraft parts and assembly. We are also a member of CALSTART. The ZEV mandate has created for Group IX the entrepreneurial opportunity that Dr. Currie talked about in his remarks. I'd like to focus my remarks primarily on that entrepreneurial opportunity that has been created by the mandates. Traditionally, small manufacturers in general in the state of California in the aerospace and aircraft industry have been what is called contract manufacturing in that we traditionally build a part to print and as such the technology or the value added has the beneficiary of that is really the source of your customer who has done the design. And as such, whoever wins that business is mainly price-driven, so more or less, you're in the commodity business. That in turn creates limitations because as you have not developed the technology, you're not in the position to attract capital, which in turn inhibits the ability of your enterprise to create value and sustain itself on the long-term and to create a product or technology that will sustain yourself for the long term. Now, what you have created through the ZEV mandates is that you have created an industry and an opportunity for companies such as ourselves to make the transition.

Number one, with the structural morass that we find ourselves in today with the downsizing of defense and aerospace, but more

importantly, you create an opportunity for companies such ourselves to acquire access to technology. Our focus within CALSTART is developing the battery monitor system. If we are successful in doing that, we will have developed a proprietary component with technology which will in turn put us in a position to attract capital, be able to expand to foreign markets, and develop an organization that will be able to participate in many markets, not only here in the United States, but overseas. But for this opportunity that you created, the situation facing small aerospace manufacturers in the state today is bleak to say the least, because the downsizing that we are experiencing today is structural and things will not be the same as in the next 20 years.

The opportunity you created in advanced transportation is one of the few bright sides that we see. Turning the clock back or changing your position on the mandates that you see today will have a traumatic affect on the futures of companies like ourselves. Number one--on our future, but it will also have impact on the fact that all of us have invested a considerable amount of time, effort and money in developing this technology. I can go further, but I would like to just keep my remarks focused on the opportunity that you've created and the structural economic opportunity that you have created.

CHAIRMAN KATZ: Mr. Barrington, thank you very much. Questions from committee members. I'm going to turn now to Jim Quillan who is the Executive Secretary-Treasurer, California Conference of Machinists and a CALSTART partner, also.

MR. JIM QUILLAN: Thank you, Mr. Chairman. I also serve on the Board of Directors of Project California.

In the mid-1993, Business and Outlook Report, Bank of America estimated that California had lost between 600 and 800 thousand jobs. Of that number, nearly one-third have been on the defense sector--defense aerospace. I think it's clear that we have not yet seen this scenario play out, with base closures and with further expected reductions in aerospace numbering I'm told somewhere in the range of half a million. And California will bear a disordinant share of those job loses. My union represents airline employees, as you know, light manufacturing, automotive repair, and defense workers. We're maintaining our membership pretty well in the first three, air transport, automotive repair, light manufacturing. Our membership in the defense has fallen by one-half in the past five years. That's motivated us to take a look at the possibility of some new industries. We see opportunities on the horizon as other speakers have indicated, particularly with respect to the electric vehicle. We strongly support the retention of the ZEV mandates. Project California estimates that by the year 2010, 50,000 jobs could be generated by the electric vehicle industry. Secondly, and although it's a little off the subject of this hearing, there's a significant expansion, particularly in Los Angeles in the urban mass transit area. As you know, Los Angeles expects to spend \$150 billion to expand light rail in the City of Los Angeles. Moreover, BART in the Bay area just recently decided to expand their routes and purchase new cars to replace aging fleets. I'm happy to report

that in that instance the Bay Area Rapid Transit Board of Directors decided to purchase cars from Morrison-Knudsen which is an American firm and, as far as I know, the only firm that is producing light rail or fast rail vehicles. Other parts of the state have on the drawing board to extend and expand light rail.

I'd like to take you back a few years. In California, we had seven auto assembly plants; we had two truck manufacturing plants; we had glass plants; we had tire plants; we had steel plants. All of those with the exception of a joint venture in the Bay Area between Toyota and General Motors, the Newmy plant, and a joint venture between Pohang Steel and Korea and U.S. Steel and Pittsburg--all of these plants are gone. And yet clearly we all understand that California is the largest market for cars in the United States and probably among the top five in the world in terms of markets for cars. But yet except for the Newmy plant, there are no automobile assembly plants in California. We think we can change that with the electric vehicle. That's why we strongly suggest that we proceed with the ZEV mandate. Because of the loss of jobs, when we lost all of the automobile plants and the supporting tire, steel, glass, the aerospace industry was a shock absorber that took up employment from those laid off and those heavy manufacturing industries. The aerospace industry is no longer a shock absorber because the aerospace industry is in decline as well. I suggest to you that with the decline in aerospace, with the military base closures, with the loss of the heavy manufacturing jobs that we have experienced in California, it's my hope that the State of California, the Governor, business

leadership recognize that we ought to be nurturing and supporting those industries that will reindustrialize the State of California to provide those jobs that make for middle class workers who send their kids to schools, who buy homes, who pay taxes and I think California can come out of this. But if we do not, you can share your predictions with me. I think it looks fairly bleak as we go into the 21st Century if we do not start working with our tax-supported institutions, our transit systems, the electric vehicle enterprises that are trying to get started.

We've got congestion problems on our streets and highways, we've got pollution problems, we've got a world-class skilled work force that frankly, are still unemployed. Many of those people are my members and there are no job prospect for them. Many elected to take lower paying jobs for survival. Many of them have retired; many of them have left the State of California. It's a terrible loss--the obsolescence of skills, a terrible loss of resources. If we stay the course on the ZEV mandates and if we try to nurture and assist these other initiatives that are coming in transportation in California, I think we can offer these folks a little glimmer of hope. Frankly, I don't see a lot out there at the moment. So thank you, stay the course. Thank you for hearing this testimony.

CHAIRMAN KATZ: Ms. Karnette has a question.

ASSEMBLYWOMAN BETTY KARNETTE: I'd like to commend you on your emphasis of our skilled working force. We've got to keep those people here or California will suffer. I concur with that. My question is, when you talked about the 50,000 jobs that would

be added, are you including all those other businesses that would be profiting, the other jobs that would be created that would be the infrastructure for the building of the electric cars, or are you just talking about the actual employees that would be working in building the cars themselves?

MR. QUILLAN: I understand the figure as developed by Project California; it would include those involved in the vehicle manufacture; it would include those involved in developing the infrastructure to support electric vehicles and other jobs associated with it. So I guess the figure is an aggregate figure.

ASSEMBLYWOMAN KARNETTE: Do you know how many of those jobs would be to skilled working force to which you referred earlier?

MR. QUILLAN: The figure I've seen is that... First of all, with respect to the development of the infrastructure, those are construction jobs. Those are certainly high-paying jobs. With respect to the jobs that would be utilized involving public utilities, are Southern California Gas Company, Southern California Edison--those are good-paying jobs. With respect to the assembly jobs, those would be fair to good paying jobs. Some of the component manufacturing jobs would be good paying jobs. Certainly the engineering talent and the scientific talent that goes into the design and development in an electric vehicle would be a good-paying job. It seems to me we went across the board in this scenario.

ASSEMBLYMAN PETE KNIGHT: A question about the other industries that have left California--the automotive industry, the tire, steel, glass, all of those industries have left California.

Now we're talking about a new industry starting up in California. Why is that industry going to stay here and not leave as the other industries have?

MR. QUILLAN: It seems to me that the electric vehicle industry has a very close connection with utilities, with policy makers, with the government, if you will. The market is here. It seems to me that there are a great deal of pressures that would behoove that industry to stay in California. Can I guarantee they'll stay here? No, I can't. But I don't think we should stand aside as we did in the seventies and watch the steel plants and the tire plants and glass plants and the automobile assembly plants leave California. We ought to take a pro-active stance as we did in the last session of the Legislature to deal with just one example, the workers' comp problem in California. I happened to serve on that task force. Some would suggest that someone from labor would not recognize that this is a constraint to California business and manufacturing. We were unanimous. The eight members on that Governor's Task Force from labor were unanimous that we need to make some changes. And with the leadership and the state Assembly and the state Senate, those changes were made. If we bring to bear that kind of interest and that kind of focus, we can solve any problem the EV industry has if they were to try to leave California.

ASSEMBLYMAN KNIGHT: I'm not concerned about the technology, I'm more concerned about the economics required for manufacturing to stay in California. You mentioned some of the issues and I think those kinds of issues have to be continually evaluated.

Reform has to take place in those areas because the automobile center of requirements is here in California but yet they left. The marketplace for the automobile was here.

ASSEMBLYMAN DAN HAUSER: Mr. Quillan, just as a follow-up, then, to Mr. Knight's question, wouldn't you agree that this country and certainly this state, may be a little smarter than we were back in the '50's and '60's and not allow foreign overseas competition to dump on the American market and wipe out this industry?

MR. QUILLAN: I'd like to believe we are. For too long California has had the attitude that we heard expressed in the movie "Field of Dreams", we are here and they will come. And they did come. But there's a new global reality, economic reality and that's not going to happen. I think we need to put shoulders together in California to retain good jobs. We need to create good jobs, including up there where you are Assemblyman Knight. I believe you're from the Antelope Valley?

ASSEMBLYMAN KNIGHT: You bet. That's why I'm offering space, clean air, buildings, anything you want. Just come talk to me.

MR. QUILLAN: I know. I have some members employed up there. That's what left of Lockheed is up in the Antelope Valley. I used to work there.

ASSEMBLYMAN HAUSER: So did Mr. Knight. Only he flew them. Thank you very much, Mr. Quillan. I'm going to take over for a couple of minutes while the Chairman catches up on some of his phone calls. Mr. Carl Perry, Executive Vice President, U.S. Electric Car from Sebastopol.

MR. CARL PERRY: Good afternoon. I want to tell you how much we appreciate the opportunity to be before you. Particularly Assemblyman Hauser, since our corporate offices and our research center are in his district. One of my newest facilities is located in Central Los Angeles in Juanita McDonald's area. In many respects, I believe this meeting is extremely fortuitous for us at U.S. Electric Car because what you're talking about, I think we represent. We are a small electric vehicle company. But I believe that we are doing very well in today's market place.

Number one, there is a market. Number two, there are products available. Three, we can meet a price which can be affordable. Our company is growing. In this past year, we're grown from 20 employees to 160. We plan, by the end of 1994, to be at 400. We plan in 1995 to be close to 1,000. Our sales will be about \$20 million this year. We predict they will be \$50 million next year and around \$150 million in 1996. Our company will build 600 electric cars and deliver them in 1994. We are the largest converter of electric vehicles in the United States. Our company...and what I wish to do today is just give you a snap shot of where we're going and why we feel that the future is now. We are at the right time and the right place when we consider that what we're dealing with, in many respects, is the first generation technology. Our mission clearly stated is to be the leading builder and developer of electric vehicles and hybrid vehicles with a full line of vehicles. So for a moment, I'd like to tell you about our product base.

We have four facilities in California. We are a California

manufacturer--here and now. We are looking at a fifth facility later this year. Our corporate headquarters, research center is Sebastopol, the garden spot of California. We have a major facility in Redlands, California. We have a major manufacturing and assembly facility which we are just opening now in downtown Los Angeles on South Figueroa in part of Watts. We are part of the Rebuild Los Angeles. We are associated with SMUD and a number of programs through ARPA, ARPA funding, federal government funding programs for development of technology in the Sacramento area. We look forward to developing a facility in the San Jose area, teaming with such companies as FMC.

Our product line. We build industrial electric vehicles in our Redlands facilities. We built over 55,000 in the past 20 years. These are vehicles that operate inside plants, airports (missing testimony) ...GEO prisms, Chevrolet S10s. We are the leading developer of composite technology for vehicles in a company that we acquired in Florida. We are the leader in developing fully composite fully-monocock vans. This is an R&D venture, but we see the world headed towards new development, new techniques in chassis manufacturing and composites would appear to us to be the way. In terms of larger vehicles, we are manufacturers of electric buses. We're providing the bus system for the University of California. Also through SMUD out in Sacramento Airport and in the City of Sacramento and McClelland Air Force Base. We anticipate a teaming arrangement with the US Air Force and with SMUD for the development of continuing composite technology as we look at new types of chassis

development.

The basis of our company is not just design and manufacturing. I would say the keystone is that we are a systems integrator. We believe in teaming with the leading technologies that are available today. One of the key participants with U.S. Electric Car is Hughes. The Hughes Power Control System Group. As was stated earlier by Dr. Curry that it was in his tenure at Hughes that they began the development of this electric drive system which was for the Impact vehicle. After that program ceased in being, the Hughes organization was looking for a home. They needed to do something with this technology. It was very fortunate for us as a small company. We went down and arranged with a much larger organization, the Hughes organization, that we would take their entire production for the next two years in electric drive systems. We think the Hughes system is one of the most significant drive systems that's on the market place today. I only make that example to point out that our role is to avail ourselves of the latest and newest technologies that are available. Some of these panel members have clearly brought forth in the discussions of battery technology where the future is. That future is sooner than we think.

One of the other issues that's discussed here is: What is the affordability of what you turn out at U.S. Electric Car? In terms of our conversion vehicles, we put a stake on the ground by saying that we've got to be able to reduce our own margins, enhance our own manufacturing capabilities, and get a more affordable price. I can tell you that in terms of fleet

sales--and that is our market--we are not in the general consumer business. We have targeted our market as the industrial fleets, government fleets. We have established a price of under \$30,000 for a truck or a sedan as was shown in Mike Gage's CALSTART presentation -- two of our vehicles. That's a significant representation of where costs can go.

I would like to summarize by saying that we are a small company, but we're a fast-growing company. We have found that there is a substantial market for the next years here in dealing in that market niche of the utilities, and of the fleet users and fleet operators. Very significant market. It is incumbent upon us as a designer and a manufacturer to find and create the best technologies possible. One of the goals that we have established is that our vehicles will be fully safety certified. We have arranged and we have acquired the leading talent in the United States in the development of safety, crash worthiness, software programs which were, frankly, developed at Lawrence Livermore Laboratories. Those researchers are part of our staff because it is our desire and our direction that we will deliver fully safety certified vehicles to the market place by June or July of this year without any waivers.

So, we think that we have found and we can address market, safety, cost, produceability. We can bring jobs to the state. There are markets, and now is the time. As we say at U.S. Electric Car: The future is now. Thank you.

ASSEMBLYMAN HAUSER: Thank you, Mr. Perry, a quick question before you sit down. One of the things when I toured your

facility that I was impressed with the most were the composite vehicles. Rather than taking existing technology or a car built for an internal combustion engine, starting from the ground up, do you see much of a market for that type of vehicle given the advantages of, say, the composites that are being used today?

MR. PERRY: I do. I think it's going to take some time. What is happening is that what we have in terms of our composite technology is what I would call established or 'here and now' technology. We're working with SMUD; we're working with some foreign manufacturers, foreign developers; we're working with the U.S. Air Force because they've been leaders in composite technology. The idea is -- you've got three areas of an electric vehicle: you've got the chassis, you've got the drive system, you've got the power and the energy source. You've heard some excellent dissertations here on what's happening with new energy sources and the battery development. Certainly drive systems, the Hughes system is excellent; General Electric; Westinghouse are developing these. The composites for the chassis are an obvious way to go. There are a lot of new technologies. What we're looking for is, obviously, with composites you reduce weight. You get a clear benefit that way. However, there are some additive costs. They are generally more labor-intensive. Material costs, obviously, metal is easy to form, easy to buy, cheaper. But, there are distinct advantages to composites in terms of safety certification, crashability. So, what we're doing now is working with leading institutions such as SMUD and others to take what exists, not only in the United States, but elsewhere and see how

we can combine it into practical manufacturing systems for chassis.

CHAIRMAN KATZ: Thank you. Next, I'd like to ask to come forward--Andrew Card, Jr., who's the President and CEO of American Automobile Manufacturers Association, Greg Dana, VP of Auto Importers of America, and David Montgomery, DRI McGraw-Hill, who would have a different view of what we've heard so far. Let's start with Mr. Card, please.

ANDREW CARD: Thank you, Mr. Chairman. I'm Andrew Card, President and CEO of the American Automobile Manufacturers Association. We represent Ford, General Motors and Chrysler. Mr. Chairman, I think that we share the same goal. And that is to improve California's and America's air quality and at the same time provide provide consumers with safe, affordable transportation. And it is these two fundamental principles which shape our thinking. America's car companies are doing an awful lot. In fact, today's cars in California are 99% cleaner than 25 years ago. Clearly, we've been working with the California Air Resources Board and others to meet the very stringent standards that are necessary to improve the environment here in California.

Right now I'd like to turn to electric vehicles if I could. As we heard a few minutes ago, the big question is: If we build it, will they come? The issue here is really matching technology to consumer expectations. Contrary what some would have you believe, the auto industry recognizes there is great consumer interest in electric vehicles. And our members know there is an opportunity to sell consumers an entirely new class of vehicles.

That's why members of this industry have spent literally hundreds of millions of dollars on the electric car. The fact is that our member companies know how to make electric vehicles today. What they don't know yet is how to make an affordable battery which will meet consumer needs. The batteries available for electric vehicles today fall short of consumer needs. If we were to _____ an electric vehicle today, it would probably run on lead acid batteries, carry two people less than 100 miles on a hot Los Angeles day, and be extremely high in cost to the consumer. And market studies show that few people would buy them. Even with one of the most advanced experimental power packs, the sodium sulfur battery, operating cost in 1998 would be unacceptable to most drivers. It would be like telling a driver he needs a \$15,000 gas tank for his car. A \$15,000 gas tank that has to be replaced every few years. A \$15,000 gas tank that holds the range equivalent of three gallons of gasoline. A three-gallon tank that takes eight hours to refill.

Now to try to solve this problem, our member companies have formed United States Advanced Battery Consortium (USABC). In this effort, carried out in concert with the US Department of Energy and the Electric Power Research Institute, is an attempt to find a breakthrough in battery technology with the research commitment of a quarter of a billion dollars. Let me quote what USABC has to say about the current state of battery technology. "At this time, the USABC's best judgment is that a mid-term battery is not feasible for low-volume production to meet the 2% mandate by 1998. First, none of the mid-term batteries has yet to meet all of the

targets. Some are close on individual parameters. All fail in terms of battery life and cost. Secondly, even assuming feasibility could be established for all targets, the last major program, the Eagle picture nickel iron battery, was estimated to take 50 months from the time a battery was proven out as to meeting the basic performance parameters to volume production. And that was based on pilot plant experiences. To meet the 1998 mandate, the ground-breaking on the pilot plant should have begun last June."

In November, the US Department of Energy, which is also part of the USABC consortium stated, "The single most important technological obstacle facing the auto industry in placing electric vehicles in the California market by 1998, is the lack of a low-cost battery that provides adequate acceleration power and travels a minimum distance of 100 miles before recharging becomes necessary".

Clearly, we have a challenge that has not been met. Mandating or forcing electric vehicles in the market before they are consumer-acceptable could actually hurt consumers, the environment, and the future of electric vehicles. The fact is the current generation of electric vehicles would be high in cost. In order to sell these vehicles, some have suggested that manufacturers subsidize them in some manner. For example, by raising the price of gasoline-powered vehicles to new car buyers, increasing the cost of motor vehicles would slow vehicle turnover which means that more high-polluting vehicles would stay on the road longer. Ironically, forcing electric vehicles on the market

before they are ready would hurt air quality. Finally, if we're not careful, premature introduction could delay development of electric vehicles for a very long time. History shows us what happens to technologies when they are not ready or acceptable for consumers. The industry made substantial investments in diesel and rotary engines only to have them rejected by consumers. The government required auto makers to provide ignition interlock safety belts which triggered a consumer backlash and later a repeal of the requirement. Where are these technologies today? The same thing could happen to electric vehicles.

If we build them, will they come? That's still the multi-billion question. But we continue to look for a break-through battery as well other technologies in order to improve California's air quality. To be successful, that technology needs to tie into consumer needs and be in synch with the marketplace. The bottom line, technology breakthroughs and consumer acceptance should dictate market opportunity rather than arbitrary sales mandates. In the meantime, America's car companies want to work with California to examine if there are real market mechanisms which can be used to help improve air quality. Thank you very much.

CHAIRMAN KATZ: What market mechanisms would you recommend to improve our air quality?

MR. CARD: First of all, you have to demonstrate that there are technologies that are acceptable in the marketplace at a value and cost the consumers can afford. That would create market opportunities. Clearly, we've seen marketing take place in areas

where people didn't think it would. In safety, for example. I think the same could happen with regard to some of the new technologies, hybrid technologies, by-fuel technologies, or in electric vehicles.

CHAIRMAN KATZ: You said you wanted to work with California. What would you recommend to California, then, if you don't like the ZEV mandate?

MR. CARD: Take a look at the big picture and help solve the air quality problems that exist by taking a look at the big picture.

CHAIRMAN KATZ: By doing what? Specifically.

MR. CARD: There are scrappage programs would help to turn over vehicles very quickly. Those create market opportunities. That one example.

CHAIRMAN KATZ: Mr. Card, I'm having a little trouble reconciling here. Ms. Levin just is naive, optimistic, doesn't understand what she's talking about, the battery doesn't exist, or...

MR. CARD: She's appropriately optimistic, but she's not addressing today's problem. She's finding a solution for tomorrow, but that solution has been absent. USABC has been working with Ms. Levin's program. In fact, they're part of the consortium. That battery that she talked about is not ready for mass production nor for the consumer.

CHAIRMAN KATZ: Today. But if don't have something like the ZEV mandate, how do you get it ready for 1998? Do we rely on the same attitude that brought us airbags?

MR. CARD: First of all, airbags came before they were mandated. But...

CHAIRMAN KATZ: Airbags were available in 1974 and it wasn't until they were mandated in the mid-80's that they were widely available. Even now they are coming more widely available.

MR. CARD: There were technology changes that took place during that same period of time, as well, that did a lot for the airbag to be deployed in a safer manner and a more predictable way. But technology is very important. I used to be a legislator. I served in the Massachusetts House of Representatives. And I realized it was quite exciting to pass laws, but no legislature has found a way to change the laws of physics or change the laws of chemistry. We are bumping up against a mandate that is challenging the laws of physics and chemistry. Our industries are very deeply committed to try to find the envelope of opportunity to bring new technologies to the market place. But the reality is, the 1998 mandate would require production in significant ways of batteries today. We have not even found significant battery production opportunities put on lines such as they would produce viable batteries to meet consumer expectations in the market place by 1998. We're getting very close to the drop dead dime line for our production facilities to actually produce product.

CHAIRMAN KATZ: What is that drop dead date in your estimation?

MR. CARD: Well, the normal time it takes an automobile from design to market place--the quickest is about 36 months. And that

is very, very fast. It usually is more like five years. So we are right now bumping up against a practical concern of having batteries available in wide numbers that are known to be safe, can meet consumer expectations, and I just don't think it's going to happen with an arbitrary mandate of sales in a market place. Instead, it has to happen by pushing the envelope of technology which our three-member companies are doing, as are automobile manufacturers around the world, as are other, I'm going to say, industrial opportunities that we see in the energy business pushing to find that solution. But the solution has not been found.

ASSEMBLYMAN KNIGHT: But in some cases, and I tend to agree with your assessment on technology at the present time, but by the same token sometimes technology can be pulled a little bit. We see that every day. Particularly in my previous business, we did that every year. With the right incentive, with the right motivation, with the right kick in the pants, if you will, technology can be advanced at a little faster rate than a normal evolutionary process. I guess that's what trying to take place here is to motivate that technology advancement. I'm not suggesting one side of the fence or the other, that I may be pushing, but I know that technology can be moved in that direction.

MR. CARD: Well, there are a number of things happening where America's car companies are pushing the envelope of technology. First of all, they've made tremendous investments. They want to see a return on those investments. Those monies that have already

been placed outside of those companies into these consortia to try to find solutions, so there is an incentive there to get a return on those investments. Additionally, they have joined with the federal government in something called the new generation vehicle, where there are significant commitments of resources trying to find a new paradigm, if you will, of personal mobility. And so there are real commitments. But there is also interest in the market place. And probably the market place will drive solutions faster than anyone else. We know that the first automobile company that introduces a viable electric vehicle into the market place with a battery that meets consumer expectations is likely to do quite well. America's car companies understand that and they are pushing very hard to be the first ones to break into that market place. But we've seen very bad examples of when technology was introduced to the market place before it was consumer acceptable. Then technology just died. We can't afford to have that happen. We also have to recognize that the economy in this country is very important. We want to make sure that the economy is stable and growing. And America's car companies are leading the way in restoring our economy to viability. That's why 19 out of every 20 jobs in the economy today in the automobile sector are from America's car companies.

CHAIRMAN KATZ: Just to clarify to people in the audience, panel three which deals with regulators in the environmental community, we're going to put off until we get closer to that topic because we're still going to complete this panel on the ZEV mandate. Then do the second panel on reformulated gasoline. I

mention that now in case anyone's waiting, but also because Mr. Card made reference in his statement to the US Department of Energy and talking about their concerns. I want to point out there's a letter that has been circulated to Committee members from the Environmental Protection Agency, on the other hand, that strongly supports California's ZEV mandate as part of what's in their federal implementation plan. Also the President made very clear comments on that same regard, along that same line last December in Canoga Park in support of California ZEV mandate.

ASSEMBLYMAN TED WEGGELAND: Mr. Card, you said something interesting a few moments ago. I wonder if you might be able to clarify or expand on that. You mentioned that the cost of producing conventional automobiles may increase to compensate for the cost associated with electric vehicles. Can you point to any figures? How much you expect the cost of conventional automobiles to rise as a result of that?

MR. CARD: First of all, there are some who are suggesting that. We'll have someone from DRI that might want to talk about that. But there have been discussions that I have heard outside of the automobile industry that show that there may be significant investments necessary to generate the purchase of a vehicle that is not consumer acceptable. Those investments would constitute a larger cost for a broader segment of the population.

ASSEMBLYMAN WEGGELAND: The reason I ask is that I'm familiar with at least one study that I thought put the amount at somewhere over \$4,000 per vehicle. Now is probably 10 or 15 years out, but that was extraordinary to me.

MR. CARD: Because of the anti-trust prohibitions against companies conveying cost and pricing information, I'm not able to give you any figures from America's car companies. But there are some who have suggested that there would cost added to traditional vehicles if the cost of an electric vehicle were far beyond that which consumers would be willing to pay.

CHAIRMAN KATZ: A number of the Committee members have left to go to San Francisco for the Speaker's Education Summit. Some of us are waiting to go later. That's why you've seen members coming in and out through the course of the day. We'd like now to ask Greg Dana whose the Vice President for Automobile Importers of America to testify.

MR. GREG DANA: Thank you, Mr. Chairman. My name is Gregory Dana. I'm Vice President and Technical Director of the Association of International Automobile Manufacturers. AIM is a trade association representing companies that sell passenger cars and light trucks in the United States that are manufactured both here and abroad. If I may make a slight correction. We used to be the Automobile Importers of America. The change to the name International simply reflects the fact that we now have numerous production facilities here in the United States. I might add that we have two manufacturing facilities here in California and we also have over 50% of the vehicles sales in this state from our vehicles producers. So I think you can see that California is a very important state to us.

Let me begin by saying that AIM supports California's clean air objectives. We recognize the fact that Southern California

has the worst air quality in the United States. We're willing to do our part to help try and address that problem. Our members have long been in the forefront of the development of advanced emission control technology and we continue that effort today. We believe that striving for clean air is simply good public policy and when industry and government can work together towards that goal, everyone will benefit.

Let me assure you that our members have committed significant resources towards the development of advanced technologies in order to meet the requirements of the LEV program. These include the expenditure of hundreds of millions of dollars on advanced controlled technology, development of alliances with battery research development and manufacturing companies, relationships with utilities to look at natural gas and the feasibility of electric vehicles, additional projects looking at other alternative fuels and power sources, such as hydrogen, propane, reformulated gasoline and hybrid vehicles. Finally, we've done significant amounts of market research to look at the consumer acceptability of such alternatives.

The zero-emission vehicle mandate of the LEV program is extremely challenging. In spite of this difficult challenge, our members are committed to meeting any requirement placed upon them by law or regulation. However, and let me stress this point very strongly, we believe that substantial breakthroughs in technology are needed for these products to be commercially viable. I'm not talking just about the basic batteries that power the vehicle, but also other ancillary systems used in the vehicle such as braking,

heating and air conditioning systems and others. At this time, our members plan to work jointly with the Air Resources Board in reviewing the state of technology development in the coming months. We plan to discuss that with the Board at the time of the review they planned for this May. The issues that need to be discussed at this time are very important and technically very complex. We believe it is appropriate to continue working at this level with the regulators on this issue. At this point and time, we are not seeking any action by this committee or Legislature on this issue. At least not while the regulatory negotiations continue with the Air Resources Board. That finishes my remarks. I'd be happy to take any questions.

ASSEMBLYMAN KNIGHT: Thank you Mr. Dana. If you'll notice, this is the first time that there is a Republic majority on the Transportation Committee. I believe our next presenter will be Mr. Montgomery.

MR. DAVID MONTGOMERY: Thank you Mr. Chairman. It's a pleasure to be here today. I appreciate the opportunity to speak to you. I'm David Montgomery and I'm Vice President of Charles River Associates. I'm here today to present to you the results of a study that was recently completed under my direction at DRI McGraw-Hill, and Charles River Associates where we worked together on the analysis of the costs, the effects, and the economics impacts of California's alternative vehicle and fuel programs.

CHAIRMAN KATZ: Clarify something for me if you will, please.
(break in tape)

MR. MONTGOMERY: ... I thought I'd begin by describing a bit

about what we did in the study and then outline some of the results.

California has taken essentially two approaches to reducing motor vehicle emissions. One is a set of performance standards directed at the emissions themselves and now those embodied in the emissions standards that will progressively become tighter for new vehicles moving toward low-emission vehicles and ultra-low-emission vehicles and focuses on tail pipe emissions and makes any vehicle which can meet those standards is a candidate to compete in the market. Similarly, standards for cleaner burning gasoline which will also reduce emissions in conjunction with the vehicles. We analyzed the cost of the effectiveness in some of the impacts of this package of programs. There's another set of programs which this hearing has concentrated on today of mandates for the sales of electric vehicles and subsidies for alternative fuel vehicles in California.

Let me turn first to, perhaps the best summary of our results which is on the cost-effectiveness of these mandates and how that compares to the other programs in California reducing emissions through the tail pipe emissions standards and cleaner burning gasoline. We concluded that electric vehicle mandates are much less cost effective than the California emission standards. That the electric vehicle mandates would have a cost of somewhere between \$50,000 and \$300,000 for every ton of hydrocarbon plus nox that they remove. But this is at least three to ten times the cost per ton of reducing emissions through the LEV and ULEV standards and through cleaner burning gasoline. In doing these

estimates, we worked together with Sierra Research, we used the California Air Resources Board's own MFAX7 Model, we took into account things like the deterioration of gasoline-powered vehicles on the road, tried to come up with the fairest estimate of emissions that we could. The second topic we looked at was the subject of subsidies in the State of California. There are a substantial number of programs. We relied again on research done by Sierra Research which I will provide copies of this to the Committee after my testimony, which look about 55 existing programs which at current funding levels would cost either taxpayers or rate payers in California something like \$2.2 billion in total between 1992 and 1998 in support of alternative-fueled vehicles and electric vehicles in various ways. The sum could reach \$3 billion by 2010 if current funding levels just for the electric utility and gas utility rate base proposals are continued. These subsidies are in addition to the efforts that were described earlier nationwide through the advanced battery consortium to develop heat technologies for electric vehicles. Let me turn now to some of the reasons for the lower cost effectiveness that we conclude at the higher cost per ton removed that we concluded characterizes electric vehicles versus approaches which concentrate on cleaner burning gasoline and motor vehicle standards.

ASSEMBLYMAN HAUSER: Could I ask you a question on your very first statement that it was considerably more--10 times--expensive to proceed with the zero-emission car than remove pollutants out of the air than other methods. But doesn't even a greater cost

assume that the electric car would in Fact be used. If in fact you're producing something that virtually no one will use, I don't understand how you can draw the conclusion that you get away... I mean if the thing doesn't work then how can it be compared to something else that does work?

MR. MONTGOMERY: We assume that the vehicles would be produced with the technology that was available in 1998 or 2010 and that manufacturers would price them relative to conventional vehicles in a way that would lead to consumer purchases of the targeted amount--2% up to 10%. We also concluded that that would require a substantial increase in the price of conventional vehicles in order to make it possible to sell electric vehicles at the same price that a comparable conventional vehicle would be sold at. That's the source of the estimate of from \$400 to \$4,400 per car in 2010 as being the added cost on all new vehicle purchases of the electric vehicles. But it is true. We are assuming in this case that the electric vehicles are comparable in every way to the gasoline-powered vehicles that they would be replacing. And that's probably an assumption which is overly generous from what I've heard from the automobile manufacturers and others of what the actual range, capacity, and other attributes of electric vehicles would be.

The cost of vehicles is the next one that I should turn to. In our analyses, we looked at the range of the literature estimating the cost of producing electric vehicles. We had discussions with automobile manufacturers and relied on some of our own studies. It appears there that even by 2010, it would

cost at least ten times as much to the added cost of electric vehicle compared to a conventional vehicle would be at least ten times what it costs to move from a current car that's being produced to a low-emission vehicle or an ultra-low-emission-vehicle. So it's about a factor of ten difference there in the cost of manufacturing a vehicle to meet the standards. As far as emissions go, the reduction in emissions that we estimate as coming from electric vehicles is only about 10% to 20% of the reduction in emissions that we would see that we estimate from the combination of California emission standards and cleaner burning gasoline. So if we put those two together, it pretty much explains our conclusions about cost-effectiveness--a much higher cost for the vehicle, a much lower total reduction in emissions compared to the LEV and ULEV program and California's Phase II to reformulated gasoline. I touched on the point of what would happen to new car prices in order for manufacturers to recover the cost of producing these vehicles and still sell them in the market place.

What this higher cost is likely to do is retard new car sales. That is one of the ways in which the electric vehicle programs might actually retard progress on reducing emissions, at least in the earlier years, because reducing new car sales reduces the turnover of the fleet. Turnover of the fleet with very clean new cars coming in and very much higher emitting old cars going out is a really important part of the process of reducing emissions in total. And slowing new car sales slows that process. These were our efforts to look at the costs and the effects on

emissions of these programs.

We then turned to the subject of what the electric vehicle program could mean for the California economy. The conclusions we reached on this are quite different from what others have asserted today. We conclude the electric vehicle mandates would mean less jobs not more. Let me back up one step to talk about this. It's no question that the California economy has suffered over the last few years. Some of the reasons for that have had to do with defense cutbacks, base closing, and other things happening outside California. But an important part in the DRI, McGraw-Hill analysis of California is that the higher cost of doing business in California have had an important affect on California's economic performance. What the electric vehicle mandates would do is raise that cost of living and cost of doing business in California. We see that as lowing employment, lowering wages, and lowering the standard of living in California. The added costs to the fuels and vehicles--all the programs of emissions standard for all cars, of bringing electric vehicles in, would cost something between \$2-9 billion in the year 2010. That expenditure gives no increase....

CHAIRMAN KATZ: That's not the ZEV mandate alone. You're not maintaining that I don't believe.

MR. MONTGOMERY: No. The ZEV mandate is responsible for about two-thirds of those costs.

CHAIRMAN KATZ: And it's responsible for that, how? You come to this conclusion, how?

MR. MONTGOMERY: Through the added cost of manufacturing

vehicles to meet the ZEV mandate compared to what it would have cost to manufacture the same number of vehicles meeting the emission standards that are required of manufacturers under the LEV and ULEV program.

CHAIRMAN KATZ: Do you believe California can meet the clean air act mandate simply by doing that?

MR. MONTGOMERY: We've actually looked at two different cases. In one of the cases the electric vehicles we assumed that...

CHAIRMAN KATZ: That wasn't the question I asked. The question I asked was a simple yes or no question which was under the scenario you created which is, 'We don't do anything with the ZEVs, we just buy all these new cars that are coming out that are so nifty. Can California meet U.S. clean air act mandates? Yes or No.

MR. MONTGOMERY: I think there are ways in which equivalent emission reductions could be generated through either changing the mix of LEVs and ULEVs in the fleet, or through alternative programs such as the scrappage programs directed toward high emitters.

CHAIRMAN KATZ: So the answer was no.

MR. MONTGOMERY: No. I don't think the answer was No. There are other programs that could achieve the same emissions....

CHAIRMAN KATZ: But that's not what you stated and that's not the question I asked. What I asked specifically was, you contended that California ought to simply continue to let the auto manufacturers make cleaner running cars and reduce the emission

through the development of those new car technologies, not a ZEV program. And my question was given that alternative as you set out, could California meet the clean air act goals? Yes or no.

MR. MONTGOMERY: That was not exactly the alternative that I set out. I was trying to compare the costs of those two programs.

CHAIRMAN KATZ: Since those were the only two you were comparing, I asked you, based on those two that you chose to compare.

MR. MONTGOMERY: Two programs that we were comparing had emission reductions of about 70,000 tons due to the California emission standards, and an additional 6,000 to 17,000 tons due to the introduction of electric vehicle mandates as part of those standards. I believe it would be possible to find 6,000 to 17,000 tons of emission reduction through, as I said, either a rebalancing of the LEV and ULEV standards. That certainly follows from the arithmetic of what we were doing or from programs that I've looked at in other contexts like the scrappage program. But anything beyond that is actually beyond the scope of what we did. We did not go through modeling compliance with the air quality regulations, so I can't address that.

CHAIRMAN KATZ: OK, let me try something else then. See if we can do this easier. You said that you thought that California taxpayers would pay \$2.2 billion for the ZEV requirements. Is that correct?

MR. MONTGOMERY: Actually, the \$2.2 billion is for the subsidy programs which are currently in effect through the year 1998. That \$2.2 billion is composed in large part of

demonstration programs for a range of vehicles, about \$.5 billion is accounted for by the rate basing at electric and gas utilities as incentives for vehicles, some of which will be for compressed natural gas vehicles, and the remainder are expenditures for places like LA County mass transit district for electrification of existing bus lines. The expenditures for electric vehicles would be over and above those. They would be mostly incurred in 1998 to 2000 timeframe as the vehicle mandates increase. And those are much larger numbers. They run up to as much as \$6 or \$7 billion a year.

CHAIRMAN KATZ: So, that \$2.2 billion is no part of the ZEV mandate, then?

MR. MONTGOMERY: That's not part of the ZEV mandate beyond '98.

CHAIRMAN KATZ: OK, I just wanted to clarify that. Also, for my own clarification, you did some similar kind of work for OTC?

MR. MONTGOMERY: I did not.

CHAIRMAN KATZ: McGraw-Hill DRI?

MR. MONTGOMERY: It was before my time there. I'm not sure if there was. It's not something I can speak of now.

CHAIRMAN KATZ: I don't know if it was done before your time or not, but according to a February 14 letter from the Northeast States for Coordinated Air Use Management, DRI McGraw-Hill did a study of similar nature based on, for their consideration, which they totally rejected and basically found no value in. Just in case you're interested.

MR. MONTGOMERY: Not everything was going on under my

jurisdiction...

CHAIRMAN KATZ: I didn't say it was your fault.

MR. MONTGOMERY: The study that was being done for the ozone... There was a study which was embarked on at DRI which I did not participate in which addressed the subject of the availability of reformulated gasoline for New York State. It's the only on-going study that I can think of. And that's a completely different topic from the one we are dealing with here.

CHAIRMAN KATZ: I think I'm speaking to the credibility of the study. The study, by the way, was called, 'Assessing the Economic ___ of Eastern States Adopting California's Low-Emission Vehicle Program'. Just for your reference.

ASSEMBLYMAN HAUSER: Can I ask a question? You talk about a two to nine billion dollar cost for implementing the electric vehicle mandate.

MR. MONTGOMERY: That was for all of the programs--the electric vehicle mandates, plus the other emission controls. The electric vehicles is about \$1-7 billion, taking just the electric vehicles.

ASSEMBLYMAN HAUSER: The reason I ask you about that is that seems like a huge variance. It's not like two to three billion, it's like two to nine billion. Why is it so difficult, why is there such a range in the variance?

MR. MONTGOMERY: Because there is so much uncertainty about both the technology and the extent of the programs that might be involved. That on the technology side, we took estimates at one end from the optimistic range of literature that saw out

there--the low end of the National Petroleum Council estimate of what electric vehicles cost. At the high end of the range, we took, in consultation with the auto manufacturers, we looked at the cost goals of the Advanced Battery Consortium and the vehicle designs that it would take to make those acceptable to ten or twenty percent of the market. On that basis came up with a very different cost. There just is a very wide range there. We were not trying to say, "We know the answer of what in 2010 exactly an electric vehicle will cost".

If I could make two or three other points to wrap up the economic analysis side of the testimony. We were starting out with the added cost of manufacturing vehicles. That's the cost that would be borne by California residents and consumers. Spending that higher cost on electric vehicles means the consumers have less to spend on everything else. That turns into job loss in California which we estimate at somewhere between 50,00 and 150,000 jobs in the year 2010 due to these combined programs, lower wages for those who remain, adding to a drop in personal income in California of \$5 to \$15 billion. In the process of developing these estimates, we again were talking to companies and reached the conclusion, based both on those discussions and other work that had been done at DRI on the location of auto production that it's very unlikely that these vehicles would be manufactured in California. They're likely to be manufactured where it's cheapest to manufacture them and that means where there are existing plants, which they have capacity that could be used for these kinds of relatively small production runs, where there are

engineering design facilities close by for dealing with problems, and particularly where there are a lot of workers who are now currently furloughed and can come be put back to work at nearly no cost to the auto companies. So I suspect that even the jobs for vehicles themselves would not appear here in California. They would be manufactured where they would be cheapest.

Putting this all together--as an economist, my assessment is that it violates basic economic principles, that a state can make itself better off and boost the economy from regulatory programs that raise the cost of doing business in the state and the cost of living. That's what electric mandates would do and they would do it with far smaller emissions benefits than other less costly programs that are now in place.

I'm prepared, I think, to answer any other questions that you might have. Thank you.

ASSEMBLYMAN HAUSER: Can you be more specific about how are these jobs lost in California? The figure, I think, was over 100,000. Be specific and tell me how are those jobs lost? Out there in the dealerships or... Can you explain that?

MR. MONTGOMERY: Jobs are lost because there is less income to go around in California to buy goods and services after this higher expenditure for electric vehicles is deducted. That a large portion of the spending on the electric vehicles--all these higher costs--are likely to go support jobs outside California and the money will go outside the state. What remains inside the state, first of all, will come out of spending on local goods and services. That has a certain multiplier effect as those

industries decline. That's the primary driver of the reduction in economic activity. At best, what we can see is that a dollar that was spent on an electric vehicle and on a job is not spent on another good produced in California. So the best you can ever expect out of a program like this is that it would be a wash on jobs because it doesn't create anymore income in California. All it does is direct California residents to spend more of their income on vehicles and they have less to spend on something else. So if their job's in one place, they have to come away from jobs and another place. But it appears that overall many of those jobs for producing the electric vehicles which California residents would be mandated to buy. But those jobs would be outside California, so there would be a net loss in jobs in California.

ASSEMBLYMAN HAUSER: You have a cost by year 2010 of \$4,400 in estimate more per car. I've seen different figures, of course, without dates on them. I assume they were in this century of anywhere from \$400 to \$1,500 more per car. I've read some in auto magazines that if it were spread all over the United States, it would be around \$500 per car. If it were in California alone, it might be \$1,500 per car. Could you explain how you come up with this \$4,400 per car?

MR. MONTGOMERY: The high end of our range was based on a scenario in which we assumed that the electric mandates were increased to 20% of new vehicle sales as has been proposed by the South Coast Air Quality Management District as a way of finding additional emission reductions.

CHAIRMAN KATZ: That's not a mandate, that's not a regulation.

That's just like a concept paper tossed out by South Coast Air Quality Management District, right?

MR. MONTGOMERY: Yes. That was our high case. The mid case was for the 10%.

CHAIRMAN KATZ: But all the other numbers that we've had so far from you are based on the worst case scenario. None of the jobs being located in California; all of the money being spent out of California, right?

MR. MONTGOMERY: Those at the high end of the range, the low end of the range that I've cited sometimes has been based on other assumptions.

CHAIRMAN KATZ: That's what I thought.

MR. MONTGOMERY: The way we calculated that was for the \$400 case, we assumed that electric vehicles would cost \$4,000 more than conventional vehicles and that they would be 10% of the market. We also concluded that the auto manufacturers would not be able to spread those costs on sales outside California. The competitive forces would prevent them from doing that because it's only on condition of doing business in California that some percentage of sales be electric vehicles. So that calculation is quite simple. \$4,000 added cost spread across for 10% of the vehicles sales. When you spread that across 100% of the vehicle sales, it becomes \$400 per vehicle.

CHAIRMAN KATZ: So you chose to ignore the OTC action. You said none of that cost would be spread outside of California.

MR. MONTGOMERY: It would end up virtually the same if the OTC took the same action, because the additional vehicles produced

for the OTC would also have an additional cost. That would have to be paid by somebody....

CHAIRMAN KATZ: So in your mind there's never an economy of scale just because you don't like the concept.

MR. MONTGOMERY: No, there are some economies of scale. But they appear mostly to apply to the manufacturing of vehicles. We've actually taken into account quite substantial economies of scale in manufacturing. But as other witnesses have pointed out, the primary cost component is in batteries. In batteries, the issue on costs appears to be the development of the technology and whether or not there is a technology break through rather than a question of the rates of production for the batteries.

CHAIRMAN KATZ: OK. Thank you very much. The second part of this lengthy exercise that we're going to deal with, and again my apologies to people who have been waiting for members who have gone to the Education Summit or.. I'd like to ask to come forward, Miss Jackie Schafer who is the Chairperson for the Air Resources Board, Mr. Robert Trunek who is the Senior Vice President, Manufacturing Engineering and Technology at ARCO, Carolyn Green, the Director of Government Affairs for Ultramar, and Jeff Irvin, the President of California Independent Oil Marketers Association. After this panel concludes anyone else who wants to add something that we haven't covered today, keeping in mind that when Mr. Richter's bills and other bills come forward, we will have more than enough opportunity to do this all over again, can feel free to come forward and make comments.

JACQUELINE SCHAFFER: Good afternoon, Assemblyman Katz. I am

Jacqueline Schafer, Chairwoman of the California Air Resources Board. I'm pleased to participate in today's hearing on California's plan for clean vehicles and fuel. I understand that the Committee is primarily interested in having my testimony on the transition to reformulated gasoline. As this committee is well aware, however, California's plan for clean vehicles and fuels is an integrated and mutually-dependent program. It is almost impossible to discuss one part in isolation from the others. I would, therefore, like to begin by placing the process for introducing reformulated gasoline into this larger perspective. And I assure you, Mr. Chairman, that I will summarize my full prepared statement.

Recognizing that motor vehicles remain the single largest contributor to California's air pollution problem, the Air Resources Board in 1990 adopted the low-emission vehicle clean fuels program. For the first time, motor vehicles and the fuels that are used in motor vehicles are treated as an integrated system. The ARB's approach is founded on several important principles. First, the program is fuel-neutral. It accommodates a variety of alternative fuels, such as compressed natural gas and methanol, as well as cleaner gasoline which we call Phase II reformulated gasoline. Second, the program is performance-based. That is, it does not specify a particular emission control technology. Rather, it sets new performance standards for tail pipe emissions for motor vehicles. Manufacturers choose which combinations of vehicle technology and or clean fuel to use. Thus, the program encourages the broadest range of technological

improvements to current emission control systems. The regulation also establishes a decline in fleet average standard for non-methane organic gases, a hydrocarbon standard. Automobile manufacturers may then use any combination of low-emission vehicles, the TLEVs, LEVs, ULEVs, and ZEVs that you heard about earlier today. And conventional vehicles to meet the fleet average standard. Third, this program is technology forcing. Because the air quality in California is so severe, the ARB also adopted a mandate for zero-emission vehicles as part of the low-emission vehicle regulation. The ARB regulation stays in the ZEV requirement gradually giving manufacturers a eight-year lead time. The mandate requires, beginning in model year 1998, that two percent of the passenger cars and light duty trucks offered for sale in California be year large manufacturer must be ZEVs with that percentage increasing to five percent by 2001 and ten percent by 2003.

The United States Environmental Protection Agency granted a waiver of federal preemption for California's low-emission vehicle program in January of 1993, and the first low-emission vehicles were offered for sale in the 1994 model year. At the Air Resources Board's hearing at which these regulations were adopted, the Board also adopted a resolution which called for the biennial review of this program. Our executive officer was directed to report to the Board, first by the spring of 1992 and thereafter at least biennially, on the status of implementing this program. The regulated public and other interested parties must be consulted in preparing the reports and must be provided an opportunity to make

oral and written comments to the Board in connection with these reports. The first review was held in June of 1992, at which time the Board determined the low-emission vehicle program was on track. I've directed the executive officer to complete the second review of the program and present the staff's report to the Board on this coming May. The ARB will review progress on the feasibility and cost issues for low-emission vehicles and for zero-emission vehicles.

Turning to reformulated gasoline, the Board adopted the reformulated gasoline regulations, Phase II regulations, in order to help auto manufacturers meet the stringent vehicle emission standards at lower cost to the consumer. Without this cleaner burning fuel, auto makers would have to apply more technology at greater cost to reach the low-emission vehicle standards. The scheduled introduction date for the Phase II reformulated gasoline is March 1, 1996. In addition to contributing to the low-emission vehicle performance standard for new cars, the reformulated gasoline regulation will significantly reduce emissions from existing mobile sources. We estimate that the 1996 on-road vehicle exhaust emissions of oxides of nitrogen will be reduced by 110 tons per day and volatile organic compound emissions will be reduced by 230 tons per day.

These emissions reductions will be achieved at a cost that is approximately one-third to one-half of the cost that California's industry would have to pay for a comparable magnitude of emissions reductions from stationary sources. This is because virtually all significant industrial sources have been or shortly will be

well-controlled. And additional controls would come at far higher costs. Achieving major reductions in pollution from cars and trucks is the only realistic path to follow for California to achieve healthful air quality. Perhaps most compelling in this reformulated gasoline program is the fact that the air quality benefits begin as soon as the regulations take effect. Unlike the gradual reductions in emissions that occur as older cars wear out and are replaced by new, cleaner running cars, all 20 million or so cars on the road in California will pollute much less after the reformulated gasoline is introduced. On average, each car will emit 15% less hydrocarbons and 10% less oxides of nitrogen. While the Board adopted the regulation because of its significant air quality benefits, we also recognized that it imposes substantial costs. These costs will be borne ultimately by the consumers. Those individuals, businesses and agencies that purchase gasoline. At the time this rule was adopted, the ARB estimated that reformulated gasoline would cost refiners between 12 and 17 cents more per gallon to manufacture than today's gasoline. Because these costs are so substantial, we continue to work closely with refiners as this rule is implemented to lower the capital and production costs of making this fuel wherever possible. Our aim is to ensure an orderly transition as reformulated gasoline enters the market place and to investigate any potential problems associated with the use of reformulated gasoline and to identify practical solutions to be applied prior to its introduction.

Specifically, we will be working with refiners to assure that together they are ready to produce the new fuel on time and in

sufficient quantities. We will pursue testing to reduce the risk that reformulated gasoline may cause or contribute to mechanical problems. And three, we will consult gasoline users and other affected parties to develop plans to ensure a smooth transition to reformulated gasoline, including contingency plans to respond to unforeseen situations that could arise. My written testimony details these activities so I will highlight just a few at this time.

We have requested all refiners to provide us with their preliminary estimates of the volumes of reformulated gasoline that they will have the capability to produce and the volumes that they expect to produce in 1996. We and the California Energy Commission have requested periodic updates of this information and will publish estimated volumes that will be produced in 1996, as well as the projected demand for gasoline. We soon will establish an interdisciplinary group that will include fuel producers, vehicle manufacturers, end users, gasoline marketers, fleet operators, auto associations, and others to identify and address specific concerns with the introduction of reformulated gasoline. We will work with all interested parties to develop a program to conduct performance testing of vehicles using reformulated gasoline. We have already written to gasoline producers, gasoline marketers, vehicle manufacturers, and after-market parts manufacturers, soliciting information that they may have already developed regarding the evaluation of engine performance with reformulated gasoline, as well as fuel compatibility with various engine materials.

We will develop consumer education information to keep the general public properly informed and prepared for implementation of this regulation. Consumers should feel confident that ample supplies of fuel will be available and that the fuel would perform as it should. Since the public will ultimately bear the additional cost of the reformulated gasoline, we also think the consumers would appreciate knowing that the price they pay at the pump includes meaningful improvements in air quality.

Returning again to the point I raised earlier concerning the price, I've noted that the additional cost to produce this reformulated gasoline was originally estimated at between 12 and 17 cents per gallon. In an effort to achieve significant savings in the cost to produce this gasoline, we are in the final stages of developing a _____ model that will allow refiners to use alternative reformulations. Application of this model will preserve the emission benefits of our rule, but will increase production capability and reduce production costs.

In conclusion, I would like to reassert that motor vehicles and their fuels are principle focus of our work at the California Air Resource Board because motor vehicles are the single, greatest source of air pollution in this state. When the Board adopted the low-emission vehicle program in 1990, inherent in the design of those regulations was the conclusion that the use of cleaner fuels including improvements in the composition of gasoline, along with the application of advanced emission control hardware, achieves the greatest possible reductions in motor vehicle emissions.

Taken as a whole, this comprehensive strategy constitutes

California's plan for clean vehicles and fuel. It is a sound strategy, which when implemented intelligently, promises to contribute significantly to improving California's air quality and to strengthening California's economic prosperity. I look forward to cooperating with the chairman, Mr. Katz, and all the members of the Assembly Transportation Committee, as we move ahead with this plan.

ASSEMBLYMAN HAUSER: Thank you, Miss Schafer. Just a real quick observation or point. I hope that we will use the experiences from the diesel fuel conversion to learn how not to do something. My real question would be, how much money is really being invested by the state in trying to determine the problems with the mechanics, the engines, so that we can head off the problems that occurred with diesel fuel?

MISS SCHAFER: There are a number of efforts for fuel testing the reformulated gasoline on-going. There were some that were conducted at the time the Board adopted the rule. There are a number that are going on right now being run by the major automobile manufacturers, as well as an organization called South Coast Alternative Fuels Demonstration which is really a coalition of interested parties that are going to test 21 Federal Express vans. We realize there are some limitations to each one of these, but we think that all together, we should get a lot better handle on the performance characteristics of the reformulated Phase II gasoline. In addition, we had begun discussions with the automobile and oil company representatives to see how we can go about conducting more extensive testing of in-use vehicles on

Phase II reformulated gasoline. We're optimistic that we'll be able to develop a comprehensive program to determine whether there are any problems and develop solutions prior to the introduction of the fuel in 1996.

ASSEMBLYMAN HAUSER: That answers what would have been my second question, the participation by the major manufacturers.

MISS SCHAFER: We are working very closely with them, but we also are expanding the organizations and interests that we normally would deal with in developing these regulations and implementing them to include the users of the fuel, marketers, intermediate marketers, and just broadening our approach beyond what we did, I believe, in the Phase II reformulated diesel case.

CHAIRMAN KATZ: Thank you, Miss Schafer. If we can move next to Mr. Trunek, VP, Manufacturing, Engineering and Technology from ARCO.

MR. ROBERT TRUNEK: Mr. Chairman, good afternoon. My name is Bob Trunek. Actually I do have a new position as of the first of February. I'm now Vice President, Environment, Health and Safety for ARCO. I'm probably am testifying partly in my old position and partly in my new one. I will also try to brief. I certainly don't want to stand in the way of the Committee and the Speaker and his event in San Francisco.

CHAIRMAN KATZ: We'll just mention when Dan and I aren't there that it was your fault.

MR. TRUNEK: I was afraid that might happen. ARCO has been a leader in clean fuels technologies for a long time. We've participated with California because the state has also been a

leader for a long time. I think it's important to note that ARCO was the firm that introduced the first reformulated gasoline to the world. We called it EC for Emission Control One back in 1989, followed up in 1990 with EC Premium, and we unveiled ECX a short while afterward. ECX was really the foundation for, and is very similar to, the gasoline formulation which was ultimately adopted by the State of California as Phase II gasoline.

There has been a lot of progress made in fuels and vehicles in the last 20 years or so. It was stated earlier today that emissions from vehicles have been reduced by more than 90%, less than 10% of what they were just 20 years ago. Phase II gasoline represents the next step in that evolution of fuels technology. Phase II gasoline represents the only strategy available to the state of California which will on the date of its introduction immediately and dramatically reduce emissions from the entire fleet. There's no other strategy which does that. At the time of its introduction, it was estimated that Phase II gasoline was the equivalent, in terms of emissions reduction, to removing 8 million cars or roughly one third of the vehicles from the roads. The Phase II gasoline also provides the most user friendly approach to meeting the LEV standards for automobile manufacturers.

Phase II gasoline will cost more. It was estimated 12 to 17 cents a gallon. Other have estimated up to 23 cents a gallon. Our own estimates are in the range of CARB's estimate of 12 to 17 cents.

CHAIRMAN KATZ: Does Phase II exceed EPA standards?

MR. TRUNEK: EPA also has two phases. The Phase I standard

for EPA kicks in in '95. It definitely exceeds the Phase I standard. Since the Phase II standard is not yet set, it's really unknown. It's expected that Phase II, federal, may be very similar to Phase II, California. But that's not known at this time.

CHAIRMAN KATZ: I just mention that. It's getting sort of tiresome to exceed federal EPA standards and then when we look at overall emissions, whether it smog check or something else, not get recognition for the fact that all of our motorists in California are paying a whole lot more, whether through the fuel standards or whether through the California emission only vehicle, or a number of things. I'm not questioning it from the standpoint of improving the air that we all breathe. It's just frustrating that the feds can't seem to understand that we seem to be doing more than anyone else in the country at this point.

MR. TRUNEK: Mr. Chairman, I couldn't agree with you more. The air in Los Angeles is twice as clean as it was, has half the pollutants that it did 20 years ago, and yet there are three times as many cars. It is incredible, the job that's been done. But it will cost more. And one of the reasons it will cost more is there are tremendous investments that are required in refineries in order to produce it. Our own company, ARCO, will be investing well over half a billion dollars in its Los Angeles refinery in order to produce this fuel.

CHAIRMAN KATZ: That's for the Phase II? What was your investment on Phase I?

MR. TRUNEK: Phase I was over \$100 million. Phase I happens

to be a good step toward meeting California Phase II. There is a tremendous amount of money required in order to meet these rules. On the plus side, I guess from your standpoint, that means construction jobs. We will be employing well over 2,000 people in our refinery during the construction of these facilities.

CHAIRMAN KATZ: How long a period of time?

MR. TRUNEK: It started last year. It will run through '95. Actually a little bit into '96. There will be some additional manpower for maintenance and operation beyond that. The Atlantic Richfield Company has been one of the major supporters of the Phase II role since its inception. We've remained committed to it. We are committed to it. We are somewhat concerned, however, that perhaps government doesn't share that commitment. It is certainly encouraging to hear the commitment that was voiced by Miss Schafer.

MISS SCHAFFER: That was my testimony, Mr. Chairman.

MR. TRUNEK: But I have to say that as recently as last week, one of the actions of the California Air Resources Board casts some doubt on that. I'm referring to a variance that was granted to the diesel rule. And the question remains: Does the commitment for support, does it include the excusing of some participants from the market place from having to meet those...?

CHAIRMAN KATZ: Since you're obviously being polite, I assume to mean the Tosco variance without the penalty.

MR. TRUNEK: You hit it. I was trying not to name companies.

CHAIRMAN KATZ: We might as well talk about what we're talking about and then we can let Miss Schafer respond to that,

too.

MR. TRUNEK: Obviously, to the extent that a competitor is not required to meet the same rule, it has the perverse affect of rewarding those who fail to comply and punishing those who do. With the kind of investment that we're talking about here, that's an untenable situation for any investor. Californians, I don't believe, will accept and nor should the ARB tolerate any relaxation in the rule, its compliance date, or the requirements for a full industry participation.

CHAIRMAN KATZ: Were the Phase II requirements to be delayed, postponed? What that basically means is that companies like yours--I know ARCO isn't the only one that has gone out and started to get geared up--but will have spent hundreds of millions of dollars for something that may not happen or would not happen, if that were the case, and you might be in the market place against somebody who just decided to take a pass on it on the theory that it might get overturned. So you're out half a billion, or whatever it is, and they sort of skate, as I assume the concern both on the Tosco, but on the bigger picture as well.

MR. TRUNEK: Absolutely.

CHAIRMAN KATZ: Dan was just mentioning that was the argument. When the Committee rejected the Statham bill which dealt with last year's requirements the argument was, again, going back to giving business something they can rely on as far as regulation, and certainly the business climate that we felt that there were a lot of producers that had spent hundreds of millions of dollars coming into compliance and that would have rewarded

those who had for whatever reason not stepped up to have delayed that. That's why the Committee held the Statham bill.

MR. TRUNEK: That is precisely our concern. Testing was mentioned earlier and let me say that we certainly know that Phase II gasoline is a new product, and every new product requires testing before it's introduction. We at ARCO are coming into this with already five years of experience in reformulated fuels, starting with our EC1, as I mentioned earlier. EC1 is not the same fuel as Phase II gasoline, but it has some of the similar kinds of components.

We feel very confident that Phase II gasoline will be a fully-acceptable fuel for all the vehicles for which it is designed. However, that doesn't mean that more testing shouldn't be done. Miss Schafer mentioned... Well, first of all the fleet testing that's being done by Federal Express in which we're participating--it's a two year program, it's about half way done. It includes the Phase II gasoline as one of the components of the test. We're also participating in other test work that's on-going, and discussions with both the autos and we'll welcome the ARB and others. We'd love to participate in further testing in order be absolutely certain that we can demonstrate the success of this fuel. As I say, we're not concerned about it but we do not want to leave any stone unturned.

Let me just close. I'd like to compliment, Mr. Chairman, the Committee on taking an active interest in this issue. Obviously, it's something that is a great concern to fuel suppliers in this state. The issues surrounding the introduction of fuel, I think,

are very complex, and it's important that they get fully aired. The most important thing message I'd like to share with you is that in order to successfully introduce this fuel, it's absolutely imperative that government stand fast in its requirement both in terms of specification and in terms of timing, because the billions of dollars that are being invested here cannot be successfully invested in the face of regulatory or legislative shifting or change. I do think that together we will certainly be able to move the state forward towards meeting its clean air objectives. I'd be happy to take any questions.

CHAIRMAN KATZ: I appreciate your testimony. Before we go on to the last two witnesses, let me ask Miss Schafer to respond on the Tosco question since that was raised in terms of this witnesses testimony and also some of the staff work that has been done.

MISS SCHAFFER: The executive office of the Air Resources Board did approve the Tosco variance on February 7. It's important to understand that the fuel which was the variance fuel for this purpose is a very clean fuel and comes close to being a fuel which is certifiable as an alternative fuel formulation. The Tosco organization and our own staff agree that when tests are done which are about to take place if not are underway right now, that this fuel stands a good chance of being certified as an acceptable alternative fuel. In any case, the variance expires no later than July 15, or 30 days after the new complying fuel is certified. The action was taken in part to ensure that we'd continued sufficient production of diesel so no new disruption in

the market place would take affect. No mitigation fee was charged in this case because of the additional cost associated with the producing this rather clean fuel which, as I said before, we believe may come close to certifying as an alternative fuel.

CHAIRMAN KATZ: What if it doesn't make certification?

MISS SCHAFER: Under the agreement, the variance expires no later than July 15, 1994.

CHAIRMAN KATZ: But you don't go back retroactively and impose six cents a gallon?

MISS SCHAFER: That's is not part of the variance agreement.

CHAIRMAN KATZ: So if it falls short then, and we're just using this as an example again, I don't know anything about this fuel. But if it falls short, then essentially they've received a six-month window, like no harm, no foul.

MISS SCHAFER: That would be a correct characterization. The other important thing that I want to mention is that in addition to agreeing to the expiration date of July 15, Tosco has in effect forfeited its opportunity to seek a waiver in the second and third year which was part of our variance process up until now. We think that they stand a good chance of certifying and that they will be treated like all other fuel manufacturers with respect reformulated diesel by July 15.

CHAIRMAN KATZ: Have you assessed a fine against any other manufacturers?

MISS SCHAFER: Yes, the fine had been assessed previously, and as of February 11, we had collected about \$10 million into the diesel fuel escrow account. If you'd like me to break that down,

\$7.6 million was collected from Chevron, \$2.5 million from Ultramar, and \$160,000 from Texaco.

CHAIRMAN KATZ: That money is distributed... What happens to the fines in the diesel account?

MISS SCHAFER: No determination has been made yet on how those funds are to be used, so they remain in the diesel account.

CHAIRMAN KATZ: Thank you. Let me ask now Ms. Green from Ultramar, to testify. Then Jeff Irvin from the Independent Oil Marketers.

CAROLYN GREEN: Thank you, Mr. Chairman. For the record, I am Carolyn Green. I'm Director of Government and Public Affairs for Ultramar, Inc. For people who are not familiar with Ultramar--we're certainly not as well known as ARCO. We're the largest independent oil company that both refines and markets on a retail basis here in California. We operate the newest refinery in Southern California producing about 45,000 barrels of gasoline and about 11,000 barrels of diesel per day from crude and intermediate feedstocks. Virtually all of our crude supplies is domestic and about 90% of that comes from California. We use a fairly large percentage of heavy sour crude oil. Even though we do, we're acknowledged as the least polluting refinery in the South Coast air basin. Particularly in light of the on-going discussion today, it's important to remember that, certainly for the foreseeable future, gasoline is going to be the fuel of choice for the overwhelming majority of California motor vehicle operators. It's important also to recognize why that's the case. California's gasoline is meeting the air quality challenge,

particularly with the reformulated gasoline standards. Ultramar was the second of only two refiners to support the Phase II reformulated gasoline standards.

We supported those standards for three reasons. First, we want gasoline to remain the fuel of choice in California. And the only way to make that happen is to show that gasoline can meet the emissions characteristics of its competition (break in tape) ...unlike the current debate over electric vehicles, the Phase II gasoline is based on existing technology. It's expensive to make the refinery modifications necessary to produce Phase II gasoline, but it can be done. Secondly, unlike some of the industry, Ultramar operates entirely within California. And if motor vehicles don't do their fair share to clean California's air, stationary sources like ours, which operate pretty close to best available control technology levels, will have to go beyond what's known to clean up our emissions. I might add that we also are fully offset. We are the only refinery that has all of its emissions offset. Even if we do that, we still won't make the air quality standards. In fact, if every stationary source in Southern California were shut down, the region would still violate the ozone standard. Aside from inspection maintenance as Mr. Trunek was mentioning, the single greatest opportunity for emission reductions is the Phase II program. And finally, I'd be remiss if I didn't admit that Ultramar thinks that we can produce Phase II gasoline at a competitive cost.

In fact as a newly-publically-held corporation, we've staked our future on our ability to meet those fuel specs on time and on

budget. This is the largest single capital project in the history of our refinery. It is going to cost us \$117 million to meet the federal and the California gasoline specs. We will be hiring an additional 800 people at the peak of construction. Most of those coming from the surrounding community. So far, we have let, by December of 1993, we had let over \$10 million in contracts to people in the Wilmington, Long Beach area. We've entered into major engineering contracts for our work with two Southern California firms.

We've been aggressively pursuing permits to do our refinery modifications. We've made sure we've kept the Air Resources Board and the South Coast District informed of our progress. We've raised concerns that we have immediately. And we've forced ourselves and the agencies to focus on those concerns until they're resolved. We have made a standing offer to all of the agencies to tour our refinery and observe our progress. I would note that we think we should be able to make an adequate return on our investment at about eight cents a gallon for the Phase II reformulated gasoline. I think with all of the...

ASSEMBLYMAN HAUSER: Eight cents a gallon. That's a little bit less than what was discussed by Miss Schafer.

MS. GREEN: That's true.

ASSEMBLYMAN HAUSER: And you feel you can still make a recovery of your investment and a profit with eight cents a gallon?

MS. GREEN: Yes, we do. In looking at some of the potential problems, what's important is to make sure we try to identify as

many potential problems as we can, but recognize there are going to be glitches. We cannot take care of everything. Various refiners are at widely different points in the permitting and construction process. I join Mr. Trunek in urging that the Administration really live up to its comments that it supports the reformulated gasoline program. We need that kind of regulatory certainty with the investments that we're making. We've been heartened by the courage of the Administration in staying the course on the diesel regs. We hope that that bodes well for the RFG program. The only other comment that I would make is that although a lot of progress has been made on the predictive model, it still isn't complete. That's really what's going to determine whether the recipe that we all come up with is going to meet the specs or not. So, if we don't have closure on that very quickly, we could see some problems. The Air Resources Board is proceeding very expeditiously. We salute them on that.

ASSEMBLYMAN HAUSER: Either that or an observation. It seems to me from what you've said that while a large firm like ARCO would certainly suffer if the regulations were changed, a moderate sized firm potentially has its neck on the line.

MISS GREEN: Not potentially--absolutely.

ASSEMBLYMAN HAUSER: And so again, we face the real possibility of losing jobs and investment in this state if we don't keep to the path we set out.

MISS GREEN: That's right. We will always disagree during the rule adoption process, but once that rule or that regulation has been put into place, we depend on the process remaining as was

agreed so that we have some sort of regulatory and planning certainty.

CHAIRMAN KATZ: Last witness we're going to hear from is Mr. Irvin, who is the President of the California Independent Oil Marketers Association.

MR. JEFF IRVIN: Thank you, Mr. Chairman. I am Jeff Irvin. I am the 1994 President of the California Independent Oil Marketers. I'm also Vice President of a family-owned petroleum distributorship in Cudahy, California. We've provided written comments. I'd like to touch briefly on four items.

We strongly recommend that the transition to RFG be phased in over a period of at least one year. After our experience with the diesel fuel crisis, we do not believe there is any benefit on a drop dead compliance date for all segments of our markets.

CHAIRMAN KATZ: Just do it during the month of March...

MR. IRVIN: You can start it April 1, but phase it in over a period of time. We believe the phasing will allow the new gasoline to naturally work its way through the distribution chain, beginning with the refiners, to distributors, and on to the retailers. It does take time to turn inventory in your tanks and it's difficult prior to April 1, to get all this old fuel out and expect to have enough supply for the new fuel. I was very pleased to Chairwoman Schafer talk about the last three items I'm going to touch on.

One being insuring adequate supply. It seems the last go-around--and I'll revert back to the diesel--there was a lot of proprietary information. We're not concerned about formulas; we

just want to know how much is going to be made available, when and where is it going to be available--statewide or only on a regional basis. There were people in parts of the state that really had trouble getting this new diesel fuel.

CARB has also indicated in recent meetings that they may not know until March 1, 1996, who's going to make what. One month before the compliance deadline just is not sufficient. I need to know, as a business operator, who's going make it and if it's going to be regional. I commend ARCO for all their efforts. We are a diesel customer of ARCO, but I can't buy gasoline from ARCO. So it's important that I have supply elsewhere. It's important that we all understand that.

We'd also like contingency plans. We'd like to establish a multi-industry, multi-agency public work group to identify potential problems during this transition. I believe CARB's already worked that in. I appreciate their efforts and it seems to be working real well. We are concerned, of course, if there is a supply disruption, if prices do go sky-rocketing as they did with diesel fuel. This time the prices are going ___ on the street. That's going to be a lot of unhappy people. We want to keep that in mind.

Finally, the testing. That's my favorite. We had a lot of customers calling saying, "Hey, this diesel's ruining my engines". We do want to see testing. The lack of requirement to test is a serious flaw. This may be a great time with any future fuels to just make it a requirement that all these fuels will be tested. We're not concerned with Ultramar fuel by itself, or an ARCO fuel.

But what happens when you commingle. Unfortunately, we do not have a lot of loyal customers. They don't all buy from one supplier. What are the effects of this fuel in cold weather like we're experiencing with diesel fuel? Just be reasonable.

We'd also like to see economic incentives for those refiners who make the fuel rather than penalties for those that don't. We all know that ultimately the penalties are passed on to the consumer and that's not really fair. If there's some way to provide economic incentives, we'd like to explore that.

CHAIRMAN KATZ: What kind of economic incentives are you talking about?

MR. IRVIN: We've talked about emission offsets, stationary source pollutants, things like that. Start them and then phase them out. Salable emission credits--that type of thing. But again, the penalties are passed down. We all pay for those.

In closing, CIOMA does support the RFG program and hopes that it really does improve air quality in the state. However, our members urge the state officials to implement the regulations as reasonably as possible to minimize disruptions and supply and price impact to consumers in the state.

CHAIRMAN KATZ: Miss Schafer do have any response to any of that or comments to want to make at this point?

MISS SCHAFFER: No. I appreciated the testimony of all the other witnesses on the panel. I and members of the staff have met with a number of these organizations to try to put together the plans that I outlined in my testimony today. So I think it's mutually reinforcing. Thank you.

CHAIRMAN KATZ: There's some interesting points on how the fuels operate when they're commingled in the gas tank as opposed to testing separately and how much of an issue there is or there isn't. If there is, I think that's something we need to look at. I appreciate the panel and appreciate your waiting and patience as we got through. Is there anyone in the audience who feels compelled to add something at this point, understanding that we're going to revisit a lot of these issues over the next couple of months and many more hearings. If not, Dan, thank you for hanging in. Chuck, thank you. I appreciate the audience's participation. And Kate, especially.

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CALIFORNIA'S PLAN FOR CLEAN VEHICLES AND FUEL:
Impact on the economy and emissions

February 14, 1994
Sacramento, California

AGENDA

PANEL ONE -- The Zero-Emission Vehicle Mandate

Dr. Malcolm Currie, Chairman Emeritus of GM-Hughes;
Co-Chairman, Project California
Mike Gage, President, CALSTART
Bill Craven, Vice President, Horizon Battery
Barbara Levin, Special Projects Coordinator, Ovonics Battery
Joe Barrington, CEO, Group IX Systems
Jim Quillan, Executive Secretary-Treasurer, California
Conference of Machinists
Carl Perry, Executive Vice President, U.S. Electricar
Andrew H. Card, Jr., President and CEO, American Automobile
Manufacturers Association
Greg Dana, Vice President, Automobile Importers of America, Inc.
David Montgomery, DRI, McGraw-Hill

PANEL TWO -- The Transition to Reformulated Gasoline

Jacqueline E. Schafer, Chairwoman, Air Resources Board
Mr. Robert Trunek, Sr., Vice President, Manufacturing
Engineering and Technology, ARCO
Carolyn Green, Director Government and Public Affairs,
Ultramar, Inc.
Jeff Irvin, President, California Independent Oil Marketers
Association (CIOMA)

PANEL THREE -- Regulators and the Environmental Community:
Perspectives

James M. Strock, Secretary for Environmental Protection,
California Environmental Protection Agency
Dave Calkins, Chief of Air Planning Branch, Air and Toxic
Division, US-Environmental Protection Agency
Norm Covell, Air Pollution Control Officer, Sacramento
Metropolitan Air Quality Management District
Veronica Kun, Senior Scientist, Natural Resources Defense
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Public Testimony

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OPENING STATEMENT

CALIFORNIA'S PLAN FOR CLEAN VEHICLES AND FUELS
February 14, 1994

California leads the country in cleaning up air emissions. We've continued this tradition with the implementation of the Clean Diesel program last fall, with our heavy vehicle smoke reduction program, and with other vehicle-related clean-up programs.

We are considering today two programs which are crucial to clean up our air: the low emission/zero emission vehicle (ZEV) regulation and the Phase II reformulated gasoline (RFG) program.

Last year, this Committee rejected a bill which sought to de facto roll back the Clean Diesel regulation. We held firm not only because Clean Diesel will improve air quality, but also because we believe that changing regulatory course in midstream is unfair to business.

Unfortunately, the implementation of Clean Diesel brought much controversy and pain. We on the Committee were painfully aware of that controversy and pain. This hearing is designed to prevent future controversy about the ZEV and RFG programs.

California's plan to require 2% of vehicles to be zero emission by 1998 has already been endorsed by the northeastern

states, and has led to vigorous job creation activities in our state. But the requirement is under attack. We want to hear from those who are creating jobs to meet the mandate, and from those who oppose the mandate. What the Committee must consider is where is the future of the auto industry: Detroit or California? If we hold firm on the ZEV mandate, we will likely bring the next generation of automobile development to California. Again, what message are we sending to businesses now investing in California jobs if we now change this mandate?

Even more immediately important to our constituents is the transition to Phase II Reformulated Gasoline in 1996. RFG is an extraordinarily effective way to clean up our air. If the transition is rocky, it will make the Clean Diesel troubles look like a Sunday picnic. We need to hear from regulators and from the industry about the transition. How can we ensure that we will not experience the transition pains we saw with Clean Diesel?

For both these regulations, we need to ask: if we delay or change them, what other steps must we take to meet statutory deadlines to clean up the air? It is my belief that the alternatives to these regulations would be harmful for our state.

California is at the turning point. We can clean up our air and rebuild our economy, if we have the courage to stay the course.

ASSEMBLY TRANSPORTATION COMMITTEE

CALIFORNIA'S PLAN FOR FUEL STANDARDS AND CLEAN VEHICLES

Staff Report
February 14, 1994

Overview

California's air quality is improving, yet the state continues to have the worst air quality in the nation. State and federal law require reduction of smog-producing emissions. The majority of these emissions are produced by vehicles. In order to meet the statutory goals, the California Air Resources Board (CARB) has established a strategy to prevent and control pollution from mobile sources. The strategy includes regulations to clean up motor vehicle fuel, to bring about the development of cleaner vehicles, and to improve compliance with emissions standards (the smog check and heavy duty vehicle smoke inspection programs).

The transition to cleaner diesel fuel meeting the CARB reduced aromatic standard, in October of 1993, was marked by severe disruptions in supply in some areas of the state and serious price increases statewide. The supply and price problems have subsided; however, there are lingering concerns about potential effects of the clean diesel on engines. The Diesel Fuel Task Force established by Governor Wilson is to report on that issue by February 19.

This hearing has been designed to provide the Committee with an opportunity to prevent transitional problems in the implementation of the two remaining major mobile source regulations: Low Emission Vehicles and Phase II Reformulated Gasoline.

The Low-Emission Vehicle (LEV)/ Zero-Emission Vehicle (ZEV) Regulation

The low-emission vehicle (LEV) regulations were adopted by CARB in September of 1990. The regulation establishes four tiers of vehicles with progressively more stringent emission standards: transitional low-emission vehicles (TLEVs), low-emission vehicles (LEVs), ultra-low-emission vehicles (ULEVs), and zero-emission vehicles (ZEVs). As part of this regulation, CARB adopted a mandate for ZEVs as part of the LEV regulations. The mandate requires that beginning in 1998, two percent of the passenger cars and light-duty trucks offered for sale in California by each major manufacturer must be ZEVs. This amounts to 36,000 vehicles out of an estimated 1,800,000 vehicles that will be sold in 1998.

MANDATED PERCENTAGE OF ZEVS .

1998	2%
1999	2%
2000	2%
2001	5%
2002	5%
2003	10%

The only option believed to be technologically feasible to produce a ZEV by 1998 is the battery-powered electric vehicle.

CARB staff estimates the total reduction in emission of hydrocarbons (HC), oxides of nitrogen (NOx) and carbon monoxide (CO) as shown below:

BENEFITS OF THE LEV REGULATIONS IN CALIFORNIA
(in tons per day)

	HC	NOX	CO
2000	29	36	14
2010	190	250	320

ZEVS are an integral element in the LEV standard. They maintain zero emissions over their lifetime (regardless of driver behavior) and require no smog checks. Their impact helps overcome the effect of increasing numbers of vehicles and miles driven.

According to CARB staff, in the year 2000, the cost to reduce hydrocarbons and NOx from the overall LEV standard is estimated to be about \$3000 per ton. That figure could vary depending upon the technology used. The cost to implement stationary source control measures for hydrocarbons and NOx range between \$2000 and \$10,000 per ton.

The northeastern states (the Ozone Transport Commission) this month adopted a policy endorsing California's LEV schedule as part of their plan to clean up the air. That proposal is awaiting action by the federal Environmental Protection Agency.

Development and manufacture of ZEVS is occurring in California. California has 14 companies producing electric vehicles and over 90 companies producing related components. These companies employ hundreds today. Project California forecasts that ZEVS can provide 10,000 new jobs in California by the year 2000 and over 70,000 new jobs by 2010.

Some automobile manufacturers have suggested a functional equivalent to the ZEV.

Policy Questions

- o Will an economical battery-powered ZEV be available to meet the 1998 mandate? What, if anything (legislative or regulatory), needs to be done to ensure that the 1998 mandate is met?
- o What are the job-creation effects of the ZEV mandate? In what way is the ZEV mandate driving the development of an affordable ZEV? Would job loss result from the delay or elimination of the ZEV mandate?

The Reformulated Gasoline Regulation

Reformulating fuels cleans up emissions from existing and future vehicles. The transition to the first phase of reformulated gasoline (Phase I) occurred in 1992. Phase I eliminated the use of lead in gasoline and reduced reactive organic gas emissions (ROG) by 80 tons per day.

Phase II reformulated gasoline (RFG) will be required to be sold in California in March of 1996. This formulation is expected to reduce ROG and NOx by up to 180 tons per day, and comprises a major element of California's plan to clean up mobile source emissions.

California refineries are planning for conversion to RFG. During the next two years, up to 20,000 new construction jobs will result from implementation of this regulation. At least two refineries have been notified by the federal EPA that their work on upgrading is unauthorized. One refinery has requested that CARB delay the date for RFG compliance.

Policy Questions

- o What has CARB learned about transition from its diesel experience? How is CARB ensuring that there will be adequate supplies of RFG available, for a reasonable price, at the March 1996 implementation date?
- o Is CARB field-testing the RFG formulation and doing on-site inspection of the refinery modifications?
- o What additional stationary or mobile source emission reduction measures would be necessary if the RFG standard was delayed or eliminated?

Related Policy Questions on Reformulated Diesel Fuel

- o What is the status of the variance fund containing penalties collected from refineries producing noncompliant diesel? What is the status of the Tosco variance?
- o What is the extent of the engine damage problem due to clean diesel? Is damage due to federal (EPA) or state (CARB) diesel formulations?

LEGISLATIVE SUMMARY

Reformulated Diesel and Gasoline

Current Session

AB 711 (Statham) Would have required the CARB to hold workshops and a hearing on the economic effect of low-aromatic clean diesel requirements prior to implementing those standards. (Failed passage in Assembly Transportation Committee)

AB 2485 (Quackenbush) Exempts the sale of diesel which meets CARB low-aromatic diesel from state sales tax. Exempts vehicles which use such fuel from the motor vehicle registration surcharge charged by some air districts. (Assigned to Transportation and Revenue and Taxation Committees)

Prior Sessions

SB 1160 (Leonard) Would have required all gasoline sold after 1996 to meet federal EPA reformulated gasoline performance standards. (Died in Assembly Transportation Committee during 1991-92 Session)

Low Emission Vehicles

Current Session

AB 783 (Polanco) Authorizes reasonable expenses of public utilities to be included in rate-setting to the extent of ratepayer benefit, for LEV infrastructure development and support. (On Senate Third Reading)

AB 1156 (Woodruff) Authorizes claims for public transit funds for the cost of converting gasoline or diesel powered buses to low-emission fuels. (In Senate Transportation Committee)

AB 2230 (McDonald) Would have established a new tax credit of up to \$2500 for an employer who produces LEV components and creates new jobs. (Returned to Desk)

AB 2495 (Richter) Prohibits implementation of the CARB ZEV mandate unless a battery meeting specified standards is certified. (Referred to Transportation and Natural Resources Committees)

AB 2677 (Alpert) Requires state fleet purchases, beginning in 1996, to comprise 5% ULEVs and ZEVs. (Not yet referred to Committee)

SB 146 (Lewis) Continues existing state tax credit for specified LEVs and low-emission retrofit devices, capped at \$1,000, until December 31, 1995. Expands existing tax credits for LEVs to include non-road vehicles. (Chapter 875 of 1993)

SB 315 (Rosenthal and Katz) To be amended to provide \$1.75 million for an "agile manufacturing" demonstration project in Los Angeles. The project is to produce EV components. (On Assembly Floor)

SB 381 (Hayden) Would have required state and local governmental agencies to purchase LEVs and ZEVs. Would have exempted ZEVs from the motor vehicle registration fee surcharge charged by some air districts. Would have extended existing tax incentives for LEVs. Would have created a \$1 motor vehicle registration fee surcharge statewide to pay for the tax incentive. (Died on File)

SB 531 (Hayden) Would have called for EV infrastructure readiness in planning transportation facilities and in specified buildings. (Vetoed by Governor)

SB 668 (Hart) Creates a temporary state sales tax exemption for the sale of ZEVs and a temporary credit of ten percent of qualified costs for in-state production of ZEVs and research and development. Funds these changes from a temporary \$1 increase in motor vehicle registration fees. (In Assembly Revenue and Taxation Committee)

SB 766 (Rosenthal) Would have authorized existing alternative energy financing authority to finance clean-fuel vehicle development. (Vetoed by Governor)

SB 1356 (Killea) Prohibits public funding for programs which direct public funding to alternative fuel usage unless specified economic impact studies are completed. (Assigned to Senate Transportation Committee).

SB 1455 (Rosenthal) Requires, by January 1, 1996, 10% of state fleet purchases be ZEVs and ULEVs. Directs General Services to conduct annual procurement of ZEVs and ULEVs.

1991-1992 Session

AB 1926 (Farr) Directed the Energy Commission to facilitate the development and commercialization of electric vehicles, advanced battery technologies, and related maintenance and fueling infrastructures. (Chapter 939 of 1991)

AB 3049 (Polanco) Requires the South Coast Air Quality Management District to establish expedited review and assistance for facilities used to research, develop, and commercialize clean fuel vehicles. (Chapter 309 of 1992)

AB 3052 (Polanco) Directed the Energy Commission, in collaboration with the Public Utilities Commission, to develop a recharging and refueling infrastructure plan for alternative transportation fuels. (Chapter 762 of 1992)

SB 1212 (Killea) Would have increased the percentage of LEV and alternative fuel vehicles the state is required to purchase (Vetoed by the Governor)

SB 1214 (Killea and Rosenthal) Calls for California transportation energy policy to result in the least environmental and economic cost to the state, and directs the Energy Commission to develop a forecast of statewide transportation energy demand. (Chapter 900 of 1991)

Earlier Sessions

SB 1006 (Leonard) Exempted specified low emission vehicles from sales tax on the price differential between them and other vehicles, to be sunset on January 1, 1995. (Chapter 990 of 1989)

SB 1905 d(Hart) Would have created the DRIVE+ program to provide sales tax credits and surcharges on the purchase of new vehicles, based on emissions. (Vetoed by the Governor, 1989-90 Session)

AB 234 (Leonard) Created a California Advisory Board on Air Quality and Fuels to study how the CARB should address meeting air quality goals through the use of clean fuel vehicles. (Chapter 1326 of 1987)

California air rules move east

Despite a bare-knuckles auto industry campaign against California's tougher clean-air rules, 12 Eastern states and the District of Columbia voted last week to adopt the California emission standards.

Those standards will require that by 1998, 2 percent of the cars offered for sale in states stretching from Virginia to Maine be "zero emission vehicles," most likely electric-powered cars. There are serious technical problems that must be solved to produce a commercially acceptable electric ZEV. But the vote in the Eastern states says loudly that the public wants the auto industry to try. That's encouraging both for California's environment and the state's nascent high-tech transportation industry.

The Big Three automakers, with backing from oil companies, contend that there is no market for electric cars and that the battery technology necessary to produce a commercially acceptable pollution-free car can't be perfected by the time regulators demand. Consumers do not want a car, they say, that can only go 100 miles before it has to be plugged in for seven hours for recharging and can cost \$30,000 or more.

There are acknowledged technical problems, but the auto industry has been wrong in the past about how far innovation can be pushed or what consumers will accept to further safety, fuel efficiency and clean air.

Cars today are loaded with features Detroit said couldn't be produced, from catalytic converters to unleaded gasoline, from air bags to antilock brakes. Many of those breakthroughs came because of regulators who stuck to their demands despite industry resistance.

Electric utilities and some small companies that are manufacturing electric vehicles now say there are plenty of willing buyers. CAL-Start, the California consortium trying to develop advanced transportation technology, has already built an electric car. CAL-Start is convinced there is a market for such cars and that California can profit by it: If electric cars were mass produced, prices could be cut in half and sales would soar. If Detroit hesitates, Japan and Europe will fill the void.

The regulatory battle is far from over. The vote by the Eastern states still must be ratified by the federal EPA. And California's Air Resources Board, which is under heavy industry pressure to weaken its rules, meets later this year to review its requirements. Yet if the effort to produce a marketable and efficient ZEV fails, it ought to be because of the limits of technology, not because of the political clout of an industry that would rather not try.

The New York Times

For Cleaner Air, a Cleaner Car FEB 1 1994

A small group of people from 12 Eastern states and the District of Columbia will meet in a Washington hotel this morning to make a critical decision for the environment, for consumers and for the automobile industry.

They are members of the Ozone Transport Commission, established by the 1990 Clean Air Act to find regional solutions to air pollution problems up and down the Eastern Seaboard. On the table is a proposal bitterly opposed by the automobile industry. If approved by the commission and by the Environmental Protection Agency, it would require all 12 states and D.C. to adopt California's tough "clean car" program.

The California program requires even lower automobile emissions in gasoline-fueled cars than those mandated by the Clean Air Act. But what terrifies Detroit even more is another mandate: the gradual introduction of electric cars, beginning with 2 percent of all new cars sold in California in 1998 and climbing to 10 percent in 2003.

The industry says the electric car requirement is impractical. But the Eastern states should say yes to the California program. Their populations and California's comprise 40 percent of the American automobile market. And the fact that 40 percent of the market will have stipulated a desire for electric vehicles would give industry a continuing incentive to spend serious money on what could be the next leap in automotive technology.

Some of the industry's fears are understand-

able. Electric car technology is primitive: tiny vehicles with a range of 150 miles costing over \$35,000. There is no obvious market and, as yet, no means of mass production. Detroit has also offered to build for everyone the same low-emission gas-powered vehicles it now builds for California.

But many state governors say they cannot meet Federal clean air standards as long as the cities are clogged with gas-driven vehicles. Detroit's technological prowess has made those vehicles 95 percent cleaner than they were 20 years ago. Even so, cars and trucks still account for nearly half of all urban smog. And there will be more of them on the road as the years go by.

Industry also argues that "you can't legislate innovation." True. But artfully drawn regulations that set general targets and allow manufacturers to find their own solutions have stimulated amazing results: unleaded gasoline, for example, the catalytic converter and cleaner, reformulated fuel. In each case, there were many in the automobile and oil industries who said it couldn't be done.

There is one final reason the Eastern states should adopt the California standards: They are not immutable. California officials will monitor technological advances and market forces. If conditions are not right by 1998, the deadline will be shoved back. But even a flexible mandate will keep manufacturers working on the problem — not just the Big Three, but a lot of little high-tech companies that may see a market where Detroit does not.

Big 3 trying to pull plug on electric car



From left, Chrysler's Bob Eaton, Ford's Alex Trotman, and GM's Jack Smith, are fighting electric cars.

Newsday

There might not be an electric car in the nation's future after all — not if the Big Three automakers have their way.

General Motors Corp., Ford Motor Co. and Chrysler Corp. offered Monday to build cleaner-running gasoline-powered cars in coming years instead of the electric cars that will be required in California starting in 1998 and possibly some of the northeastern states at the same time.

Under California clean air standards, 2 percent of each automaker's sales in that state in 1998 must be of "zero emissions" vehicles — which, practically speaking, means electric cars. The percentage increases each year until 2003 when 10 percent of cars must produce zero emissions.

So the auto industry must not only offer electric vehicles for sale, but also persuade thousands to buy them.

Twelve states and the District of Columbia either have adopted some form of the standards or are considering doing so, said Thomas

Jorling, New York state environmental conservation commissioner.

The carmakers' proposal, made through the American Automobile Manufacturers Association, is to phase in cleaner running cars between 2001 and 2003 in those 13 jurisdictions and in any other that wants them. It also calls for the new gasoline-powered cars to exceed federal clean air regulations.

The proposal is indicative of the industry's rising opposition to being forced to build electric cars.

Although GM, Ford and Chrysler have shown prototype electric models and have begun programs to place test vehicles in the hands of electric utilities and consumers for market research, their executives continue to express doubts about whether thousands of consumers will want cars that are both expensive and are limited to a 100-mile driving range.

In an interview with the trade paper *Automotive News* in October, Ford Vice Chairman Lou Ross said, "We are charged with developing an electric vehicle, but I see a vehicle with no market."

AUTOS

ASSAULT ON BATTERIES

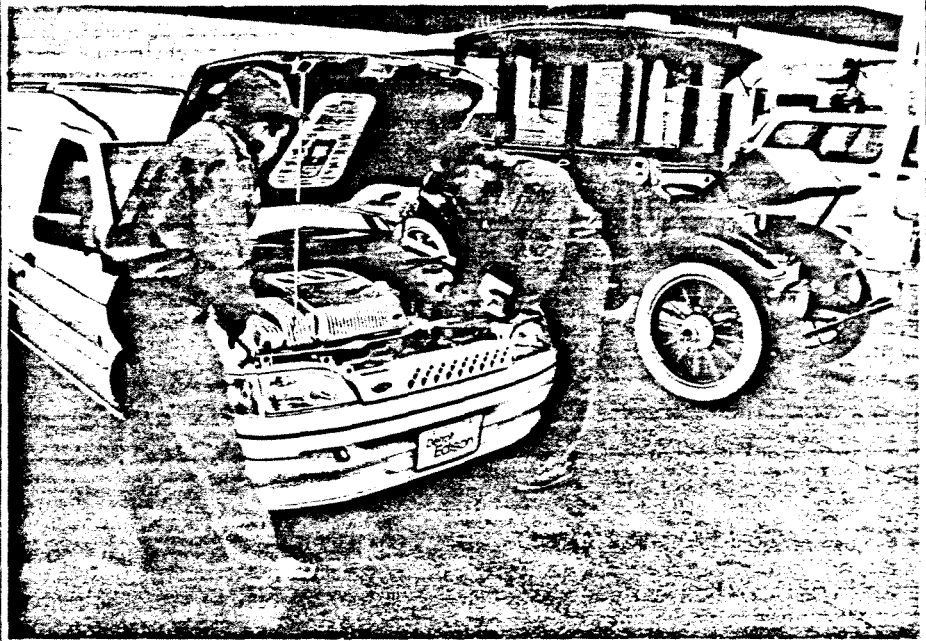
Detroit wages war on legislation promoting electric cars

Ford Motor Co. made sure that there was plenty of fanfare on Nov. 16, when it handed over the keys to its new Ecostar electric vans. Vice-Chairman Allan D. Gilmour trekked west to deliver one to Southern California Edison Co. Back in Motown, Detroit Edison Co.'s chief executive, John E. Lobbia, tooled up in a 1914 Rauch & Lang electric car to collect his company's first Ecostar.

Behind such high-voltage eco-PR, however, the Big Three auto makers are working to delay or cancel rules that require them to offer electric vehicles for sale in the U.S. by 1998. They fear that they will lose hundreds of millions of dollars pushing expensive technology on reluctant consumers. So they're lobbying lawmakers, taking states to court, and grouching about the lack of long-range batteries to power such vehicles. "You can't legislate innovation," says Kenneth R. Baker, head of GM's electric vehicle program.

Despite Detroit's complaints, California regulators are standing by rules established in 1990 that require manufacturers to push up the number of electric cars they sell in the state to 2% of overall sales by 1998 and to 10% by 2003. Given Detroit's lead time for new products, carmakers have just a few months to decide which models to make to meet California's requirements. Adding to the heat, auto makers in Europe and Japan are pushing ahead with their own electric car programs.

For now, the Big Three seem to be putting as much effort into lobbying as engineering. In August, Ford's Gilmour flew to California to meet with Governor Pete Wilson. In a follow-up letter, Gilmour said Ford expected to spend \$2 billion by 1998 to meet the state's electric vehicle requirement—and to lose money in the process. Meanwhile, the American Automobile Manufacturers



DOUBLE SPARKING: A FORD ECOSTAR DELIVERED TO DETROIT EDISON AND A 1914 RAUCH & LANG

Assn. has led the legal battle to block Northeastern states from adopting the California rules.

The car companies have plenty of evidence of the high cost of getting into electric vehicles—they've made sure of that. Ford's \$2 billion figure, for instance, includes such items as setting up a dealer network and projected losses for the first few years when volumes will be low and costs high. "The controller threw in everything he could find," concedes John R. Wallace, Ford's director of electric-vehicle development programs.

VOLTSWAGEN? Among the Big Three, Chrysler Corp. seems to have the soundest plan to meet the California deadline. It's quietly readying the next generation of its popular minivans to run on gasoline, natural gas, or electricity. The gasoline version premieres in 1995, the other models in 1996. To keep costs down, it's designing all versions to be put to-

gether largely on the same factory line.

Across the Atlantic, a joint venture in Germany between Mercedes-Benz and Volkswagen is testing advanced batteries in 60 different electric prototypes. Mercedes expects to build an electric version of its A3 small-car prototype by the end of the decade. Japanese carmakers are pressing ahead, too. Last year, Honda Motor Co. dropped its Formula One racing program to focus on environmental research and development.

Some of the most intriguing research, though, is at small companies. A zinc-air battery developed by an Israeli company, Electric Fuel Ltd., has powered a small Mercedes van 200 miles on a single charge, double the range of other batteries. The German postal authority will test the product in more than 50 vehicles next year. A German company, Magnet-Motor, has tested a city bus that's partly powered by a flywheel spinning at 12,000 revolutions per minute. Other companies, such as three-year-old American Flywheel Systems Inc. of Seattle, also hope to power vehicles with the energy stored in rapidly rotating gyros. With so many companies in the clean-car race, can Detroit really afford to back off the throttle?

By David Woodruff in Detroit, with John Templeman in Bonn and Neal Sandler in Jerusalem

Ford says California's rules, which mandate that 2% of all sales must be electric cars by 1998, will cost it \$2 billion

Will California Plug Into Electric Cars?

New Vehicles Would Create 70,000 New Jobs for the State

By David Cogan

The emerging electric vehicle (EV) industry is viewed by most experts as a major opportunity for California. By capitalizing on its high level of technological expertise, the state could become the hub for a new worldwide business. The introduction of EVs is further expected to bring substantial environmental benefits to the state. However, the major U.S. automakers have mounted a campaign against California's innovative air quality regulations, which would stimulate production of EVs. If corporate America has its say, the electric vehicle in California may remain only a good idea.

With the demise of California's defense industry and the devastating effects of the recession continuing to linger, the need to develop new industries has never been greater. Electric vehicles emerged as a positive option for a new, statewide industry in the late eighties, when officials began looking at ways of improving California's air quality.

In 1990, the California Air Resources Board (CARB), under the leadership of Jannane Sharpless, innovatively mandated that companies selling more than 35,000 vehicles in California must provide 2 percent zero-emission vehicles (ZEV) for sale by 1998, increasing to 10 percent by 2003. The board's move, which also included tough requirements for reducing emissions in conven-

tional vehicles, spurred research and development of EV components and a system of charging stations across the state. With the worldwide EV industry still in its infancy, and 70 percent of its parts different from those used to build conventional vehicles, a recent study projected that California could be the beneficiary of 70,000 new jobs in the direct production of EVs over the next decade.

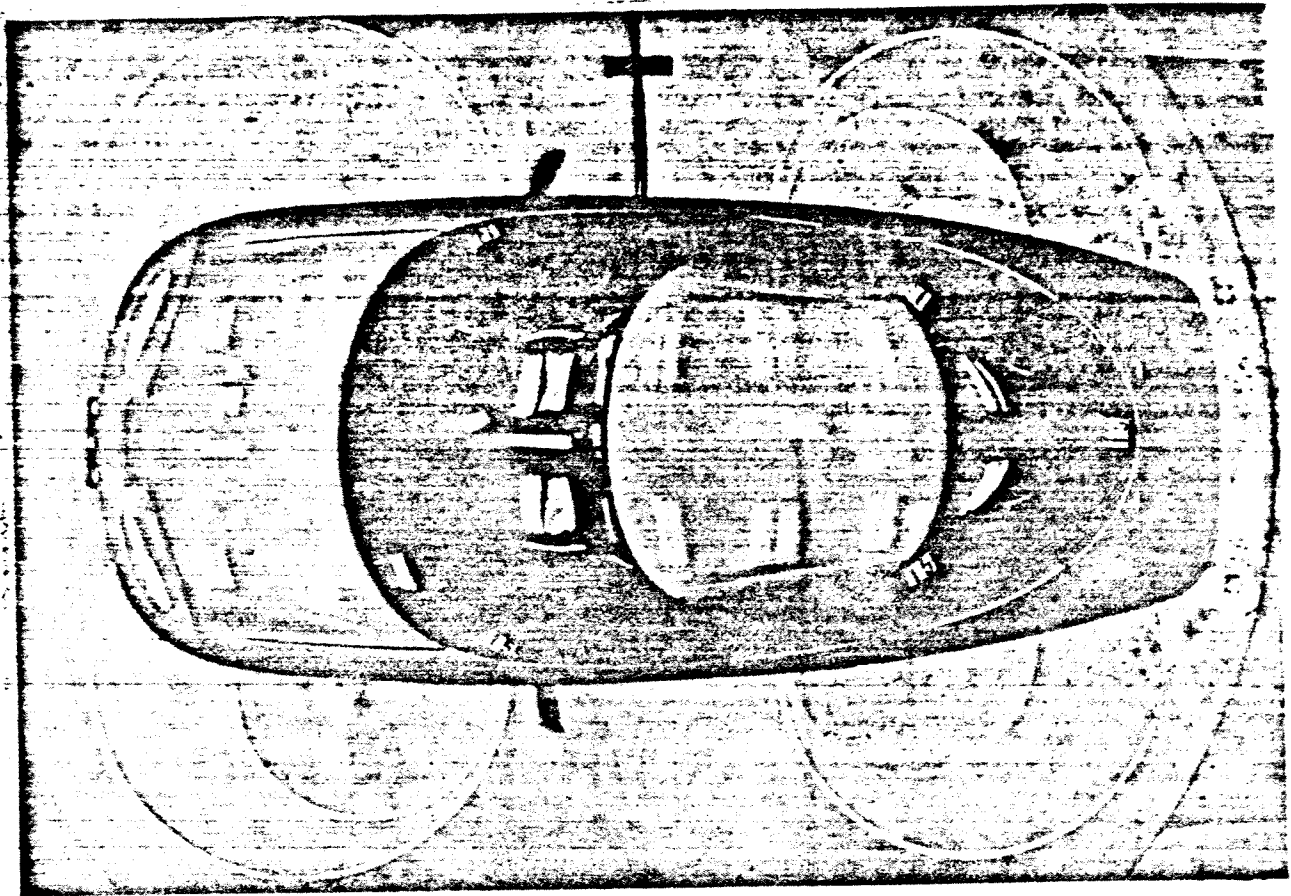
Despite the positive forecast, the optimism about EVs has been clouded recently as the "Big Three" automakers — Ford, GM, and Chrysler, began an aggressive lobbying effort against California's ZEV regulations. The automakers pleaded with Gov. Pete Wilson, claiming that EV research would be too expensive and that no one would buy the vehicles. Fears, escalated in early November when rumors abounded in Sacramento that Jannane Sharpless, chair of the CARB, was on her way out. Sharpless was ultimately "reassigned" on November 18 to the California Energy Commission. In her place, Wilson appointed Jacqueline Shafer, a former Reagan and Bush staffer who served on Reagan's anti-regulation White House Council on Environmental Quality. While the governor minimized the significance of the move, and contends that he does not want to alter the current policy, observers view Sharpless's removal as a bad omen.

"[Sharpless's removal] is cause for very serious concern. The environmental community as a whole is quite dismayed," says Dennis Zane, executive director of the Coalition for Clean Air. "When

(continued on page 12)

"With the automakers' resistance, the development [of the EV industry in California] will be slower, and instead of the jobs being in California they will be in Europe or Japan."

—KIP WILEY, DIRECTOR OF LEGISLATION
FOR SEN. TOM HAYDEN



The car of the future?

(continued from page 8)

the principal leader in clean air legislation is removed, it cannot help but convey some dissatisfaction with the current policy."

Although Wilson hasn't attempted to change the EV regulations, CARB announced that it would form a task force to reexamine the regulation requiring the reformulation of diesel fuel to reduce emissions, after receiving recent complaints from the trucking industry.

The auto companies say they have no problem developing EVs, but argue that in the current recessionary business environment, the CARB's EV requirements are simply too costly. Ford, for example, estimates it will spend \$2 billion between now and 1998 developing EVs. Further, they are unconvinced that a market will exist for vehicles that currently have a battery capacity of only 100 miles and may cost between \$15,000 and \$20,000. In a letter to the governor that was leaked around the State Capitol building, Ford Vice President Alan B. Gilmour asserted that California could reach its air quality goals more cheaply through the use of alternative fuels, attempts to get older cars off the road, and reducing the emissions on conventional vehicles.

"Even if the [EV] mandate is modified or removed," Gilmour wrote in the memo to Wilson's chief of staff, Bob White, "we are committed to continue the research and development of electric vehicles and battery technology."

Most experts on EVs are unconvinced by the auto industry's arguments. Some observers believe the auto industry's intransigence about EVs is because the production would occur largely in California, rather than Detroit, there-

by making it less of a priority to them. Others simply view the industry as shortsighted and self-interested. "The Big Three have not been very enlightened in the past, and they continue not to be. They were slow on air bags, too," says Don Shields, executive director of Project California, a group of academics, business leaders, and government officials working on behalf of the legislature to target economic opportunities for California. Shields is convinced EV technology will be ready by 1998 and that Californians will buy the vehicles. The state, Shields says, will have to implement an aggressive strategy to get the industry off the ground if the auto industry continues to drag its feet.

State Senator Tom Hayden, a longtime supporter of EVs — he owns an electric car — agrees that most new industries need government assistance to get off the ground. With other legislators, Hayden has introduced legislation to help create a demand for EVs. The bills would require, among other things, that the state's auto fleet be 10 percent EVs by 2003, tax credits be given on the purchase of EVs, and that Caltrans be compelled to install charging stations at specific locations around the state. For Hayden, too much is riding on EVs to allow them to come to market at the auto industry's own pace.

"If [the automakers] succeed in repealing or even scaling back the regulations, we may squander a great opportunity," said Kip Wiley, Hayden's director of legislation. Wiley notes that with demand for EVs already high in densely populated cities in Japan and Europe, competition for the emerging market will be stiff. Japan has already set a goal of having

200,000 EVs for sale by 1996, and Volvo of Sweden is accelerating its research of EV components. "With the automakers' resistance, the development [of the EV industry in California] will be slower, and instead of the jobs being in California they will be in Europe or Japan," Wiley says.

With the passage of the Federal Clean Air Act in 1990, other states are now looking to follow California's lead on ZEVs and LEVs (low emissions vehicles). In the Northeast, the multi-state Ozone Transport Region, which includes New York and Massachusetts, is currently considering adopting a standard similar to California's. They too are under intense pressure from automakers to legislate less demanding requirements.

Most EV proponents are hoping Wilson remains focused on the economic benefits electric vehicles will provide California and will leave the regulations intact. However, with the gubernatorial election less than a year away, it's difficult to predict what Wilson will do as he begins consolidating the support he needs from big business and the right wing to remain in office.

Ford May End Effort to Build Electric Vehicle

■ **Autos:** The company is considering postponing development until a better battery is available.

By DONALD W. NAUSS
TIMES STAFF WRITER

DETROIT—Ford Motor Co. may cancel its program to build an electric vehicle from the ground up, its director said Tuesday, calling the effort financially wasteful until more advanced battery and related technology is developed.

Such a step would increase pressure on California to relax its mandate requiring auto makers to sell zero-emission vehicles in the state beginning in 1998. Car makers worldwide want the mandate repealed.

A delay of Ford's new electric vehicle program would leave the company likely to rely on the conversion of existing internal-combustion engine vehicles if it is to meet California's regulations. The company will continue testing its prototype Ecostar, which is essentially an electric conversion of its European Escort van.

"We are reassessing the appropriateness of spending money on a ground-up vehicle," Dennis Wilke, director of Ford's electric vehicle programs, acknowledged after a speech to the World Automotive Congress. "If the battery and powertrain

Please see FORD, D6

FORD: Awaiting a Battery Idea

Continued from D1
technology are not there, it's a waste of money."

Wilke said Ford has spent more than \$100 million on electric vehicle development in the past two years. The company is now considering whether such spending should be directed more at technology advancement rather than product development, Wilke said.

The reassessment comes just two months after Alexander Trotman was named chairman and chief executive of Ford. Publicly, Trotman is more pessimistic and outspoken about electric vehicles than his predecessor, Harold Poling.

At the Detroit auto show last week, Trotman told reporters that Ford hopes to persuade the California Air Resources Board to drop its mandate in favor of proposals that would rely on alternative fuels and other measures.

"We think we can achieve the Clean Air Act objectives without a mandate," Trotman said. "There are other feasible alternatives."

Ford officials said Tuesday that they will soon present a plan to California officials showing how federal pollution standards can be met without requiring zero-emission vehicles. Electric power is the only viable option in the near term for meeting the state's rules.

The proposal will call for a mix of vehicles fueled by compressed natural gas, methanol and other alternative fuels. It will also advocate a stronger smog check system—currently a matter of conflict between the state and federal governments—and a program to remove high-polluting clunkers from California roads.

The Big Three began a lobbying push last fall aimed at persuading California to relax the electric vehicle mandate. The auto makers argue that they are unable to produce a vehicle with sufficient range and a low enough cost to

attract buyers. The main obstacle: the lack of a good battery.

Detroit sees 1994 as a key year in the electric vehicle debate. The ARB will review its emissions regulations this year, and the companies say they must make production decisions soon.

While Detroit appears increasingly optimistic that a rollback will occur, electric car proponents in California say the state will not readily fold.

"At this point, we have no reason to believe the mandate won't hold," said Diane Wittenberg, manager of electric transportation for Southern California Edison, a strong supporter of electric cars.

Indeed, Jacqueline Schafer, the ARB's new chairwoman, said at the Los Angeles Auto Show last week that the agency had no plans to kill or delay the zero-emissions regulation.

In the meantime, the auto makers continue to conduct advanced battery research in tandem with the federal government and the electric utility industry. The auto companies are also pursuing electric car development.

To date, only General Motors Corp. has unveiled a ground-up electric vehicle—the two-seat Impact—but the company has backed away from a promised 1995 rollout.

Ford has been more secretive about its electric vehicle programs. Trade publications indicate that Ford is working on a small, four-passenger commuter car. There has also been speculation that the company would build an electric-powered family van developed in Europe.

Should we care if Detroit won't build electric cars?

Jessica Mathews is a senior fellow at the Council on Foreign Relations.

By Jessica Mathews

WASHINGTON - Four years ago, California launched a missile that could land with devastating impact on Detroit's Big Three: By 1998 the state decreed, 2 percent of the new cars sold there must be "zero emission vehicles" (ZEVs). For now, that means electric cars. The requirement climbs to 10 percent by 2003.

New York, Massachusetts and Maine have adopted California's standard. Maryland and New Jersey have done so conditioned on enough other states joining in. Connecticut and Pennsylvania are thinking it over. And in early February, a regional air commission will decide whether to ask the Environmental Protection Agency to make the standard mandatory for every state from Maine to Virginia.

If that happens, and the ZEV standard survives Detroit's intensifying efforts to kill it, California's requirement will become the de facto national standard. If the technology works, as a growing number of experts think it can, America will find itself making a technological quantum leap because an obscure California agency took a step Congress would never in a million years have attempted.

Why the risks to Detroit? Ironically, for a technology that promises an enormous advance in air quality, noise reduction and energy savings, electric cars are much simpler than a gasoline-powered car. There is no internal-combustion engine with 70 years of optimization built into it, no radiator, no gas tank, no muffler, no tailpipe, no pollution-control equipment. None of these systems, on which competitors would face Detroit's tens of billions in investments and decades of experience, are

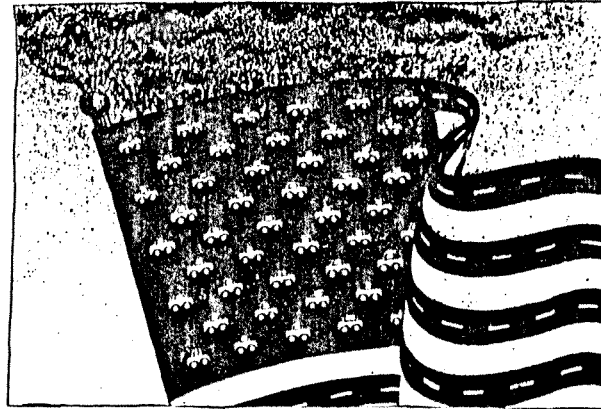
needed. There is one huge challenge - a powerful, affordable energy storage system. Develop that, and the rest is easy.

Detroit had focused on chemical batteries, which, until recently, seemed the only answer. But decades of research have not significantly improved their shortcomings: great weight, high cost, short range and brief lifespan. Different combinations of chemicals may yet do the trick. More likely, newer ideas - flywheels (a mechanical battery), fuel cells or ultracapacitors - may turn out to be better.

THESE OPTIONS rest on fresh thinking, borrowing from space and other nonautomobile applications. It's a perfect setup for a brash, innovative, high-tech newcomer. No law of nature says the United States can support only three auto companies (Japan supports nine). It was a decade ago, remember, that the notion that IBM could lose market share to tiny start-ups seemed laughable.

Detroit can easily keep its monopoly of U.S. car production, but perhaps only if it can break its habit of reflexively opposing every publicly mandated change in technology. Whether on safety, emissions or mileage, the Big Three put their effort into proving that whatever the government wants can't be done. Only when everything the lobbyists and lawyers can think to do has failed do they get down to engineering. It's the same this time. Since the day the ZEV standard was adopted, the Big Three have insisted that it can't be met.

Maybe they are right. This time, however, there is the risk that while Detroit fights the standard, newcomers will be fighting to meet it. "You can't legislate innovation," complains a GM spokesman. True, but you can darn sure stimulate it. Offer a guarantee share of California's market, and folks pay attention.



MAGUIRE/Special to The Bee

No law says the U.S. can support only three auto companies, which put their effort into proving that whatever the government wants can't be done.

The Big Three have been to visit California's conservative Republican governor. They have taken New York and Massachusetts to court. They are lobbying fiercely in every Legislature. Yet even though the California schedule is technologically risky, the states don't seem to be listening. That's because - says New York State Environment Commissioner Thomas Jorling, one of the ZEV standard's strongest proponents - the states see it as a promising source of economic development. Pushed by the standard, technology is bursting out all over, involving both new companies and underemployed defense contractors. No law of nature says American auto companies have to be based in Michigan either.

THE STATES also are keenly aware that if ZEVs succeed they can avoid far more costly measures to meet the stringent standards of the 1990 clean air amendments.

Meanwhile, back in Washington, the administration and the Big Three have formed a partnership to develop in "approximately a decade" a prototype (not a production car) of an affordable car that could achieve mileage "up to" three times that of today's cars, or an average of 82 miles per gal-

lon. Reaching levels of puffery unusual even for this town, the administration called this loophole-riddled goal a "technological venture as ambitious as any America has attempted" that will "push the theoretical limits of energy efficiency."

NO ONE was impolite enough to point out that a few years back GM unveiled a four-passenger, 100 mpg prototype called Ultralite. The Ultralite was not affordable, but neither did it use technologies such as regenerative braking (which captures and reuses braking energy rather than losing it as heat) that are now assumed to be part of advanced cars.

What value there is to the partnership is more political than technological: to break the years of confrontation between Washington and Detroit over fuel efficiency and provide a test case for the administration's technology policy. A serious Apollo- or Manhattan-type project would never have been set up this way. As long as Detroit does not use it as a reason to kill the ZEV standard, the partnership may prove to be a modestly useful sideshow, while the future - with or without the Big Three - unfolds elsewhere.

Washington Post

California Council on Science and Technology
PROJECT CALIFORNIA

Hearing on
Clean Car and Clean Fuel Elements of California's Mobile Source Plan
Assembly Committee on Transportation
Honorable Richard Katz, Chairman

Statement by
Dr. Malcolm R. Currie
Chairman and CEO Emeritus, GM-Hughes,
former Undersecretary of Defense, Research and Engineering,
and
Co-Chair, **Project California**

Monday, February 14, 1994

Sacramento, CA

Thank you, Mr. Chairman and Members of the Assembly Committee on Transportation for this opportunity to present my views and those of Project California relating to California's clean air standards and to the enormously promising electric vehicle industry.

In these brief remarks, I would like to emphasize just four major points, namely:

First: The California Air Resources Board regulations relating to so-called Zero Emission Vehicles (ZEV's) and Ultra Low Emission Vehicles (ULEV's) have acted as a powerful stimulus for investment in entrepreneurial activity in both large and small companies and for the creation of new jobs in California. Pragmatically, no matter how the regulations came about, they have, in fact, constituted a powerful socio-economic instrument for development of our State's economic environment as well as our quality-of-life environment.

Second: Tough goals drive technological progress, invention, and competition. They drive entrepreneurial activities like those now taking place in California which are a direct result of government leadership in establishing these goals. An exciting and revolutionary new industry is being born which uniquely fits our State's industrial and intellectual capabilities. I believe that a large consumer-driven market will evolve over the next decade from what is now an initially legislatively driven market.

Third: Powerful traditional automobile manufacturers apparently view all of this as a threat rather than as an opportunity. Together, they are using implied economic coercion and fear to scuttle California's clean air rules, to stem the tide and to postpone indefinitely the advent of this very large industrial transformation. I'll indicate why I believe this is unnecessary and why, in fact, it is detrimental to their own interests.

Finally: At the end of the day, we must ask "What is best for California"? California should not fold on this issue. It should not give up its internationally recognized role-model position. In doing so we would not only lose this leadership, but would also be relinquishing an important economic opportunity for industry and jobs and would be sending a negative signal which would further impair our State's business climate.

In making these points, Mr. Chairman, I have no personal axe to grind. I act as an individual seeking what is best for rebuilding California's future:

-- As an industrialist, I participated in the automotive industry as well as in the defense/aerospace industry. I have also been heavily involved in defense diversification and, in fact, personally started the group that developed the propulsion system for GM's Impact electric vehicle and that has since grown into a large industrial activity.

-- I have also acted as Co-Chair of Project California. Project California is a statewide program whose goal is to create new industries and jobs by establishing California as a world leader in advanced transportation and related telecommunications systems for people, goods, services, and information. These objectives also contribute directly to our State's environmental and societal goals. Project California is guided by a Select Panel of 25 distinguished leaders in industry, academe, government, and labor from across the State. It is bipartisan and its ambitious action agenda received the endorsement of California's political leadership with the signing of a "California Declaration of Leadership in Advanced Transportation and Related Telecommunications" by the Governor, by the Speaker of the Assembly, by the President Pro-Tempore of the Senate, and by the minority leaders. This constitutes a landmark commitment by California.

The bottom line, of course, is not just advanced transportation, advanced infrastructure which will attract new industry, and an improved environment. The bottom line is also jobs. Project California, through extensive studies of markets and technologies, through surveys, through studies of policy impediments and incentives, and study of the practical creation of self-reinforcing industrial clusters in California, projects a realistic attainment of some 200,000 direct jobs by year 2000 in various areas of advanced transportation and some 400,000 jobs plus 200,000 or so tertiary jobs by 2010, based on conservative market shares. These are good jobs at good wages.

The development of an active and growing electric vehicle and alternative fueled vehicle industry cluster is a significant part of this vision -- Project California projects a market of several billion dollars in California alone by around the turn of the century and 70,000 EV-related jobs by 2010. A major part of the job creation strategy is to build directly on the large anchor market in California.

As I mentioned earlier, with the stimulus provided by the CARB regulations, the technologies are evolving rapidly in batteries, flywheel storage systems, fuel cells, motors, high power semiconductor electronics, and materials. First-generation commuting electric vehicles having ranges of around 80 miles exist now and super-low emission hybrid electric vehicles with ranges of hundreds of miles within a few years are being developed. In addition, the utilities are actively working to establish a dispersed infrastructure for charging which will create customer confidence and acceptance in first-generation limited range vehicles. CALSTART is an important facilitator in all of these industrial activities.

Now let me briefly elaborate on two of the points I made earlier.

Frankly, as a businessman, I have not always supported specific air quality regulations which sometimes seemed to be expensive ways to achieve improved air quality *per se*. However, in the case of the particular clean car regulations which are the subject of this hearing, environmental and economic policies obviously are closely linked together. We can argue endlessly, for example, whether electric power plant emissions should be taken into account analytically in defining tail pipe standards or whether scrapping all pre-1980 cars could achieve a similar environmental result more cheaply. But I think this misses the key point -- that this bold and admittedly somewhat arbitrary mandate now will have both a positive economic as well as environmental impact on the State. It is entirely reasonable to view this mandate as a broader socio-economic instrument for the development of California -- and the fact that its intention and goal is broader than environmental alone should be understood and encouraged.

Now let me look at this from the viewpoint of a large automotive manufacturer. They recognize that the consumer acceptance of first-generation EV's, *i.e.*, the size of the market and exact market growth rate, is uncertain at this time. Further, if they approach it traditionally and design new vehicles from the ground up in a traditional way and then tool up to produce them and then amortize the large investment over relatively few vehicles this obviously leads to high unit costs. It is, then, predictably concluded that this is a bad business deal, at least from a pure financial viewpoint. Given this scenario, I would agree. With this conclusion, their reaction is to then band together to launch a massive, well-funded campaign to defeat the CARB mandates or to try to postpone them indefinitely, promising to continue to work on technologies for the future "when the world is ready" and promising to achieve clean air some other way. Further, as part of their united campaign, they make economic calculations and ascribe enormous added consumer costs or implicit taxes and subsidies and loss of jobs as the price for their having to respond to the regulations. After all, based on previous precedents, this is a tried and true formula for rejecting new developments. This, in fact, is what is happening and this is what this hearing is all about.

But let me suggest a different kind of approach more in tune with our times. For example, an enlightened automotive leader might ask the following questions:

- o How can we meet this challenge and creatively turn it into a great opportunity instead of a potentially costly threat?
- o How can I use it to my competitive advantage?
- o How can I meet the requirements gracefully and at drastically reduced investment?
- o For example, during the transition period from a legislatively-driven market to a consumer-driven market, can I advantageously evolve by converting one or two of my

existing great looking fully tooled and mass-produced models to electric propulsion in limited quantities? Can I assemble them or help an entrepreneurial organization to assemble and test them for me in California? Can I thereby gain a competitive image and position and, at minimum investment, understand factors involving customer acceptance and the future marketplace?

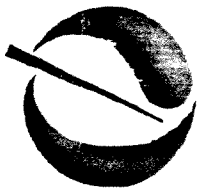
o Can I thereby get a jump on my competition from Europe and Japan, where intensive work on EV's is occurring?

I can only note that anything new which disrupts the past has historically always had to overcome entrenched interests and entrenched methods of thinking. That is why new companies grow, and older ones that can't adapt decline. There are many examples of this in our rapidly changing world.

In closing, Mr. Chairman, let me say that in my professional, technical, and business judgment, we are on the threshold of a new industry in which California can participate and realize great economic as well as environmental benefit. California is uniquely positioned to leverage its tremendous investment in aerospace/defense, in other high technology industries, in its laboratories, universities, and manufacturing capacity.

We need this kind of positive uplift and vision in California. I can tell you first-hand that there are today well over 100 firms directly involved across the State in electric vehicle technologies. They are building promising enterprises, as you will hear. I can tell you that this is also an important contribution to so-called defense conversion.

An enlightened public policy by Californians for California is providing a powerful kick-start for this activity. We should not retreat from our position before the eyes of the world and in the face of external business interests who are doing business in a traditional way and not contributing to our State's economy. We should not waste the investments already made and the positive momentum we now have and which we badly need in California at this time. The State and its industry needs consistent policies. We need a firm sense of constancy of purpose from our government leaders. We need to stay the course. This would be a hell of a time to blow this opportunity!



California Environmental Protection Agency

NEWS RELEASE

C20-94

**TESTIMONY BY JAMES M. STROCK TO ASSEMBLY TRANSPORTATION
COMMITTEE ON ZERO-EMISSION VEHICLES AND REFORMULATED GASOLINE**

FOR IMMEDIATE RELEASE
Tuesday, February 15, 1994

CONTACT: James J. Lee
(916) 324-9670

SACRAMENTO -- Following is testimony given by Secretary for Environmental Protection James M. Strock at a meeting of the Assembly Transportation Committee on Monday, February 14, on current efforts achieve low- and zero-emission vehicle and reformulated gasoline standards:

"Chairman Katz, ladies and gentlemen, I appreciate the opportunity to appear before you this afternoon as you consider the status of California programs for reformulated gasoline, and to achieve low and zero emission vehicles in the coming years.

"Governor Wilson remains committed to both the reformulated gasoline rule, and the low and zero emission vehicle regulations and schedule. The environmental challenge of clean air -- apparent to all Californians -- can best be met through advancements in transportation technology. There is also a tremendous economic opportunity. Governor Wilson will work with you to assure continued progress in both of these areas.

"Because of the scope of the challenge, some may flinch from decisive action. That would be a grave mistake. Those who would compromise the vehicle emission limits must answer the question, how would they propose to cut emissions? If progress is not sustained from advanced transportation, then the difference will have to be made up from further restrictions on emissions from so-called "stationary sources." That means factories, dry cleaners, foundries, print shops, bakeries, oil refineries and so on. The jobs of Californians would be unnecessarily placed at risk.

"The advanced transportation regulations not only avoid unnecessary economic cost; they also help California seize new economic opportunities. Low- and zero-emissions vehicles technologies can build upon California's competitive advantages -- a high technology academic and industrial base, large state markets, and most importantly, innovative and industrious individuals from across the world -- to create a new industry of international implications.

-- MORE --

"Recently the Ozone Transport Commission created by the federal Clean Air Act voted overwhelmingly to adopt California's advanced transportation air regulations for the northeastern states. When one looks to the future, whether to New England or New Delhi, low and zero emission vehicles will have a growing place. Those vehicles should come, to the greatest possible extent, from California.

"The economic opportunity presented has been noted by key leadership groups that are focused on the "bottom line." According to the UCLA Lewis Center for Regional Policy Studies, an electric vehicle industry could create as many as 24,000 jobs for Californians. Over the next generation, Project California projects as many as 70,000 new jobs.

"Chairwoman Schafer will speak in greater detail about the regulatory underpinning for advanced transportation, which includes the reformulated gasoline rules on to the forthcoming zero emission vehicle mandates over the coming years. ARB is planning to hold the next in its series of technical reviews of the LEV/ZEV this spring.

"Governor Wilson recognizes that the important work on this quest is to be performed not by lawyers and lobbyists, but by engineers, scientists and hard-headed business leaders who need certainty for investment purposes. I know that many of those testifying today are looking forward to the opportunity to make their case before the Board, and they can be confident that the technical review will be just that, a review based on the technical merit and analysis.

"Chairman Katz, thank you for the opportunity to testify. I would be pleased to answer any questions you might have, recognizing that Chairwoman Schafer is best placed to respond in detail on the ARB schedule."

**TESTIMONY BEFORE THE
ASSEMBLY COMMITTEE ON TRANSPORTATION
CALIFORNIA LEGISLATURE**

Sacramento, California

February 14, 1994

**Barbara Levin
OVONIC BATTERY COMPANY
(A Subsidiary of Energy Conversion Devices, Inc.)
1707 Northwood Drive
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The state of California has provided leadership and vision in promoting clean air through its stringent vehicle emissions program, particularly the Zero-Emission Vehicle (ZEV) mandate. Adoption of the program by other states, especially the recent vote of 13 northeast states to adopt the same program as a region, attests to the power of that vision.

The ZEV mandate embodies a great challenge. And it sets deadlines - deadlines which provide time to develop and commercialize new technologies, but demand near term results to address a problem whose solutions are long overdue. Since electric vehicles are the only ZEV which can meet those deadlines, the biggest technical challenge embodied in the ZEV mandate is development of a battery that will enable production of commercially viable electric vehicles by 1998.

I am here today to state unequivocally that the challenge has been met. The Ovonic battery is a here and now battery that makes EVs practical, affordable and attractive - not just for fleets or other niche markets, but to the general consumer who wants a car with no maintenance, the convenience of refueling at home or at work, with high performance and quiet operation, and with a practical driving range of 150 to 200 miles between charges.

Ovonic Battery Company (OBC) was established in 1980 to develop a rechargeable nickel metal hydride (NiMH) battery utilizing new hydrogen storage materials developed at Energy Conversion Devices, its parent company. OBC's NiMH batteries were initially developed in small sizes to replace nickel cadmium batteries used in notebook computers, cellular phones and other portable electronic devices. These batteries are now in commercial production by our licensees around the world.

Our EV battery development program went into high gear when we received the first contract awarded by the U. S. Advanced Battery Consortium in May, 1992. In less than a year and a half, we had our first battery in a vehicle. Today Ovonic batteries are powering several electric vehicles, both in the US and abroad. The Ovonic battery at its current state of development has demonstrated the following:

1. Over twice the range of existing lead acid batteries.

A converted four passenger Geo Metro, which OBC has purchased and is operating using an Ovonic battery, has demonstrated a range of 150 miles on the highway between charges.

While this is impressive performance for a conversion EV, a ground up designed EV would achieve over 200 miles using Ovonic batteries. Based on published performance numbers for GM's impressive Impact vehicle, we project a range of over 250 miles for this state of the art EV when the Ovonic battery is employed.

- 2. Excellent acceleration - 0 to 60 mph in 8 seconds.**
- 3. Lasts the lifetime of the vehicle.**
- 4. Fast recharge capability.**

Can be recharged to 60% of capacity in 15 minutes and to full capacity in one hour. The battery can also be recharged more slowly at home or work using a standard household outlet.

- 5. Totally sealed and maintenance free.**
- 6. Contains no toxic materials.**

Can be safely disposed of in landfills.

- 7. Completely Recyclable.**

The only shortcoming of the Ovonc battery today is the lack of availability in commercial quantities. Whereas we have been very successful in commercializing our small size Ovonc batteries based on the quality of the technology and the expanding market for portable electronic devices, the EV battery is not yet in volume production due, in part, to the uncertainty of the future EV market, particularly in light of recent efforts to roll back the California ZEV mandate and stop its spread to other states.

Based on materials and components manufacturing operations at OBC and extensive detailed cost analyses, we are confident that in volume production, Ovonc batteries would cost approximately \$3000 to \$4000 for a car and \$5000 to \$6000 for a van and would last the lifetime of the vehicle.

Lower fuel and maintenance costs of an EV will offset much of the battery costs. Based on the present cost of gasoline and electricity, the fuel cost to travel 100 miles is estimated to be \$5 for a gasoline car and \$1 for an EV, which amounts to a savings of \$4000 over 100,000 miles. This does not include other maintenance savings associated with internal combustion powered cars such as oil changes, tune-ups, etc. The federal EV tax credit of up to \$4000 provides an additional offset.

Our battery costs are based on the state of technology as it exists today. History also teaches us that the costs of new products such as computers, VCR's and even the automobile itself, drop dramatically as the technologies mature and their markets grow. OBC is already working on improvements which will substantially reduce costs and improve performance of the NiMH battery beyond today's impressive levels.

OBCs battery development program is an excellent example of the dynamic role the ZEV mandate has played in the development and commercialization of EV technology. The lack of an established market for EVs made it difficult to obtain needed financial support for our EV battery development programs until California adopted the ZEV mandate. A firm resolve by California to retain the mandate, coupled with the recent U.S. Court of Appeals decision upholding the right of other states to adopt the California program, will reduce market uncertainty and enable our battery as well as other emerging EV technologies to proceed to commercialization in the US in a more timely fashion.

Further development and commercialization of advanced EV technologies such as the Ovonic battery will inevitably occur because of the worldwide need for clean air and relief from dependence on imported oil. Maintaining the ZEV mandate will help to insure America's leadership and competitive edge in these emerging technologies. Failure to maintain the mandate will make commercialization in the U.S. more difficult and result in the loss of environmental benefits and economic opportunity for California and the nation.

Thank you.



American Automobile Manufacturers Association

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Andrew H. Card, Jr.
President and Chief Executive Officer

**Testimony of
Andrew H. Card, Jr.
President and CEO
American Automobile Manufacturers Association
before the
California Assembly Transportation Committee
February 14, 1994**

I am Andy Card, President and CEO of the American Automobile Manufacturers Association which represents Chrysler, Ford and General Motors.

Mr. Chairman, I believe you and I share the same goal: to improve California's air quality and at the same time provide consumers with safe, affordable, transportation. It is these two fundamental principles which shape our thinking.

I know that many are expecting me to tell you what we can't do. But I'm here to tell you what we **are doing** and what we **can do**. Importantly, we both need to ask the question: what is right for the consumer and the environment?

First, let me speak to the issue of air quality. America's Car Companies recognize the seriousness of California's air quality problem. A great deal of progress has been made. The auto industry has already made significant gains in cutting tailpipe emissions. Today's California cars are 99 percent cleaner than 25 years ago.

To further cut emissions, CARB has put in place even more stringent requirements. Our member companies have launched an enormous effort to meet the Onboard Diagnostics (OBD) and Low Emissions Vehicle (LEV) requirements. Our member companies are hopeful these requirements can be met without serious adverse effects on vehicle performance and cost. In addition, major efforts are underway in the area of alternative-fuel powered vehicles. They are also developing hybrid vehicles. And our member companies are making progress on the Ultra Low Emission Vehicle (ULEV). One of our members has certified **one** vehicle, a dedicated natural gas powered vehicle, at ULEV

levels. But it is unclear how these standards can be met by a broader range of vehicles. Our member companies believe we can make further progress. Realistically, however, some regulations may need to be adjusted. And, as in the past, we will work closely with CARB.

Let me now turn to the electric vehicle. The question is: "If we build it, will they come?" The issue here is matching technology to consumer expectations.

Contrary to what some would have you believe, the auto industry recognizes there is great consumer interest in electric vehicles. Our members know there is an opportunity to sell consumers an entirely new class of vehicle. They know that the first company to introduce a product that meets the needs of large numbers of consumers will be very successful. That's why members of this industry have spent hundreds of millions of dollars on the electric car.

The fact is, our member companies know how to make electric vehicles. What they don't know yet is how to make an affordable battery which will meet customer needs. The batteries available for electric vehicles today fall short of customer needs. If we were to produce an electric vehicle today, it probably would run on lead acid batteries, carry two people less than 100 miles on a hot Los Angeles day and be extremely high in cost to the consumer. Market studies show that few people would buy them.

Even with one of the most advanced experimental power packs -- the sodium sulfur battery -- operating costs in 1998 would be unacceptable to most drivers. It would be like telling a driver he needs a \$15,000 gas tank for his car. A \$15,000 gas tank that has to be replaced every few years. A \$15,000 gas tank that holds the range equivalent of three gallons of gasoline. A three gallon tank that takes eight hours to refill.

To try to solve the problem, our member companies have formed the United States Advanced Battery Consortium (USABC). This effort, carried out in concert with the U.S. Department of Energy and the Electric Power Research Institute is an attempt to find a breakthrough in battery technology with a research commitment of a quarter of a billion

dollars. Here's what USABC has to say about the current state of battery technology:

At this time, the USABC's best judgment is that a mid-term battery is not feasible for low volume production to meet the 2% mandate by 1998. First, none of the mid-term batteries has yet to meet all the targets. Some are close on individual parameters; all fail in terms of battery life and cost. Secondly, even assuming feasibility could be established for all targets, the last major program, the Eagle Picher Nickel Iron battery, was estimated to take 50 months from the time a battery was proven out as meeting the basic performance parameters to volume production (based on pilot plant experience). To meet the 1998 mandate, the groundbreaking on the pilot plant should have begun last June.

In November, the U.S. Department of Energy stated:

...the single most important technological obstacle facing the auto industry in placing electric vehicles in the California market by 1998 is the lack of a low-cost battery that provides adequate acceleration power and travels a minimum distance of 100 miles before recharging becomes necessary.

Clearly, the federal government recognizes the need for breakthroughs in technologies if we are to achieve dramatic improvements in emissions and fuel economy in vehicles acceptable to the American consumer. That's why the federal government and America's Car Companies joined together in the Partnership for a New Generation of Vehicles. In short, this effort requires a whole new way of thinking about personal mobility.

Mandating or forcing electric vehicles on the market before they are consumer-acceptable could hurt consumers, the environment, and the future of the electric vehicle. The fact is the current generation of electric vehicles would be high in cost. In order to sell these vehicles, some have suggested that manufacturers subsidize them in some manner, for example by raising the price of gasoline-powered vehicles to new car buyers. Increasing the cost of motor vehicles would slow vehicle turnover which means that more high

polluting vehicles stay on the road longer. Ironically, forcing electric vehicles on the market before they are ready would hurt air quality.

Finally, if we are not careful, premature introduction could delay development of electric vehicles for a very long time. History shows us what happens to technologies when they are not ready for or acceptable to consumers. The industry made substantial investments in diesel and rotary engines, only to have them rejected by consumers. The government required auto makers to provide ignition-interlock safety belts which triggered a consumer backlash and later a repeal of the requirement. Where are these technologies now? The same could happen to electric vehicles.

If we build them, will they come? That's still the multibillion dollar question.

But we continue to look for a breakthrough battery as well as other technologies in order to improve California's air quality. To be successful, that technology needs to tie into consumer needs and be in sync with the marketplace. The bottom line: technology breakthroughs and consumer acceptance should dictate market opportunity rather than arbitrary sales mandates. In the meantime, we want to work with California to examine if there are market mechanisms which can be used to help improve air quality.

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Economic Consequences of Adopting California Programs
for Alternative Fuels and Vehicles

Prepared by:

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February 1994

1.0 Executive Summary

DRI/McGraw-Hill and Charles River Associates have completed a study of the economic costs to California of adopting programs for fuels and vehicles that go beyond federal requirements. The study considers not only California reformulated gasoline and vehicle standards, but also incrementally analyzes the impact of subsidizing the sale of alternative fuel vehicles (AFV) including mandates for the sale of electric vehicles (EV). The study also estimates the emission reductions that result from these programs.

Cases

The study is designed to allow evaluation of the incremental costs of regulations on both fuel and vehicles by analyzing three cases which progressively increase the level of regulation (Table 1.1). The first case (Base Case) which serves as the basis for comparison with the other cases assumes that California implements Federal standards for gasoline and vehicles. The second case assumes that California implements California vehicle and fuel standards but no mandate for electric vehicles (EV). The third case includes the California vehicle and fuel standards including mandates for EVs and subsidies to promote the purchase and use of AFVs. The high and low ends of the range of results come from assumptions about the cost of EVs and AFVs and on how aggressively regulatory and subsidy programs are implemented.

Table 1.1
The Cases

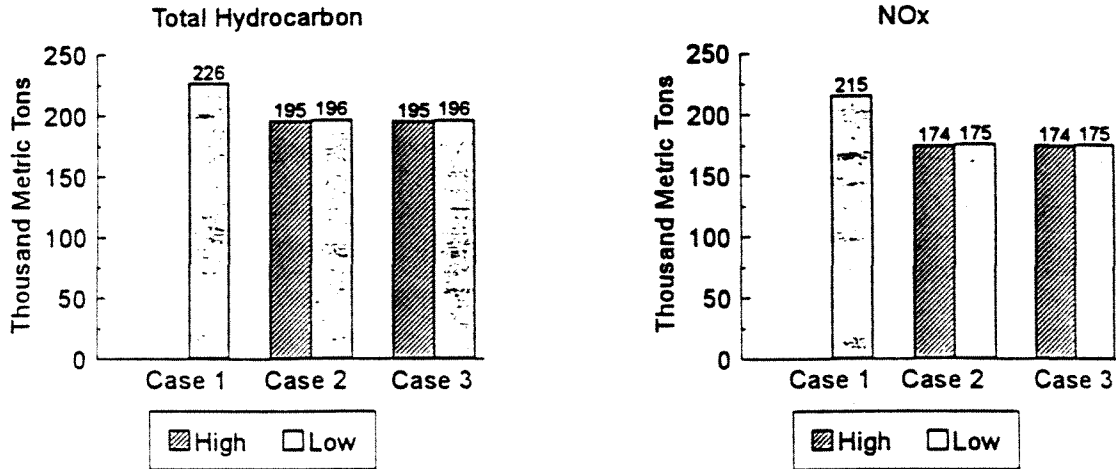
	Federal RFG	California RFG	Federal Vehicle	California Low Emission Vehicles (LEV)	Electric Vehicles (EV)	Market Driven AFV	Subsidized AFV
Case 1	X		X			X	
Case 2		X		X		X	
Case 3		X		X	X	X	X

Conclusions

Emission reductions due to electric vehicle mandates and AFV subsidies are costly in comparison to the emission reductions that can be achieved with cars and trucks that meet California's emission standards and use reformulated gasoline (Table 1.2). In 2010, the cost to reduce hydrocarbons (HC) and nitrogen oxides (NO_x) with EVs and AFVs is \$48,000 to \$292,000 per metric ton of emissions avoided. This contrasts with the California vehicle emission standards and reformulated gasoline programs which collectively cost \$16,000 to \$30,000 per metric ton of HC and NO_x. This cost-effectiveness estimate includes both the added cost of manufacturing vehicles that meet California standards and the added cost of meeting California's Phase II regulations for reformulated gasoline, and cannot be used to independently determine the cost-effectiveness of California Phase II gasoline. Some studies⁽¹⁾⁽¹¹⁾⁽¹²⁾⁽¹³⁾ that have looked at vehicles and fuels separately suggest that meeting the California Phase II reformulated gasoline standard could be more

effective method of reducing emissions. Moreover, electricity must be generated to power electric vehicles, producing NO_x emissions that have not been included in this calculation.

Figure 1.1
Emission Levels in 1998

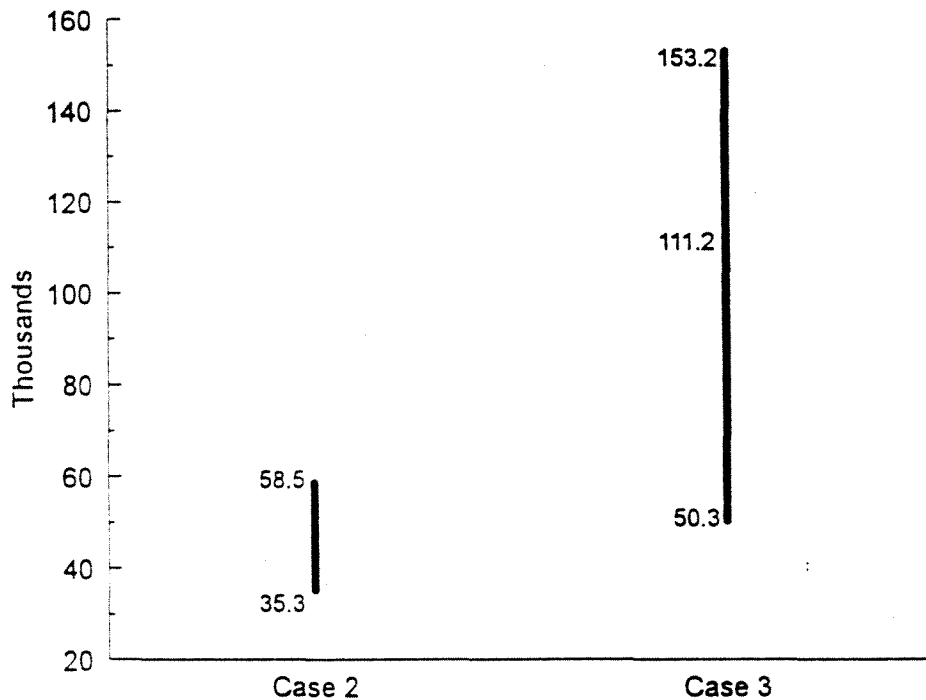


Taxpayers and utility customers in California will pay for \$2.2 billion in subsidies to AFV and EVs by 1998. State, regional and local government agencies in California, as well as universities, have in place 55 programs to provide incentives and direct funding for alternative fuel vehicles. These programs are in addition to exemptions from part of state fuel use taxes and sales taxes for AFVs and EVs. Two-thirds of the subsidies will be provided by two programs. The LA County Mass Transit District has plans for converting existing bus lines to electric trolley lines at a cost of over \$1 billion. Gas and electric utilities have been authorized by the California Public Utility Commission to provide subsidies to electric and natural gas vehicles which are paid for through higher rates charged to all their customers. Several utilities have recently proposed substantial increases. At current subsidy levels, these programs could cost utility rate payers \$451 million in 1993 dollars between 1993 and 1998. By 2010, these programs would cost a cumulative \$1.2 billion in 1993 dollars and subsidize a total of 220,000 vehicles if continued at their current levels. Despite their cost, the subsidies may have little effect on emissions or alternative fuel consumption because about the same number of alternative fuel vehicles would be purchased without subsidies, based on the projected economics of fleet use.

The price of every new conventional vehicle sold in California could be increased by \$400 to \$4400 by 2010, just to cover the cost of mandated sales of electric vehicles. Motor vehicle sales will decline as a result of mandates for EVs, leaving more old vehicles on the road and increasing emissions. The California vehicle emission and fuel standards would result in increased costs for consumers. These costs are pushed even higher by mandates for EVs. Manufacturers will have to recover the costs of producing electric vehicles. If they charged the full cost to electric vehicle purchases, they could not meet sales targets, because electric vehicles would cost much more than conventional vehicles. To encourage electric vehicle sales, vehicle manufacturers will have to raise the price of

Forcing consumers to pay more for vehicles and fuel will result in lower expenditures on other goods and services. As a result industries which serve local markets, such as services and retail trade will suffer. Personal income in California will drop by \$4.8 to \$14.5 billion in 2010, measured in dollars of the day. With the California low emission vehicle and fuel standards, job loss by the year 2010 will be between 35,000 - 59,000. Should the EV mandates and AFV subsidies be adopted then the job loss will increase to between 50,000 - 153,000. The loss in jobs along with the subsidies will mean shortfalls in tax revenues. By 2010, tax receipts will be down \$1.0 billion - \$2.8 billion. A significant part of the annual loss in taxes – \$314 million to \$412 million in 2010 – will be from fuel taxes that finance highway construction.

Figure 1.2
Incremental Job Loss in California
Year 2010



Key Assumptions

The main assumptions (Table 1.3) underlying the analysis concern the cost of fuel and vehicles. The assumptions concerning the incremental cost of reformulated gasoline were based on a prior study by DRI of the cost of California reformulated gasoline. Natural gas prices were based on the current DRI forecast for overall natural gas supply and demand. Motor vehicle costs were based on published studies by others. Costs of EVs in the low case are based on the low end of the range of estimates by the NPC, and in the mid and high cases on continually improving battery technology and vehicle designs required to match the size and performance of the gasoline vehicles they replace. The incremental costs for California low emission vehicles used in this analysis do not include the upper end

Two scenarios for regulatory implementation of EV mandates were assumed. In the low case and mid case, we assumed that the current CARB plan would take effect, and in the high case we assumed that recommendations of the South Coast Air Quality Management District for an increase in the EV mandate to 20% would be translated into a statewide CARB requirement and a tightening of the average tailpipe emission standard. Case 3 High is considered a sensitivity case for evaluating the impacts of an expanded electric vehicle mandate. This case assumes the development of breakthroughs in EV technologies as well as significant changes in consumer preferences beyond the Case 3 low and mid scenarios.

Even with the EV mandates, auto manufacturers are unlikely to locate production facilities in California. Auto manufacturers are likely to locate plants outside California, where they can produce EVs at lowest cost. Reasons that costs are lower outside California include: the availability of modern and efficient production facilities elsewhere in the country, availability of furloughed auto workers who are receiving compensation even though they are not working, plants with capacity better suited to the projected volumes of electric vehicles to be required, and efficiencies of locating manufacturing near engineering/design. There have been proposals to provide subsidies and tax incentives to encourage vehicle manufacturers to open or reopen plants for producing EVs in California, on top of the mandates for EV sales. This study has used a conservative approach to estimating costs, by assuming no additional subsidies for manufacturing facilities. If those subsidies were provided, they would increase the cost of EVs to California, because California taxpayers would be covering any difference in cost between production in California and production at the least costly location outside California.

Vehicle manufacturers will need to recover the costs of producing electric vehicles. If they charged the full cost to electric vehicle purchasers, they could not meet sales targets, because electric vehicles would cost much more than conventional vehicles and have limited range. The California EV mandate is structured such that each manufacturer will have in California the same proportion of conventional vehicle sales relative to electric vehicle sales. Consequently, each vehicle manufacturer will likely raise the price of conventional vehicles by the same amount and there will be no relative price shifts between manufacturers. This is not necessarily true nationally. Shares of California electric vehicle sales relative to nationwide conventional vehicle sales may differ for each vehicle manufacturer. As a result, unitizing the costs of California electric vehicles nationwide could lead to different changes in price for each manufacturer. Competitive market forces would cause those manufacturers that have disproportionately increased their price to either incur the cost themselves or lose market share. This study assumes that vehicle manufacturers will recapture the incremental cost of electric vehicles sold in California by changing prices of conventional vehicles sold in California. As a result, the incremental cost of electric vehicles will be borne by California consumers purchasing conventional vehicles.

**Testimony before the California State Assembly
Committee on Transportation**

**W. David Montgomery
Charles River Associates**

**Sacramento, California
February 14, 1993**

Thank you, Mr. Chairman. My name is David Montgomery, and I am Vice President of Charles River Associates, an economic consulting firm. Though I do not live here now, I am not a stranger to California, having lived here during the 1970s while teaching at Caltech, and last winter while a visiting lecturer at Stanford. It is a pleasure to appear before this committee to describe the results of the study of California alternative vehicle and fuel programs that was recently completed under my direction at DRI/McGraw-Hill and Charles River Associates.

DRI/McGraw-Hill and Charles River Associates (CRA) were asked to perform this study because their qualifications include extensive experience in analysis of alternative vehicle fuels (AFV) scenarios, transportation planning, and the evaluation of economic effects of proposed energy and environmental policy directives. I myself have conducted a series of studies on policy toward alternative fuels over the past few years.

Let me begin with some general observations that underlie this study. Under the Clean Air Act Amendments of 1990 and California's own Clean Air Act, California has set standards for emissions from new motor vehicles and for reformulated gasoline that are more stringent than those applied in the rest of the country. These are performance standards -- for average emission rates from an auto manufacturer's fleet and for a cleaner-burning motor fuel. We have estimated the costs of these standards, measured in several dimensions, and their effectiveness in reducing emissions. In addition, California has adopted a number of subsidies for alternative fuels and a specific mandate that a growing percentage of new cars sold in California be electric vehicles. These subsidies and mandates have far higher costs than the California vehicle and fuel standards, and they will produce little or no reduction in emissions. Mandating and subsidizing the use of specific fuels, on top of strict performance standards for emissions, adds a lot to costs and very little to the environment.

The fuels and vehicle analysis¹ performed by DRI/McGraw-Hill and CRA evaluated the incremental costs and changes in emission levels associated with two progressively higher levels of regulation, as I described. Both of these cases were compared to a base case

¹ *Economic Consequences of Adopting California Alternative Fuels Program*, DRI/McGraw Hill and Charles River Associates, 1993.

implementing the current federal standards for reformulated gasoline and tailpipe emissions. This comparison makes it possible to see the incremental effects of regulation adopted in California over and above those in effect in the rest of the country, and to see how rapidly costs increase when fuel mandates are imposed on top of environmental performance standards.

There are five primary conclusions that may be drawn from this evaluation. They will be briefly presented here, with supporting explanation and pertinent background.

First, emission reductions due to electric vehicle (EV) mandates and AFV subsidies are costly in comparison to the emission reductions that can be achieved with cars and trucks that meet California's emission standards and use reformulated gasoline. In 2010, the cost to reduce hydrocarbons (HC) and nitrogen oxides (NO_x) with EVs and AFVs will range from \$48,000 to \$292,000 per metric ton of emissions avoided. That is at least three to ten times the cost of improvements in emissions that will be achieved through implementation of the California vehicle and reformulated gasoline standards.

The relatively high cost of the EV and AFV programs stems primarily from two factors: 1) the additional expense of manufacturing these vehicles, and 2) the small incremental emission reductions realized from their use. The added cost to manufacture an EV is 10 to 35 times the added cost of manufacturing a vehicle that meets the California emission standards using reformulated gasoline. Because new vehicles must meet the same tailpipe emission standards for HC regardless of whether EVs are introduced, there is virtually no HC reduction and only a small reduction in NO_x attributable to the introduction of EVs. In addition, there are emissions from electricity generated to recharge EVs. I have not included these emissions in my cost-effectiveness calculation, but they would make EVs even more expensive compared to vehicles and fuels satisfying California standards.

Second, the introduction of EVs and AFVs leaves emissions nearly unchanged in 1998. California low-emission vehicles and reformulated gasoline *alone* reduce HC and NO_x emissions by about 70,000 metric tons in 1998. The EV mandates and AFV subsidies decrease emissions by no more than 200 metric tons, a truly insignificant amount in comparison, and they may actually increase emissions. The reason emissions may increase is that the small reduction in emissions from new vehicles is offset by another effect. Higher new car costs slow sales and replacement of older, higher emitting vehicles and increase emissions from the existing fleet.

New car and truck prices increase because someone must pay for the cost of EVs and AFVs. Auto manufacturers would not be able to sell their required allotment of EVs if they charged their full cost to purchasers of EVs, because the cost of EVs will be much higher than the cost of comparable vehicles that otherwise meet California emission standards. In order to sell EVs, manufacturers will have to spread these costs over all new cars sold in California. This price increase will lead to a decline in new vehicle purchases and subsequent delaying of routine automotive stock turnover, historically the primary driver for reducing motor vehicle emissions.

Third, taxpayers and utility customers in California will pay for \$2.2 billion in subsidies to AFVs and EVs by 1998. Government agencies in California have 55 programs in place to provide incentives and direct funding for alternative fuel vehicles. The source for a significant portion of these subsidies will be California gas and electric utilities. At current funding levels, utility ratepayers would pay \$451 million (1993 dollars) in higher rates between 1993 and 1998 to subsidize EVs and AFVs. Several California utilities have recently requested substantial increases in these subsidies. It is hard to see how ratepayers would benefit from the expanded electricity sales that might result.

At current funding levels, these subsidies will benefit about 220,000 vehicles between now and 2010. Our baseline forecast is for more AFVs than that to be chosen by fleets based on straight market economics and the Federal fleet program. Thus, depending on how they are targeted, the utility subsidies on the current scale might not bring about any increase in alternative fuel use. Much of the utility subsidies for AFVs could prove to be windfalls for those who would have adopted alternative fuels in any event.

Fourth, the price of every new conventional vehicle sold in California could be increased by \$400 to \$4,400 by 2010 just to cover the cost of mandated sales of electric vehicles. The California vehicle emission and fuel standards will result in increased new car costs; EV mandates would push costs even higher. Motor vehicle sales will decline as a result of mandates for EVs, leaving more old vehicles on the road and increasing total emissions. To meet EV sales targets, EV prices would have to be kept below costs, and conventional vehicle prices would have to be increased to make up the shortfall to manufacturers. This would result in fewer sales of conventional vehicles, slower automotive stock turnover, and a corresponding increase in emissions compared to implementing just the California vehicle emission and fuel standards program.

Fifth, imposing mandates and subsidies to promote the purchase of EVs and AFVs, in addition to California vehicle and fuel standards, will hurt the economy of California, cause California job loss, and reduce tax revenues. Complying with the California emission and fuel standards will cost a family of four \$130 to \$240 (today's dollars) in 2010. If AFV and EV measures are imposed, that cost rises to between \$160 and \$1030. This effective loss of income means fewer goods and services will be purchased in local economies. California total personal income will drop by \$4.8 to \$14.5 billion in 2010 (2010 dollars). Between 35,000 and 59,000 jobs will be lost by 2010 with just the low emission vehicle and fuel standards. If EV and AFV mandates are imposed, the job loss will increase to between 50,000 and 153,000. State tax revenues will drop too; by 2010, tax receipts will be down \$800 million to \$2.8 billion, much of this loss from fuel taxes that finance highway construction.

We also concluded that, even with the EV mandates, auto manufacturers are unlikely to locate production facilities in California. Auto manufacturers are likely to locate plants outside California, where they can produce EVs at lowest cost. Reasons that costs are

lower outside California include: the availability of modern and efficient production facilities elsewhere in the country, availability of furloughed auto workers who are receiving compensation even though they are not working, plants with capacity better suited to the projected volumes of electric vehicles to be required, and efficiencies of locating manufacturing near engineering/design facilities.

There have been proposals to provide subsidies and tax incentives to encourage vehicle manufacturers to open or reopen plants for producing EVs in California, on top of the mandates for EV sales. This study actually used a conservative approach to estimating costs, by assuming no additional subsidies for manufacturing facilities. If those subsidies were provided, they would increase the cost of EVs to California, because California taxpayers would be covering any difference in cost between production in California and production at the least costly location outside California.

This concludes my oral statement. I will be happy to respond to any of your questions.

TESTIMONY OF
JACQUELINE E. SCHAFFER
CHAIRWOMAN, CALIFORNIA AIR RESOURCES BOARD
before the
Assembly Transportation Committee
"California's Plan For Clean Vehicles and Fuel:
Impact on the Economy and Emissions"
February 14, 1994

Good afternoon Assemblyman Katz and Committee Members. I am pleased to participate in today's hearing on "California's Plan For Clean Vehicles and Fuel". I understand that the Committee is primarily interested in having my testimony on "the transition to reformulated gasoline." As this Committee is well aware, however, California's plan for clean vehicles and fuels is an integrated and mutually dependent program; it is almost impossible to discuss one part in isolation from the others. I therefore would like to begin by placing the process for introducing reformulated gasoline into this larger perspective.

THE LOW-EMISSION VEHICLE PROGRAM

Recognizing that motor vehicles remain the single largest contributor to California's air pollution problem, the Air Resources Board in 1990 approved the Low Emission Vehicle/Clean Fuels Program. For the first time, the motor vehicle and its fuel are treated as an integrated system.

ARB's approach is founded on several important principles. First, the program is "fuel neutral". It accommodates a variety of alternative fuels, such as compressed natural gas and

methanol, as well as a cleaner gasoline, which we call Phase 2 Reformulated Gasoline.

Second, the program is "performance-based"; that is, it does not specify a particular emission control technology. Rather, it sets new performance standards for tailpipe emissions from motor vehicles. Manufacturers choose which combinations of vehicle technology and/or clean fuel to use. Thus, the program encourages the broadest range of technological improvements to current emission control systems. In brief, the low-emission vehicle regulations established four tiers of vehicles with which to meet progressively more stringent emission standards:

- transitional low-emission vehicles (TLEVs)
- low-emission vehicles (LEVs)
- ultra-low emission vehicles (ULEVs)
- zero emission vehicles (ZEVs).

The regulations also established a declining fleet-average standard for non-methane organic gases (NMOG) (a hydrocarbon standard). The NMOG standards for these categories are 50%, 70%, 84%, and 100% lower, respectively, than the 0.25 gram per mile hydrocarbon tailpipe emission standard for conventional cars and light trucks. Automobile manufacturers may use any combination of low emission vehicles (TLEVs, LEVs, ULEVs, and ZEVs) and conventional vehicles to meet the fleet-average standard. The average of the NMOG standards, for all vehicles produced in a given year, determines if a manufacturer is in compliance.

Third, the program is "technology forcing". Because the air quality in California is so severe, the ARB also adopted a mandate for zero emission vehicles (ZEVs) as part of the low-emission vehicle regulations. The ARB regulations phase-in the ZEV requirement gradually, and give manufacturers an 8-year lead time. The mandate requires, beginning in model year 1998, that two percent of the passenger cars and light-duty trucks offered for sale in California by each large manufacturer (>35,000) must be ZEVs, with the percentage increasing to five percent by 2001 and ten percent by 2003. [Intermediate (3,000 - 35,000) manufacturers are affected in 2003; small-volume (<3,000) manufacturers are not affected.]

Credit-trading is allowed for ZEVs, increasing a manufacturer's flexibility. Although the ZEV mandate does not specify which technology must be used to meet the standard ("any vehicle which is certified...to produce zero emissions of any criteria pollutant under any and all possible operational modes and conditions"), the only option believed to be technologically feasible by 1998 is the electric vehicle (EV), powered by electrochemical batteries. In the future, emerging technologies such as electromechanical batteries (flywheels), ultracapacitors, and fuel cells may provide power for EVs.

The U.S. Environmental Protection Agency granted a Waiver of Federal Preemption for California's Low-Emission Vehicle Program

in January 1993. The first low emission vehicles were offered for sale in the 1994 model year. Over the next ten years, allowable emissions will be reduced 75 percent for hydrocarbons and 50 percent for nitrogen oxides, the two precursors to ozone formation.

BIENNIAL REVIEW OF LEV/ZEV PROGRAM

At the ARB's 1990 hearing at which these regulations were adopted, the Board also adopted a resolution which called for biennial reviews of the program. The Executive Officer was directed to report to the Board by Spring of 1992, and thereafter at least biennially, on the status of implementing the program. The regulated public and other interested parties must be consulted in preparing the reports and must be provided an opportunity to make oral and written comments to the Board in conjunction with the reports. The first review was held in June 1991, at which time the Board determined that the Low-Emission Vehicle program was on track. I have directed the Executive Officer to complete the second review of the program and present the staff's report to the Board this coming May. The ARB will review progress on the feasibility and cost issues for low emission vehicles (LEVs) and for zero emission vehicles (ZEVs). Cost-effectiveness of ultra low emission vehicles (ULEVs) will also be addressed in this review. ARB expects that the cost of achieving these limits has been significantly reduced since 1990.

REFORMULATED GASOLINE

The Board adopted reformulated gasoline regulations ("Phase 2") in order to help auto manufacturers to meet the stringent vehicle emission standards at lower costs to the consumer. Without cleaner burning fuel, automakers would have to apply more technology -- at greater cost -- to reach the low emission vehicle standards. The scheduled introduction date for "Phase 2" reformulated gasoline is March 1, 1996.

In addition to contributing to the low emission vehicle performance standard for new cars, the reformulated gasoline regulation will significantly reduce emissions from existing mobile sources. We estimate that the 1996 on-road vehicle exhaust emissions of oxides of nitrogen (NOx) will be reduced by 110 tons per day and volatile organic compound (VOC) emissions will be reduced by 230 tons per day. These two pollutants are the main constituents of "smog". In addition, we estimate that emissions of toxic compounds will be reduced by 30 percent.

These emission reductions will be achieved at a cost that is approximately one-third to one-half of the cost that California's industry would have to pay for a comparable magnitude of emissions reductions from stationary sources. This is because virtually all significant industrial sources have been or shortly will be well controlled, and additional controls would come at

far higher costs. Achieving major reductions in pollution from cars and trucks is the only realistic path to follow for California to achieve healthful air quality.

Perhaps the most compelling aspect of the reformulated gasoline program is the fact that the air quality benefits begin as soon as the regulations take effect. Unlike the gradual reductions in emissions that occur as older cars wear out and are replaced by new, cleaner-running cars, all 20 million cars on the road in California will pollute much less after the reformulated gasoline is introduced. On average, each car will emit 15 percent less hydrocarbons and 10 percent less oxides of nitrogen.

As an associated economic impact, we estimate that refinery modifications necessary to produce the reformulated gasoline will result in 20,000 construction-related jobs from 1994 to 1996, and an estimated increase in permanent employment of 1000 workers at the state's refineries.

While the Board adopted the regulation because of its significant air quality benefits, we also recognize that it imposes substantial costs. These costs will be borne ultimately by the consumers -- those individuals, businesses and agencies that purchase gasoline. At the time this rule was adopted, the ARB estimated that reformulated gasoline would cost refiners between 10 and 17 cents more per gallon to manufacture than today's

gasoline. Because these costs are so substantial, we continue to work closely with refiners as this rule is implemented to lower the capital and production costs of making this fuel wherever possible.

Lessons learned from the experience we gained, with much pain, with the introduction last October of reformulated diesel are already being applied as we move forward with the reformulated gasoline program. Our aim is to ensure an orderly transition as reformulated gasoline enters the marketplace and to investigate any potential problems associated with the use of reformulated gasoline and to identify practical solutions to be applied prior to its introduction.

Specifically, we will 1 work with refiners to assure that together they are ready to produce the new fuel on time and in sufficient quantities; 2 pursue testing to reduce the risk that reformulated gasoline may cause or contribute to mechanical problems; and 3 consult gasoline users and other affected parties to develop plans to ensure a smooth transition to reformulated gasoline, including contingency plans to respond to unforeseen situations that could arise. I will summarize activities on each of these fronts in more detail.

First, we have taken aggressive action to ensure refineries are permitted in a timely manner, and are ready to produce

reformulated gasoline in 1996.

o For the past two years, we have been working with refiners, local lead agencies, permitting agencies, and air pollution control districts to expedite the approval of construction projects with the California Environmental Quality Act (CEQA) process and the approval of land use and environmental permits from state and local agencies. We have provided your staff with a status report on each refiner's progress to date.

o We require refiners to submit frequent compliance reports on their progress relating to the production of reformulated gasoline. We will carefully review each compliance plan to ensure refiners are diligently taking all necessary steps to comply on time. We also intend to regularly audit refiners' activities to come into compliance.

o We have requested all refiners to provide us with their preliminary estimates of the volumes of reformulated gasoline that they will have the capability to produce and the volumes they expect to produce in 1996. We and the California Energy Commission have requested periodic updates of this information and will publish estimated volumes that will be produced in 1996 as well as the projected demand for gasoline.

Second, we are taking action to make sure appropriate testing and

research are conducted to ensure that no fuel-related mechanical problems occur.

o We will soon establish an interdisciplinary group that will include fuel producers, vehicle manufacturers, end users, gasoline marketers, fleet operators, auto associations and others to identify and address specific concerns with the introduction of reformulated gasoline.

o We will work with all interested parties to develop a program to conduct performance testing of vehicles using reformulated gasoline. We have already written to gasoline producers, gasoline marketers, vehicle manufacturers, and after-market parts manufacturers soliciting information that they may have already developed regarding the evaluation of engine performance with reformulated gasoline as well as fuel compatibility with various engine materials.

o We are working with other government agencies, such as the California Energy Commission and the U.S. EPA, to investigate and identify any potential problems and solutions associated with the use of reformulated gasoline prior to its introduction.

o We will develop consumer education information to keep the general public properly informed and prepared for implementation of the regulation. Consumers should feel confident that ample

supplies of fuel will be available and that the fuel will perform as it should. Since the public will ultimately bear the additional cost of reformulated gasoline, we also think that consumers would appreciate knowing that the price they pay at the pump includes meaningful improvements in air quality.

Third, as I mentioned earlier, the additional cost to produce reformulated gasoline was estimated at between 12 to 17 cents per gallon at the time the regulations were adopted. Past experience has shown that the competitiveness of the market place -- and entrepreneurial ingenuity -- usually result in lower actual costs by the time regulations are implemented. In an effort to achieve significant savings in the cost to produce the reformulated gasoline, we are in the final steps of developing a predictive model that will allow refiners to use alternative formulations. Application of the model will preserve the emissions benefits of our rule, but will allow increased production capability and reduced production costs. The Board will also be reviewing additional data that the auto and oil companies have developed to determine if there are any areas where the existing rule can be modified in a way that makes fuel easier to make, without sacrificing emission benefits, and otherwise ensure a smooth transition.

CONCLUSION

Motor vehicles and their fuels are a principal focus of our work at the California Air Resources Board because motor vehicles are the greatest single source of air pollution in this state. When the ARB adopted the Low Emission Vehicle program in 1990, inherent in the design of those regulations was the conclusion that use of cleaner fuels (including improvements in the composition of gasoline) along with the application of advanced emission control hardware, achieves the greatest possible reductions in motor vehicle emissions. This was the first time that the vehicle and its fuel was treated as an integrated system. Maintaining the performance of motor vehicles in-use is the aim of two other highly important programs: the Smog Check program, which you have very recently voted to improve; and the in-use compliance program, which depends on a comprehensive on-board diagnostic system that checks the performance of key emission control systems on an on-going basis. If performance degrades, a warning light is illuminated, and information needed to repair the problem is stored in the on-board computer. By 1996, all LEVs will be equipped with on-board diagnostics.

To summarize our strategy: more stringent tailpipe emission standards continuously adds cleaner new cars to California's fleet, eventually replacing the entire fleet with the most stringently controlled vehicles; the entire fleet is made cleaner

by adopting reformulated gasoline for the vast majority of in-use motor vehicles; Smog-Check holds the consumer responsible for properly maintaining the vehicle's pollution control equipment; and the manufacturer is held responsible for guaranteeing that pollution control equipment will remain effective throughout most of the life of the vehicle.

Taken as a whole, this comprehensive strategy constitutes California's Plan for Clean Vehicles and Fuel. It is a sound strategy which, when implemented intelligently, promises to contribute significantly to improving California's air quality and to strengthening California's economic prosperity. I look forward to cooperating with you, Chairman Katz, and with all the members of the Assembly Transportation Committee, to move ahead with this plan.

ARCO Products Company Testimony
By Robert J Trunek
Before the California Assembly Transportation Committee
February 14, 1994

Good afternoon, I am Robert Trunek, ARCO's Vice President of Environment, Health and Safety. I am here today representing ARCO's views on the importance of the CARB Phase II gasoline rule to the State of California and the California environment.

ARCO is a recognized leader in the development of emission control gasolines. ARCO's first emission control gasoline, EC-1, was introduced in California in 1989 and our expertise in clean fuels has now expanded to include the new diesel fuel required by CARB last October. We have five years of experience in the production, testing and consumer acceptance of reformulated gasolines and fuels. As an experienced supplier of clean fuels, ARCO wants to reaffirm its commitment to the timely introduction of CARB Phase II gasoline. We encourage CARB and the legislature to do all they can to ensure that California meets the 1996 Phase II deadline.

The introduction of CARB Phase II is important to California. It will provide enormous and immediate air quality benefits and complement the substantial emission reductions that have already been made statewide. Since the late 1960's, the combined technological changes to fuels and vehicles made by the oil and automotive industries have reduced mobile source air pollution significantly. Between 1968 and 1993, a combination of tighter controls on vehicles and the associated fuel modifications eliminated a substantial percentage of the certified emissions of light duty vehicles.(The reduction of Hydrocarbons, NOx and CO emissions from 1968 to 1993 is 94%, 75% and 94%, respectively.)

In 1996, the use of CARB Phase II in all gasoline powered vehicles throughout California will help achieve even greater reductions. This is the only strategy available which will, on the day it is introduced, immediately and substantially reduce emissions from the entire fleet. It will be equivalent to retrofitting all existing cars with pollution control equipment which would otherwise cost hundreds of dollars for each and every car. At the time it was passed, it was estimated that the effect of the rule would be equivalent to taking 8 million vehicles off the road. That is almost a third of the vehicles in the state. No other fuel and no other strategy can provide these immediate emission benefits in the existing car fleet. This fuel is also a key element in providing a consumer friendly way to meet California's new low emission vehicle standards.

CARB gasoline will cost more to make than conventional gasoline, but the costs are much lower than those associated with any other fuel alternatives. CARB has estimated that the increased cost to manufacture this new fuel will be 12 to 17 cents per gallon more than conventional gasoline. ARCO's own estimate falls within this range.

ARCO will invest well over \$500MM by 1996 to meet clean gasoline requirements and make the necessary modifications to our refinery. These investments will generate as many as 2350 construction jobs and 40 new permanent jobs. Similar investments by other California refiners will result in significant economic benefits to the state right now. Furthermore, by taking this cost effective, consumer friendly step now, the state can avoid far more draconian stationary source reductions.

ARCO has supported the development of CARB's new gasoline standards. We remain committed to the CARB II program, including an orderly and timely transition to the new fuel in 1996.

It is far less certain that California government has the same commitment.

As recently as February 8, 1994, CARB granted another variance to its clean diesel rule and, at the same time, proclaimed that it would significantly reduce air pollution. Actions such as this send a clear message to investors that timely compliance with CARB orders is not necessary and that there are few, if any, penalties to be assessed if one does not comply. In the February 8 decision, CARB stated that no penalty for noncompliance was required because the refiner had incurred some costs. This was of little comfort to other refiners who expended huge sums to comply in a timely manner or paid penalties when they failed to meet the deadline for compliance.

It is essential that all branches of the government display the fortitude needed to hold steadfast; to refuse to permit the sale of fuel which does not satisfy the requirements of the Phase II rule. Only then will there be full support for the substantial investments needed to meet the 1996 deadline. Anything short of a total commitment will compromise the process and discourage investments, thereby failing to achieve the desired emission reductions and creating marketplace chaos. Only the legislature and the Administration can provide the certainty that is required. Californians will not accept, and we believe CARB should not tolerate, any relaxation of the standard, or any delay in the 1996 implementation deadline. Any other outcome will penalize those of us who have made huge financial commitments to produce cleaner gasolines and cleaner air.

All new products need to be tested before being introduced to the consumer. Reformulated gasoline is no exception. We are confident there is ample time for testing CARB II gasoline. Our confidence is based on five years of experience with low emission

gasolines and our participation in the joint AUTO/OIL research and other programs. Additional testing is underway. One example of ongoing programs, the Multifuel Federal Express Cleanfleet program (111 vehicles/five fuels/completion 1994), has completed one year, over 2 million miles of testing and is continuing.

We are considering additional joint testing programs and would invite CARB to participate in these efforts. We are also recommending that an education program begin soon so that consumers are informed about the benefits of CARB gasoline.

Since 1970, the automotive industry has done an outstanding job in reducing emissions. Their LEV plans, when combined with CARB Phase II gasoline, will radically improve the future air quality of this state. Similarly, programs such as vehicle scrappage programs would provide significant benefits.

These are very cost effective programs which will yield immediate benefits and as in the case of scrappage, at no cost to the consumer. All of the efforts described above involve virtually no inconvenience to the consumer. Other alternative fuel/vehicle systems that are proposed require radical changes in fuel use and in the cost of vehicles and fuels, with little if any measurable benefits. Many of the alternatives are sales hype, offered by promoters who want to expand their business at consumer expense. Before we commit limited consumer and taxpayer dollars, we must clearly understand, without a rhetorical cloud, the true cost of change and the benefits to be achieved.

The public wants and deserves clean air and they expect business to produce that result. The business that does so at the least cost, with the least inconvenience to the public should succeed. The public votes with its consumer dollars and business will respond to their expectations or disappear. If government interferes with this

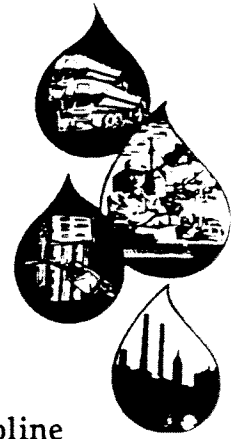
freedom of choice by dictating either the vehicle to be sold or fuel to be used, innovation will be stifled, and we all achieve less than our potential.

In closing, I compliment the chairman and this committee for your interest in transportation issues. They are complex. Through the hearing process, we can come together and openly discuss California's needs and options and highlight the consequences of each proposal. I would urge this committee to explore each issue before it proceeds. I believe that our industry has stepped up to the air quality problem and developed a series of excellent programs for improving the quality of California air. We ask of this body and California administrative agencies that they adhere to the fuel rules that they have adopted and not shift with each fad that blows through California. Billion dollar investment cannot be made in the face of constant legislative or regulatory change. Working together, we will continue to make progress toward California's clean air goals.



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Assembly Transportation Committee Testimony Regarding Introduction of Reformulated Gasoline February 14, 1994

Thank you, Mr. Chairman and committee members, for the opportunity to speak on behalf of the California Independent Oil Marketers Association (CIOMA) regarding the introduction of the reformulated gasoline regulation, scheduled to take effect in April 1996. Although this deadline may seem far off, it is in reality approaching very quickly. We should now be planning for implementation of this regulation by ensuring that a smooth transition is made from use of the old fuel to the new one.

Smooth transition depends on four things -- 1) an appropriate timeframe for introducing the new gasoline throughout the industry; 2) adequate supplies of fuel from all the fuel producers and importers that currently supply California gasoline; 3) contingency plans that permit quick response to supply or distributions problems; and 4) adequate field performance and engine wear testing of the new fuels prior to certification for public use.

Timeframe -- Phase-In the New Regulation

CIOMA urges CARB to introduce this regulation over a period of at least one year. As the diesel experience last fall indicated, a drop-dead compliance deadline for all segments of the market places severe and unnatural demand on fuel supplies. Gasoline producers may encounter many of the same problems in modifying their refineries to produce reformulated gasoline that they experienced in making low-aromatic diesel. If refineries are unable to produce and reserve adequate amounts of reformulated gasoline to meet the deadline, then the same kinds of shortages and price spikes could occur.

A more effective solution would be to phase out the old fuel by setting compliance deadlines for each of level of the gasoline distribution chain that enable refiners, distributors, retailers, and consumers to turn their tanks within a reasonable amount of time. Generally, it takes two to three tank turns to fully flush traces of the old fuel from storage and fuel tanks. Since some segments of the market from distributor to consumer may take two months to turn one tank of fuel, giving each market segment six months staggered throughout the one year period should reduce the excessive demand for fuel seen last September and October and make transition much less a crisis.

This phase-in also permits the market to use supplies of old and new gasoline if sufficient supplies of reformulated gasoline are not available from all suppliers. Those suppliers who are capable of producing substantial quantities of reformulated gasoline could be given economic incentives, such as saleable emissions credits or emissions offsets of stationary source criteria pollutants from production of

reformulated fuel. CIOMA strongly opposes the use of penalties or fees that will ultimately be passed onto consumers who will be forced to pay for the costs of making the new fuel as well as a means of insuring future supply.

Adequate Supplies from Traditional Suppliers

Distributors and retailers often buy fuel from a variety of suppliers. This practice serves the consumer by making the best fuel available at the lowest possible price since it spurs competition between fuel suppliers. Prices will inevitably rise to unprecedented levels if either the number of suppliers falls dramatically or if these suppliers do not have adequate amounts of fuel that can be sold in California. The state must take every step available to ensure that all current suppliers remain in the California market and that the fuel specification does not preclude import of fuel from overseas or out-of-state if supplies drop significantly below demand.

As distributors, we need reliable information as soon as can be obtained about which producers will be supplying reformulated gasoline and which will not. At a recent meeting where implementation of the reformulated gasoline regulation was discussed, CARB officials indicated that expecting compliance reports from refiners by November 1995 would be unrealistic given current timeframes for releasing CARB predictive model and the level of preparation refiners have already made for producing reformulated gasoline. CARB officials then said that information may not be available until March 1, 1996 -- just one month before the compliance deadline.

Releasing information about which refiners will be in compliance only one month before the deadline must be met will not give marketers adequate time to find alternate suppliers if one of their critical sources of supply will not be in compliance. If suppliers will not be able to advise CARB of their ability to comply until March 1, 1996, then CIOMA strongly recommends that the deadline for initiating compliance be pushed back and the fuel introduced through a long-term phase-in period. Supply from many sources is the key to effective introduction of this regulation. Without adequate supply throughout the state, disruptions will occur.

Contingency Plans Can Reduce Impact of Supply Disruptions

When a regulation that has such a broad impact is introduced, disruptions, problems, can be expected to occur. Problems are not necessarily disastrous, but they certainly can be if they are not anticipated and if no contingency plans are made to determine what can and should be done if problems occur. CIOMA strongly urges the state to establish a multi-industry, multi-agency, public working group to identify potential problems that may result from implementation of the reformulated gasoline regulation and to develop contingency plans for quickly addressing those problems in a manner least disruptive to all concerned.

In recent discussions CIOMA has had with state agencies looking at implementation of the reformulated gasoline regulation, many references have been made to "letting the market take care of itself" and using the variance procedures to remedy supply or distribution problems. CIOMA does not believe that reliance solely on these solutions is effective or wise. The 1993 supply shortages and price spikes substantiated

CIOMA's concerns about the effectiveness of the variance mechanism to insure adequate fuel supplies.

The state cannot solely rely on market economics when governmental policies have removed some of the critical balances that keep the market competitive. CIOMA also believes the development of supply contingency plans with a trigger point, based on an industry determined level of supply, at which the regulations would be suspended until adequate levels of supply return to the market would help stabilize supply driven price jumps.

Setting single state standards that deviate substantially from those followed in the other fifty states changes the balance of trade in California. As previously mentioned, if importers and traders cannot bring fuel into California to meet demand when supplies produced by refiners here are low, then market forces cannot respond adequately. When the state has taken action which effectively removes a market segment that helps balance supply and demand, then it must look at ways to restore that balance if supply and demand are too far out of line.

Responses may include requiring allocation by historic volumes rather than price or temporary suspension of the regulation until sufficient supplies are available to bring supply and demand back into balance. The state cannot forget that the consumer ultimately pays for these regulations. Therefore, the state cannot allow an uncompetitive market to unfairly price a product that governmental policies made artificially scarce. To make sure the interests of all concerned or affected by the regulation are addressed, we urge the state to set up a working group to develop appropriate and effective responses to market imbalance.

Test Fuel Formulas, Don't Make Consumers Become Guinea Pigs

Gasoline is a product that has been developed over the last century to effectively run in engines. Changes made by refiners over the years have generally been widely introduced only after extensive laboratory and field testing. Although the state requires new fuels to be extensively tested for emissions, the reformulated gasoline regulation contains no requirement for refiners to test the new fuel's useability or quality in engines. CIOMA believes that the lack of such requirements is a serious flaw in this regulation.

Fuel useability and quality testing should be completed by all refiners seeking to certify new gasoline formulas with CARB. CARB should require laboratory and field tests as prescribed by standards development organizations, like the Society of Automotive Engineers, the International Standards Organization, and the American Society for Testing Materials. In addition, the state should examine the emissions impact new technologies or federal regulations, like the on-board canister rule, will have and complete a broad scale emissions inventory to determine the cumulative effect of all regulations on improving air quality. Results from these alternatives may reduce the need for stringent fuel and engine specifications. Perhaps an objective examination of the Clean Air Act requirements and emission reductions efforts would provide insight into the success CARB has already achieved and what is further needed.

In closing, CIOMA supports the reformulated gasoline regulation and hopes that it will improve air quality substantially. However, our members urge state officials to implement the regulation as reasonably as possible to minimize disruptions in supply and distribution of gasoline and the price impact to consumers.

U.S. ENVIRONMENTAL PROTECTION AGENCY
TESTIMONY BEFORE THE STATE OF CALIFORNIA ASSEMBLY
COMMITTEE ON TRANSPORTATION
FEBRUARY 14, 1994

Good afternoon Chairman Katz and members of the Committee. My name is Dave Calkins, and I am Chief of the Air Planning Branch of the EPA Region 9 Air and Toxics Division. Felicia Marcus and David Howekamp have asked me to send their apologies for their inability to be here today. In addition, I have brought a letter from Assistant Administrator Nichols for the record.

I am here today to express U.S. EPA's strong support for California's existing plan for clean vehicles and fuel programs. Technology forcing regulations, such as California's LEV program, lead to innovative solutions in our efforts to solve the difficult air quality dilemmas facing us throughout California and the Nation. California will serve as a launching pad for marketable technologies in a global arena increasingly concerned with environmental quality.

Numerous factors have led to California's current leadership in electric vehicle technology. California's market demand will be the earliest, largest, and most sophisticated in the world. The level of research and development provided by the universities and national laboratories in California is unequalled anywhere. The presence of the electronics and aerospace industries has created a crucial foundation for development.

California is already home to over 100 companies dedicated to electric vehicle technologies. Companies are developing every conceivable electric vehicle product -- from advanced batteries and aluminum frames to DC/AC converters and regenerative braking systems. These companies, and the new ones which will be developed in the next few years, will also be leaders in the emerging environmental technology export market.

The California Council on Science and Technology has projected that by 2003 over 70,000 Americans will be employed in direct manufacturing jobs in electric vehicle industries. California alone has the potential to be the site of 10,000 new jobs by the year 2000 and 70,000 new jobs by 2010, including direct manufacturing and assembly, indirect, construction and deployment, and service jobs.

This hearing is particularly timely as EPA is announcing Federal Implementation Plan (FIP) proposals tomorrow which include support for California's LEV program. Emissions reductions from those programs will be credited in the FIP.

CLEAN AIR ACT: BACKGROUND

The fundamental goal of the Clean Air Act Amendments of 1990 as mandated by Congress is to reduce pollution by over 50 billion pounds a year. The reductions will come from cutting the emissions from several principal sources including motor vehicles. Motor vehicles contribute about half of California's emissions of volatile organic compounds and oxides of nitrogen. In addition, mobile sources account for about ninety percent of the carbon monoxide emissions. These pollutants result in the nation's worst carbon monoxide and smog problems. For California's 31 million residents, that means greater risk of respiratory problems and reduced cardio-pulmonary function. With 26 million vehicles in California, upgrading mobile source programs will do more to improve air quality than in any other pollution control area.

CLEAN AIR ACT: CLEAN-FUELED VEHICLE REQUIREMENTS

The Clean Air Act Amendments of 1990 (CAAA) establish two clean-fueled vehicle programs. Both require controls that go beyond those necessary to meet the basic mobile source control provisions. The vehicles regulated under the programs are: car and truck fleets; and cars to be sold under a pilot program in California. Clean fuels include methanol, ethanol, reformulated gasoline, natural gas, liquified petroleum gas and electricity.

The CAAA incorporated a concept originated by the California Air Resources Board of defining several vehicle emission categories representing emissions levels lower than those applying to conventional vehicles. These "Low-Emission Vehicles" or LEV standards include permissible exhaust emissions for certifying vehicles as LEVs, Ultra Low-Emission Vehicles (ULEVs), and Zero-Emission Vehicles (ZEVs). Because the standards are based on emission performance, not fuel type, vehicles can certify as LEVs, ULEVs, or ZEVs on any fuel which meets the standards.

EPA has established an additional clean vehicle emission category known as "Inherently Low-emissions Vehicles" or ILEVs. To qualify as ILEVs, vehicles must first qualify as LEVs and then meet additional criteria. The primary ILEV criterion is that the vehicle inherently emit little or no evaporative emissions even if the evaporative emission controls malfunction, as has often occurred in actual use. Also, an ILEV must meet the LEV exhaust standards for hydrocarbons and carbon monoxide and the ULEV standards for nitrogen oxides. As with the LEV categories, a vehicle operating on any fuel or fuels that meets these criteria can qualify as an ILEV; the most likely vehicles to be certified as ILEVs will be pure alcohol vehicles (100 percent methanol or ethanol), dedicated gaseous fuel vehicles (compressed natural gas or liquified petroleum gas (propane)), or electric vehicles (in which case ILEVs may also be ZEVs). Vehicles which operate on more than one fuel may be ILEVs if they meet the requirements on each fuel. The most likely application of ILEVs will be with centrally fueled fleets.

There are a growing number of local, state, and national programs in which LEVs, ULEV, ZEVs and/or ILEVs play a role. These include 1) California's LEV program (which several states have adopted or are considering adopting); 2) the federal Clean Fleet program and the California Pilot Program; 3) the implementation of the federal fleet provisions of the Energy Policy Act; and 4) a variety of programs initiated at the state and local level to accelerate the introduction of alternative fuel vehicles into fleets. For a variety of reasons, including air quality and compliance with Clean Air Act and Energy Policy Act fleet programs, policy makers at all levels of government are considering programs that would mandate or offer incentives for the purchase of LEVs, ULEVs, ZEVs, or ILEVs.

California is substituting its LEV program to meet the Federal Clean Fleet and California Pilot programs mandated by the Clean Air Act

Federal Clean Fleet Vehicles

The fleet vehicle requirements apply to cars and all sizes of trucks in serious, severe and extreme ozone nonattainment areas. Fleets of 10 or more vehicles that are capable of being centrally fueled are covered, but certain vehicles, including ones for law enforcement and emergency use and rental retail, are exempted. The amendments' definition of "covered fleets" is quite expansive, with vehicles owned, operated or leased included. For cars and light trucks, standards are specified that will result in emissions being 60% to 70% less than under basic vehicle requirements.

Standards providing a slightly lesser benefit are to be set for heavy-duty trucks. The percentage of each fleet that must meet the stricter standards increases from 1998 to 2000, with 70% of new fleet cars and light trucks and 50% of heavy trucks ultimately being required to be clean-fueled.

California Pilot Program

In California, a portion of the vehicles sold must meet standards that are substantially more stringent than under the national program. The number of these clean-fueled vehicles that must be produced and sold increases from 150,000 in 1996 to 300,000 in 1999 and each year thereafter. The standards for the pilot program are to be about 50% more stringent than the national standard in the initial years and, beginning in 2003, should achieve about 70% greater control.

As under current law, states may elect to adopt and enforce California vehicle standards. States that choose to adopt California standards are given no new authority to require availability of clean fuels. To meet automakers' concerns, the act clarifies that states adopting California standards cannot take any action that would result in automakers having to build a special car to meet its requirements.

Reformulated Gasoline

Cleaner, reformulated gasoline is mandated in the nine cities with the worst ozone pollution (about 25% of the market). Limits are set for oxygen content, aromatic hydrocarbons and benzene. The fuel also must meet restrictions on ozone-forming VOCs and hazardous air pollutants. The Federal program takes effect in 1995, with restrictions being tightened in 2000. States can elect to have the requirements in other cities with ozone pollution problems.

CALIFORNIA PROGRAMS

In 1990, California adopted very stringent light and medium-duty emissions standards. The LEV program relies on advanced emission control technologies, clean gasoline, and an on-board diagnostics system, which together are designed to assure that in-use vehicles emit at or near their respective emission standards.

The California reformulated gasoline program is being implemented in two phases. Phase 1, which began on January 1, 1992, included a moderate reduction in the Reid Vapor pressure, requirements for deposit control additives, and the phase-out of leaded gasoline. Phase 2 involves a comprehensive set of specifications designed to achieve maximum reductions in criteria and toxic pollutants and in the mass and reactivity (ozone-forming potential) of emissions from gasoline-fueled vehicles. All gasoline sold in California after March 1, 1996 will have to meet the aforementioned specifications.

FEDERAL IMPLEMENTATION PLANS

The U.S. EPA is under court order to issue a FIP for California by February 14, 1994. The FIP is designed to bring the areas surrounding Los Angeles, Ventura, and Sacramento into attainment of national, health-based air quality standards for ozone pollution and to bring the Los Angeles area into attainment for carbon monoxide.

The FIP includes proposals to regulate emissions from the following source categories:

- o Commercial and industrial facilities, chemical plants and gas stations;
- o Products that pollute when used, such as pesticides, house paints and industrial coatings;
- o On-road vehicles such as automobiles, motorcycles, and light-, medium- and heavy-duty trucks;
- o Non-road vehicles such as marine pleasure craft, lawn and garden equipment, all-terrain vehicles, and farm and construction equipment;
- o Civil and military airports, ships in ports and passing by the Ventura coast, locomotives, interstate trucks, and used cars imported from other states.

The FIP builds on the existing state regulatory program to reduce emissions from automobiles (e.g., LEV, reformulated gasoline). To provide extra emissions reductions above and beyond the substantial reductions provided by LEV, the proposed FIP also includes an enhanced Smog Check program and an enhanced in-use vehicles compliance program.

The enhanced Smog Check program is included due to the importance of such a program as a cost-effective tool to reduce vehicle emissions. However, U.S. EPA is continuing to discuss with Chairman Katz and other California legislators and leaders a state program that would meet federal performance standards. Once such an approvable program is adopted by the state, it would take the place of that FIP component.

OZONE TRANSPORT COMMISSION VOTE ON CA LEV

As you are aware, the Ozone Transport Commission (OTC), a group of states extending from Virginia to Maine, voted nine to 4 on February 1 in favor of petitioning U.S. EPA to mandate California's low-emission vehicle (LEV) program. Under Section 184 of the CAAA, U.S. EPA has nine months to review the OTC petition. Thus, U.S. EPA must remain neutral until the decision making process (e.g., public hearings, solicitation and review of comments) is complete. However, it is important to note that the OTC vote signals a movement to more stringent standards. The potential addition of the Northeast market would mean that one in every three vehicles would have to meet California standards.

In closing, I want to reiterate our full support for California's LEV program. We will continue to work with you to ensure the successful implementation of the program. I will be happy to try and answer any questions you may have. Thank you for the opportunity to testify on these important issues.





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**Testimony of the
NATURAL RESOURCES DEFENSE COUNCIL**

**Before the
STATE OF CALIFORNIA ASSEMBLY
COMMITTEE ON TRANSPORTATION**

February 14, 1994

**Concerning
CLEAN AIR AND CLEAN FUEL ELEMENTS OF
CALIFORNIA'S MOBILE SOURCE PLAN**

**Prepared by
VERONICA KUN
SENIOR SCIENTIST**

My Name is Veronica Kun and I am a senior scientist with the Natural Resources Defense Council. The NRDC is one of the nation's premier non-profit environmental organizations. Founded in 1970, it is now backed by 170,000 members, including 30,000 members in California, and has a staff of more than 80 lawyers, scientists and environmental specialists working in five offices nationwide. The NRDC led the fight to get lead out of gasoline, CFC's out of aerosol sprays and Alar out of apples. It is currently spearheading campaigns to clean up air and water pollution, minimize ozone depletion, reduce global warming, and reverse rainforest destruction.

I am here today to present testimony concerning the health effects of air pollution, and its particular risks to children. This committee, in its legislative and oversight capacities, has jurisdiction over that part of the economy, the transportation sector, which is the largest source of air pollutant emissions. In the past, controlling emissions from automobiles has been the single most successful program instituted in this state. In the future, securing the vital additional emissions reductions necessary to meet minimum health standards may well prove to be the state's greatest challenge.

NRDC urges the Chairman to use the full power of this Committee's legislative and oversight authority to protect and extend existing vehicle emissions programs. These programs are essential to securing clean air for the State's residents and to protect its children from the enormous health risks posed by living in heavily polluted areas.

I. INTRODUCTION

Young children constitute the largest group at high risk from exposure to air pollution. In California alone, there are 6 million children under the age of fourteen. Ninety percent of them live in areas that fail to meet state air quality standards. In Southern California, there are more that 2.5 million pre-adolescent children breathing highly polluted air.

NRDC recently published a study of the health impacts of air pollutants on children, and the implications of this research for children in the Los Angeles Air Basin and other polluted areas. NRDC had prepared this study by reviewing recent medical literature concerning both the general health effects of air pollution and, where it is available, the specific evidence concerning children. We also evaluated evidence about children's activity patterns and exposure to air pollution and their particular physiological vulnerabilities. Finally, we examined the state of air quality in the Air Basin and the adequacy of existing clean air programs and health standards.

The principal conclusion of this report is that Southern California, as well as the nation as a whole, is failing to protect its most precious citizens -- its children -- from the

adverse health effects of air pollution. In Southern California and other regions in air pollution crisis, emission reduction efforts and health standards are insufficient to shield children from potentially serious health damage. As the report describes, children in these regions are chronically exposed to high levels of pollutants that may have a cumulative and possible irreversible impact on their health. This means that every day and every year in which a child is exposed to high pollutant concentrations, the risk of health damage increases.

NRDC's purpose in preparing this report is to inform the public about these serious health consequences of air pollution and to demonstrate the urgent need for cleaner air in Southern California and other heavily polluted areas. The health of children in this state must not be compromised by our failure to institute and maintain an aggressive air pollution control program.

II. ACTIVE BODIES, YOUNG LUNGS: CHILDREN'S VULNERABILITY TO AIR POLLUTION

Children's behavior patterns and certain aspects of their physiology lead to greater exposure to air pollutants than those experienced by an average adult. Physiological immaturities in their developing systems render young children more susceptible to some of the damaging effects of this exposure.

Greater Exposure

- * Children take in more air relative to their body weights and lung surface area than do adults. Relative to their weight, therefore, children also receive higher doses of air pollutants than do adults.
- * Children spend more time outdoors than any other age group. In California, children typically spent more than two hours outdoor every day, versus slightly over one hour every day for adults. Much of children's exposure is likely to occur during mid-day and afternoons, when pollutant levels are highest in Southern California.
- * Children are more active while outdoors than are adults, spending three times as much time engaged in sports and other vigorous activities. Increased activity creates increased oxygen demand and raises breathing significantly.
- * Gravity forces many air pollutants to the ground or floor. By virtue of their stature, young children are more exposed to pollutants recirculated into the air from contaminated dust and dirt.

* Respiratory symptoms such as coughing and shortness of breath serve as signals of air pollution exposure and warnings to move indoors or curtail exercise. However, research on ozone exposure shows that children often fail to exhibit these symptoms, despite significant changes in lung function. Research also indicates that some children do not take note of symptoms when they do occur.

* The nasal airways filter many particles that would otherwise be inhaled into lungs; breathing through the mouth increases the dose of particles reaching the lungs. Most people breathe increasingly through their mouth as their level of exertion rises. Children are prone to mouth-breathing because they are very active outdoors, and they have small noses that are easily blocked by congestion, constriction or other illness.

Greater Physiological Vulnerability

* The lungs grow rapidly both in size and in complexity during childhood. During this period, damage to the lungs through irritation, inflammation, or infection not only affects the tissues themselves, but can also impede the further development of tissues and biochemical mechanisms in the lung. In addition, infants and children may be at greater risk from airborne carcinogens (such as some groups of particulate matter) than adults: there is some evidence that carcinogens have a greater effect on rapidly growing tissues than on mature tissues. Children exposed to carcinogens also have a longer expected life span over which carcinogenic action may occur.

* Children's pulmonary defense systems are immature, so that their lungs are less able to remove or neutralize contaminants (such as bacteria, particles, and other foreign matter) than adults' lungs are. Children also experience frequent respiratory infections -- an average of eight a year. Polluted air exacerbates the problems of frequent infection in several ways:

- 1) Exposure to air pollution, especially to ozone and particulate matter, has been shown to increase children's susceptibility to infection.

- 2) Exposure to ozone, nitrogen dioxide, and particulate matter can impair the respiratory immune and clearance mechanisms.

- 3) The irritating properties of pollutants can inflame the airways. Research implies that chronic exposure to ozone causes chronic airway inflammation and enlargement and excessive formation of cells without cilia in the airway lining.

In turn, infection and the inflammation and mucus secretion that can take place during infection render the lungs more susceptible to air pollution by hindering the removal of particulate matter from the lungs. Thus, air pollution exposure exacerbates infection, and infection exacerbates the response to air pollution.

* Children's airways are smaller than adults', so that they are more easily obstructed during infection, inflammation, or muscle constriction. They are also likely to trap more particles than adults' airways. One researcher estimates that children's airways may trap 60 percent of particles entering the lungs, versus 40 percent for adults.

* There are several additional structural immaturities that make children's lungs more delicate than those of adults. Inflammation and infection that might create mild symptoms in an adult can therefore be more serious in a child, and air pollution can be an additional burden for a child with respiratory problems.

1) Early in life, the air sacs are fewer, so that there is less "reserve volume" from which to supply oxygen demand.

2) In adults, gas is able to move directly from one air sac to another through holes in the sacs and channels between the small airways and the sacs -- so that gases can be distributed deep in the lung, circumventing obstructed areas. Infants and young children do not have enough of these pathways to allow for this restorative air drift.

3) Infants and small children have relatively less reserve surface area in their lungs available for times of stress or increased metabolic demand.

4) The rib cage, chest wall, and chest muscles are immature at birth: full development may not occur until 16 years of age. An infant's chest wall has less structural resistance than an adult's and can cave in more easily during labored or obstructed breathing, causing lung collapse. (This is relevant to general respiratory vulnerability, but not generally a concern with air pollution exposure.)

Children At Greatest Risk

* Polluted air is an additional burden on the sensitized respiratory systems of allergic and asthmatic children.

* Up to 25 percent of the otherwise healthy population (both children and adults) may be hyper-responsive to ozone exposure (without necessarily exhibiting any outward symptoms).

* The lungs of newborns and infants are less developed and often lack the mature immune system defenses found in older children. Although there is little information about the age at which children are at highest risk from low-level air pollution, the youngest children are known to be at greatest risk from cigarette smoke. As infants' vulnerability is offset by their relative immobility, or low exertion rates, and the small amount of time they spend outdoors, preschool children may be at greatest risk.

* The health of poor children may already be compromised by conditions such as lack of adequate medical attention, undernourishment or malnourishment, or crowded or unsanitary living conditions.

* Other children at increased risk include those frequently exposed to sources of contaminants such as industrial pollution sources, areas of heavy traffic, and cigarette smoke.

III. WITH EVERY BREATH THEY TAKE: THE HEALTH IMPACTS OF AIR POLLUTION ON CHILDREN

Scope of the Review

In preparing this report, NRDC focussed on pollutants that are both problematic in Southern California and most likely to cause long-term health effects -- the effects with the greatest potential impact on the future well-being of children growing up with pollution. The studies reviewed examine the health effects of ozone, particulates, nitrogen dioxide, and sulfur dioxide, particularly those bearing most directly on long-term health damage. In most cases, little laboratory research has been done specifically on risks to children. NRDC believes that our survey of children's vulnerability, together with the evidence from research that does exist on children's health risks, shows that children may be disproportionately affected by many if not all of the health impacts described. Additional research is urgently needed to refine medical understanding of -- and ultimately to prevent -- the health risks to children.

Cellular Damage

* Even short-term exposure to low levels of pollutants can cause marked changes and damage in the lung at the cellular level. Furthermore, evidence suggests that if the exposure is prolonged and repeated, the damage is progressive and cumulative, and may not be reversible.

1) Sulfur compounds can interfere with the lungs' mucociliary clearance system. Ozone may hinder the immune system's ability to defend against infection. This effect has been found in laboratory animals at levels below the federal ozone standard.

2) Ozone exposure is connected with inflammation of the airways -- an indication of injury to these tissues -- that persists for many hours or days after exposure ceases. This effect has been seen in humans at levels below the federal standard. Exposure to acidic aerosols may aggravate the effect.

3) Sulfur compounds and ozone (even at low levels) make the airways more sensitive to other agents that cause bronchial constriction (as in asthma).

4) Even short-term ozone exposure increases lung cell permeability. This effect may hinder the body's ability to regulate the movement of gases and liquids between the lungs and the bloodstream, potentially facilitating the body's uptake of inhaled toxic substances and perhaps promoting enhanced allergic sensitization.

Reduced Lung Function

* Even brief exposure to levels of ozone *below the federal standard* can induce temporary but significant impairment in lung function (the lungs' ability to inhale and exhale an adequate volume of air). Prolonged exposure can cause impairments that persist for many hours or days. Similar, although less comprehensive, effects are observed from exposure to sulfur dioxide and other sulfur compounds. Chronic exposure to pollutant mixtures such as of sulfur oxides, particulates, and ozone may cause chronic impairment of children's lung function. (Lung function impairment is often a consideration in setting air pollution health standards. It is also significant because it may be a sign of invisible, sub-clinical damage inside lungs, and because people with severe asthma or other lung disease may not be able to tolerate additional lung function impairments).

Increased Susceptibility to Respiratory Illness

Respiratory illness such as bronchitis

* Several epidemiological studies, mostly of pollutants in combination and most involving particles, found a significant correlation between exposure to air pollution and the frequency of respiratory symptoms, ranging from chest colds to hospital admission for bronchitis, pneumonia, and emphysema.

* Ozone, particles, sulfur dioxide, and nitrogen dioxide, either independently or in combination, are linked to increases in respiratory disease at *levels below federal health standards*.

* The effect on children, as measured by hospital admissions, is greater than the effect on adults.

* There is some evidence that this effect, for extended exposure to particle pollution, may be cumulative.

Effects on asthmatics

* There has been a dramatic upsurge in asthma during the past twenty years that cannot be completely explained by improvements in disease tracking, diagnosis, treatment, and access to health care. In addition, more people are being hospitalized for asthma and more people are dying as a result of asthma attacks. These trends are most pronounced among children under fifteen. While there is disagreement in the medical community as to whether air pollution is a factor in the upsurge in asthma cases, numerous studies show links between attacks (and/or clinic and hospital admissions for asthma) and air pollution levels. Air pollutants may trigger the asthmatic response directly or may increase sensitivity to allergens.

* A variety of pollutants are implicated in these studies -- ozone, acidic aerosols, nitrogen oxides, sulfur dioxide, and particles. Ozone and nitrogen oxide at levels at or below the federal standards have been associated with increased emergency visits and hospitalizations of children for asthma attacks.

Higher mortality rates

* Elevated death rates have been found at concentrations of particulate matter that are well below federal health standards; death rates start to inch upward when particles reach levels as low as a third of the current standard.

* One study also found small, but significant, associations between daily mortality and three separate environmental factors: automobile emissions (such as carbon monoxide and nitrogen dioxide), photochemical oxidants such as ozone, and temperature.

Long-term effects of chronic exposure

* Studies of laboratory animals suggest that, with long-term ozone exposure, damage to lung cells can accumulate and develop into structural changes. Among the effects observed are progressive changes in respiratory function, increase in airway responsiveness, progressive respiratory symptoms, and chronic inflammation with healing by fibrosis (a type of scarring that stiffens the lung and may make it less capable of efficient gas exchange).

* One study found that laboratory animals intermittently exposed to ozone developed greater biochemical and physiological changes than animals that breathed ozone continuously. Some epidemiological research also suggest that multi-day, episodic ozone levels may cause cell death and inflammatory reactions in humans. The implication is that there is little scientific basis for the current ozone federal health standard with an averaging

time of only one hour.

* There are three major concerns identified in the medical literature as possible effects of the long-term lung damage induced by chronic exposure to pollution:

1) Stunted growth of lung capacity in children. One study found that residents of a more polluted area in the Los Angeles Air Basin had substantially worse lung function when they were initially tested, and showed significantly more rapid deterioration of lung function over time, than residents of a less polluted area. Children appeared to experience less rapid growth of lung function, while adults showed a greater rate of deterioration.

2) Accelerated aging of the lungs. The aging process in the lung, which occurs naturally throughout adulthood, is marked by increased deposits of collagen that may stiffen the lung and impair its efficiency. Ozone is strongly implicated as a cause of premature aging of the lung. Tissue changes seen in laboratory animals include death of ciliated cells; reduced ability to remove foreign material; inflammation; biochemical changes that suggest damage to tissues; and stiffening of to lung and/or increased collagen production.

3) Chronic lung disease. Chronic exposure to pollution may raise the risk of developing chronic lung disease later in life. Chronic bronchitis, airway obstructive disease, and asthma cases have been associated in some research with high levels of particles. An autopsy study of fourteen to twenty-five-year-old accident victims in Southern California showed evidence of chronic damage and disease. Researchers stated that their subjects "had lungs of older people," and believed air pollution was one of the factors. (However, this study is far from conclusive due to other factors such as the likelihood that many of the subjects were cigarette smokers.)

IV. PARADISE LOST: AIR POLLUTION IN THE CITY OF ANGELS

The South Coast Air Basin is home to 12.8 million people. They drive 8 million cars and operate more than 50,000 stationary point sources of pollutant emissions. A total of 9,000 tons of pollutants is added to the air each day.

Moreover, the Basin's topography and weather make it a constant and highly effective pollution trap. The ring of mountains surrounding the Basin impedes air flow. During the summers, an "inversion layer" collects and concentrates pollutants under a lid of hot air. The 270 days of full or partial sunshine every year create photochemical reactions that produce secondary chemical compounds such as ozone and particulates. During the "smog season" (May 1 to October 31), health standards may be

violated almost every day for several months. Topography and weather also act to spread the pollution over a wide area.

Overview of air quality in Los Angeles

Of the six pollutants for which EPA has set health standards, the South Coast Air Basin meets only those for sulfur dioxide and lead. The Basin routinely violates the federal standards for the other four pollutants; ozone, particulates, nitrogen dioxide, and carbon monoxide. (Los Angeles was the only area that failed to meet the federal nitrogen dioxide standard in 1991, although it has met the standard more recently.) In 1990, the health standard for one or more of these pollutants was violated 175 days at one or more locations in the Air Basin. The Basin also routinely registers the highest pollutant levels in the country.

Smog alerts and health advisories: air too dirty to breathe

Regional health officials have devised an air pollution emergency response system. A "health advisory" is triggered for ozone when pollutant levels reach 0.15 ppm, a "Stage I ozone episode" at 0.20 ppm, and a "Stage II ozone episode" at 0.35 ppm. (The federal standard is 0.12 ppm.) During health advisories schoolchildren are required, and other sensitive individuals are encouraged, to curtail outdoor activity.

In 1989-1991, an average of 105 ozone health advisories and forty-seven Stage I episodes were called each year. These episodes are widespread and affect large populations. In 1989, all but one of the thirty-five monitoring sites in the Basin registered ozone levels high enough to trigger health advisories. In both 1990 and 1991, all but four monitoring sites in the Basin registered ozone health advisory levels. There are also occasional "episodes" of carbon monoxide and nitrogen dioxide pollution in the South Coast Basin.

Averaging angels: the war on Los Angeles air pollution

As bad as the air in Southern California is, it is not beyond the reach of federal and state pollution control program to remedy. The pollution control strategies required by state and federal law and implemented by regulatory agencies have had significant successes, in spite of the growth in pollution. However, restoring healthful air to the Basin will require redoubled efforts and greater emissions reductions than have every been achieved in the past.

Historical trends

Ozone. Ozone has been the most difficult pollutant to control. However, the number of days violating federal standards has decreased significantly in the past three decades. In 1960, the worst ozone location in the Basin had 221 days exceeding the

federal standard; in 1990, the worst location had 84 days. The number of violations in the Basin has declined by 32 percent over approximately 1979 and 1988, compared to an average of 10 percent for the nation as a whole.

Particles. PM₁₀ is the one pollutant for which there has been no significant improvement in the Air Basin. There has been a 51 percent increase in PM₁₀ emissions between 1975 and 1990, including a 14 percent increase between 1985 and 1990.

Nitrogen dioxide. The average frequency of federal violations dropped 78 percent between 1980-82 and 1988-90. The average number of days violating the state one-hour standard dropped from nineteen in the mid-1970s to two in 1990. In 1992, Los Angeles had no violations of the federal standard. The average annual concentration has been slower to improve, dropping only 13 percent between 1980 and 1990. However, the average for nonattainment areas nationwide has improved only 7 percent in the same period.

Carbon monoxide. Both the South Coast region and the nation as a whole have made impressive strides in controlling carbon monoxide levels. In the Basin, violations of both the state and federal standards fell 90 percent between 1976 and 1990. This is consistent with the 88 percent average national decline in violations from 1979-1988.

Sulfur dioxide and lead. Concentrations of these pollutants in the South Coast Basin now meet both federal and state health standards.

Future prospects. By 2010 the basin's population will be 23 percent higher than it is today. The expected 3 million new residents will generate thousands of new sources of pollution. The number of miles traveled by automobile is expected to increase by 65 percent over the next two decades, completely overshadowing anticipated improvements in automobile pollution control systems. At the same time, emissions must be reduced substantially below current levels for the Basin to meet federal air quality standards. Hydrocarbon emissions will have to be reduced by 83 percent. Nitrogen dioxide must be reduced to 65 percent of what is today. Carbon monoxide must be reduced by 29 percent, PM₁₀ by 44 percent.

At a minimum, the required emissions reductions will demand full implementation of all pollution control measures in the region's current Air Plan. Moreover, future emissions reductions must come from parts of the economy that have been the most resistant to controls -- the transportation and land-use sectors.

V. RECOMMENDATIONS FOR CLEANING UP AIR POLLUTION

More aggressive clean air strategies

Better air pollution control programs

NRDC has identified eight areas in particular where California air quality programs must be strengthened:

- 1) The Air Resources Board and the California Legislature must renew and reemphasize their commitment to the rapid commercialization of a zero-emissions automobile fleet. Investors, California businesses and automakers must be left in no doubt that California intends to move forward on schedule with the ZEV mandates.
- 2) California must move quickly to implement cost-effective measures to clean up the existing non-automobile vehicle fleet. Diesel buses, trucks, construction and farm equipment, and marine engines are extremely important sources of NOx and particulates. However, they are woefully under-regulated. The Air Resources Board should institute a much more rigorous emissions standard which would promote the development of advanced engines and the wider use of cleaner-burning fuels by these sources.
- 3) Critical technical and institutional problems in state cleanup programs must be solved; for instance, emissions accounting must be improved and air quality officials must be given the scope of authority for coordinated regional plans of action.
- 4) The State Implementation Plan must provide for accurate monitoring and evaluation of individual programs and cumulative progress, and for strict legal accountability.
- 5) The State Implementation Plan must include measures, such as land-use controls and controls on pollution from smaller sources, that are technically and economically feasible but have typically been excluded because they are politically difficult.
- 6) Other states and EPA must join California in promoting cleaner vehicles, including promoting alternative-fueled and electric vehicles through technology-forcing requirements and incentives.
- 7) California must strengthen its strategies for controlling transportation emissions and reducing automobile travel. These should include providing alternatives to automobile travel, creating incentives for drivers to use their cars less, and following more compact "smart growth" land-use patterns that are conducive to alternative transportation systems.
- 8) California must secure more reductions in emissions from industry, businesses, and other stationary sources -- including consumer products and smaller businesses, which have not been

successfully regulated hitherto.

Better public education

Regulators and policymakers must expand and enhance current public education and involvement programs to build a base of support for these improvements. The public must be informed of the quality of the air they are breathing, associated health risks, and the rationale and methods behind pollutant control programs.

Targeting communities with the greatest needs

Communities of color often suffer disproportionately from air pollution; the same is true of lower-income communities. Air quality officials must investigate local variations in risk from air pollution, so that those who are at particular risk can know what hazards they face, and so that implementation plans can target communities most at risk.

Better health standards

* Air quality standards are critical because they are the moving force behind federal, state, and local pollution control programs. Standards determine which areas are subject to clean air regulation. Moreover, the degree to which a region falls short of air quality standards determines the schedule and aggressiveness of the pollution reduction efforts it must undertake.

* The California Clean Air Act requires the Air Resources Board to establish pollutant standards based on health considerations. To do so, the agency must find the lowest exposure level that causes adverse health effects in the most susceptible segments of the population, and set the standard so as to prevent these effects. The standards must also provide an "adequate margin of safety" for all populations against suspected health impacts.

Recommendations

* NRDC believes that the criteria used by both California and federal air quality regulators do not account for three important factors discussed in this report: repeated and chronic exposures, exposure to combinations of pollutants, and the need for an adequate margin of safety. Regulators must speed research to expand on what is known about these problems at present. Based on this research, they must change their fundamental assumptions and criteria for setting health standards.

* In addition to these general criticisms, NRDC has five specific recommendations for improving state and federal health standards for individual pollutants:

- 1) Tighten the federal ozone standard.

- 2) Establish both a federal and California long-term ozone standard.
- 3) Strengthen the federal particulate standards.
- 4) Refine both the federal and California particulate standards so that they offer adequate protection against the most dangerous particles.
- 5) Strengthen the federal standards for nitrogen dioxide and sulfur dioxide.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
AIR AND RADIATION

Assemblyman Richard Katz
Chairman
Assembly Transportation Committee
State Capitol, Room 4202
Sacramento, California 95814

Dear Assemblyman Katz:

Thank you for the opportunity to comment at the special hearing of the Assembly Transportation Committee on California's low emission and zero emission vehicle (LEV/ZEV) mandate.

The U.S. Environmental Protection Agency (EPA) supports California's efforts to achieve significant mobile source reductions through enacting ambitious LEV/ZEV standards. With emissions from mobile sources accounting for a large and ever-increasing proportion of the total emissions inventory in California's dirtiest air basins, the state's adoption of stringent technology-forcing standards for new vehicles is critical in maintaining the growth potential of the state's manufacturing base.

Today Administrator Carol Browner will be signing the proposed Federal Implementation Plan for the Sacramento, Ventura and South Coast air basins. Implementation of the LEV/ZEV program is an important baseline assumption in the proposal and an essential element in the federal attainment strategy. As a result, every ton of emissions not reduced through the LEV/ZEV program will have to be obtained from the implementation of further controls on stationary sources and potentially from other more intrusive mobile source measures such as restrictions on driving.

California's leadership in the clean vehicles program has spurred other states to pursue similar strategies. Recently a federal appeals court upheld the state of New York's right to adopt California's LEV/ZEV program. EPA supported New York's efforts to fight off an auto industry challenge by filing an amicus brief in this case. The ruling added momentum to efforts by other Northeast states to petition the EPA to mandate California's program. On February 1, the Ozone Transport Commission (OTC), a group of states from Maine to Virginia, approved a petition requesting EPA to review the necessity of adopting the LEV/ZEV mandate in order to achieve attainment in



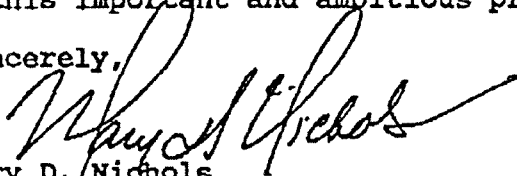
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the region. EPA is committed to reviewing the OTC petition through an open, expeditious, and comprehensive process.

The OTC petition opens the potential for an expanded market for the "California Car" and enormous opportunities for the over 100 California companies already dedicated to pursuing electric vehicle technologies. LEV/ZEV represents another instance of the significant economic benefits associated with California's strong environmental commitment. According to the California Council on Science and Technology, over 70,000 Americans will be employed in direct manufacturing jobs in electric vehicle industries. The Council projects that the state's edge in this emerging technological market will translate into 10,000 new jobs by the year 2000 and 70,000 new jobs by 2010, including direct manufacturing and assembly, and indirect construction, deployment, and service jobs.

The EPA is strongly supportive of California's LEV/ZEV program not only because of the dramatic air quality improvements it will achieve, but also for the dynamic economic opportunities it holds for the state. EPA remains committed to assisting California in implementing this important and ambitious program.

Sincerely,



Mary D. Nichols
Assistant Administrator
for Air and Radiation



NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT (NESCAUM)

MEMBERS

CONNECTICUT BUREAU OF AIR MANAGEMENT
MAINE BUREAU OF AIR QUALITY CONTROL
MASSACHUSETTS DIVISION OF AIR QUALITY CONTROL
NEW HAMPSHIRE AIR RESOURCES DIVISION

NEW JERSEY OFFICE OF ENERGY
NEW YORK DIVISION OF AIR RESOURCES
RHODE ISLAND DIVISION OF AIR AND HAZARDOUS MATERIALS
VERMONT AIR POLLUTION CONTROL DIVISION

February 14, 1994

Assemblyman Richard Katz
State Capitol, Room 3146
Sacramento, CA 95814

Dear Mr. Katz:

The Northeast States for Coordinated Air Use Management, NESCAUM, is a regional organization with the objective of assisting the eight northeast states with the development of effective, economically sound, air pollution control strategies that will meet their clean air goals. NESCAUM has been involved with evaluating the benefit and costs associated with the California motor vehicle emission control program since 1987. Since the fall of 1990 NESCAUM has provided its member states with extensive technical and analytical support in their efforts to adopt California's low emission vehicle (LEV) program.

As you may know under the auspices of the Northeast Ozone Transport Commission (OTC) the twelve states and the District of Columbia voted on February 1, 1994 to follow California's lead and issued a formal recommendation to the US EPA to ensure that a LEV program, including zero emission vehicles (ZEVs), is implemented throughout the northeast and mid-Atlantic region beginning with the 1999 model year. Prior to the OTC action New York and Massachusetts had adopted regulations requiring California certified low emission vehicles beginning with the 1995 model year. The OTC recommendation does not interfere with New York's and Massachusetts' plans to implement the LEV program earlier than the other OTC states. Both the New York and Massachusetts programs include a 1998 ZEV mandate identical to the ZEV mandate adopted by the California Air Resources Board. It is important to point out that the economic development opportunities and air equality benefits associated with ZEVs was a key factor in the minds of a number of Governors who voted in favor of OTC's LEV recommendation.

The automobile and petroleum industries have waged very aggressive lobbying and legal campaigns with the intention of undercutting state efforts to adopt LEV legislation and regulations. As evidenced by the OTC vote on February 1, 1994 the industry's comprehensive misinformation campaign was not successful. On the legislation front the automobile industry has also been unsuccessful in their challenges to both the New York and Massachusetts LEV programs. On February 9, 1994 the US Court of Appeals upheld New York's right to adopt California's LEV program including the mandate for ZEVs. In November 1993 the Federal District Court in Boston rejected, on all counts, the auto industry's request for an injunction against Massachusetts' LEV program.

In the northeast, the opposition has tried to use various means to show that the LEV program, including ZEV, will adversely impact the economic health of the region. One of the most frequently used arguments against the LEV program presented at legislative hearings throughout the Northeast has been a portion of the results of a study commissioned by the American Petroleum Institute (API) from DRI/McGraw-Hill (DRI). This study, *Assessing the Economic Effects of Eastern States Adopting California's Low Emission Vehicle Program* is presented as an assessment

of the "...economic ramifications of adopting the California LEV program and using reformulated gasoline on the New York economy as well as other east and mid-Atlantic states" (ES-i).

The results of the API study fail to fulfill this goal for a number of reasons: 1) the results quoted from the study are those which are based upon the highest industry cost estimates; 2) the study design fails to include an assessment of the LEV program alone; 3) the results are presented without the necessary context of information on the costs of implementing alternative control strategies that would achieve emission reductions equivalent to the LEV program; 4) the results are presented without the necessary context of information on the costs of not implementing the LEV program, thereby failing to meet the requirements of the CAA and becoming subject to the non-discretionary imposition of punitive federal sanctions including a revocation of federal highway money and a virtual ban on industrial growth; and 5) the report fails to acknowledge, even qualitatively, the potential positive economic and public health effects of the LEV program.

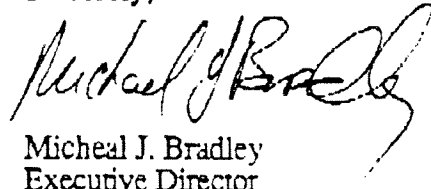
The study's omission of the potential benefits of the LEV program results in a failure to include positive economic effects such as improved crop yield, increased tourism, increased worker productivity, decreased mortality, decreased morbidity and improved visibility. A study by ICF Resources, Inc. and Smith Barney, released in January of 1992, estimates that four segments of the air pollution control industry will experience a cumulative revenue increase of \$50 to \$70 billion from 1992 to 2000 (ES-8). Mobile source-related industry alone is projected to grow by \$9-13 billion by the year 2000. This estimation is supported by the fact that the regional market response to the ZEV component of the LEV program has resulted in over 100 northeast companies initiating efforts to compete in ZEV-related business.

It is important to remember that one of the most compelling arguments in support of LEV is its cost effectiveness. The crux of the conclusion of the API report is that these changes will result in job losses, lowered personal income, and lower wages and salaries for the region. A gross oversight of the report is the omission of the fact that all the alternatives available for complying with federal law (including the "no action" alternative) will be more expensive: they will result in higher losses for jobs, income and wages. As a result, NESCAUM believes that the API study is severely hampered in its ability to inform public policy.

The NESCAUM states believe, based upon this and other studies, that the LEV program represents one of the most cost-effective compliance strategies available to the Northeast. The ZEV component of the program will deliver long term air quality benefits and is fostering rapid technological advancements by both large and small companies. Interest in electric vehicles here in the northeast has grown enormously over the past two years as electric vehicle demonstration programs have been launched in each of the northeast states. A strong commitment to ensuring that electric vehicles emerge in the marketplace during this decade is jointly shared by the northeast state governments, private industry, and environmental advocates.

We continue to depend on California's national leadership in promoting tough clean air standards that also make practical economic sense. Please call me if you have any questions.

Sincerely,



Micheal J. Bradley
Executive Director

TESTIMONY PRESENTED TO:
THE ASSEMBLY COMMITTEE ON TRANSPORTATION
HEARING ON THE CLEAN CAR AND CLEAN FUEL ELEMENTS OF CALIFORNIA'S
MOBILE SOURCE EMISSIONS REDUCTION PLAN

PRESENTED BY:
JOHN C. COX, COUNCILMEMBER, CITY OF NEWPORT BEACH, CA
MEMBER, SCAG REGIONAL COUNCIL
CHAIRMAN, SCAG TRANSPORTATION AND
COMMUNICATION COMMITTEE
CO-CHAIR, SCAG/SCAQMD TCM POLICY COMMITTEE
CHAIRMAN, SCAG ADVANCED TRANSPORTATION TECHNOLOGY TASK FORCE

February 14, 1994, 1:30 PM

Sacramento, CA

Chairman and Committee members, my name is John Cox. I am a council member from the City of Newport Beach, a member of the SCAG Regional Council, Chairman of SCAG's Transportation and Communications Committee, Co-Chair of the SCAG and South Coast Air Quality Management District Transportation Control Measure (TCM) Policy Committee, and Chairman of SCAG's Advanced Transportation Technology Task Force.

SCAG is the regional council of governments serving 6 counties, 185 cities, and 15 million people in Southern California. The South Coast Air Basin, within our region, is the only area of the country classified as an *extreme* ozone non-attainment area under the federal Clean Air Act. Our region's four air quality districts and the California Air Resource Board (CARB) have aggressive plans underway to meet federal and state clean air requirements. In 1993, SCAG established an Advanced Transportation Technologies Task Force to help guide the development of new technologies in the context of our proposed Regional Comprehensive Plan, with special attention to improving mobility and air quality. California's Low Emission Vehicle (LEV) program, with its Zero Emission Vehicle (ZEV) mandates, is already an indispensable part of our region's adopted air quality, mobility, and economic revitalization plans.

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WHY AM I HERE TO TESTIFY?

As you begin to consider implementation of the ZEV and reformulated gasoline (RFG) standards in California's Mobile Source Emissions Reduction Plan, I believe it is important for your Committee to be aware of the *economic* and *environmental* reasons why SCAG continues to support the ZEV mandates. Based on work done for Project California and SCAG's own Advanced Transportation technology Task Force (ATTF), we strongly believe that the ZEV mandates are crucial both for cleaning our air and for rebuilding our economy.

ENVIRONMENTAL REASONS FOR OUR POSITION

Recent studies clearly show that today's automobile fleet is much more polluting than was previously suspected. This reinforces the need to continue the mandates for zero emission and ultra-low emission vehicles. At a time when the ability of previously identified transportation control measures to achieve our mobile source reduction goals is being painstakingly reassessed, it would be folly indeed to back away from the ZEV and ULEV mandates which are one cornerstone of the AQMP for the South Coast Air Basin.

In a report done for the California Council on Science and Technology's *Project California*, technical experts concluded that ZEV's do have commercial potential *as long as CARB maintains its regulatory mandate*. According to the report, "if the automobile industry is required to produce ZEV's, we believe the technology will progress rapidly and that the price differential for ZEV's will decline to a point where it will not be a significant barrier to meeting market penetration objectives."

ECONOMIC REASONS FOR OUR POSITION

More recently, a memorandum prepared for the SCAG ATTF states that:

"ZEV's are the single greatest hope for smog choked areas such as Los Angeles. ZEV's can have an equally large impact on the California economy and job base. Thousands of jobs will be created in research, development, manufacturing, sales, service, construction and deployment. Employment will be created for engineers, construction workers, sales people, mechanics, scientists, and a hundred other vocations."

We couldn't agree more. Indeed, California's regulations are spurring the rapid development of the electric vehicle industry. California is already home to hundreds of businesses dedicated to ZEV technologies. Companies are developing every conceivable ZEV product - from advanced batteries and aluminum frames to DC/AC converters and regenerative braking systems. As California struggles to emerge from the prolonged economic downturn, one of the key opportunities lies in the manufacture of super-clean vehicles. Any backing down from California's clean vehicle mandates would deal a crippling blow to promising entrepreneurial activities such as Cal-Start. Moreover, such a decision would eliminate a golden defense-conversion opportunity at a time when all our energies should be focused on helping the State's aerospace and defense workers find new, meaningful, and financially rewarding jobs.

Moreover, pollution reductions have to come from somewhere. Any elimination of the ZEV mandates will concomitantly impact our ability to achieve reductions from mobile sources,

which in turn would result in increased **emission** reduction requirements on businesses in the South Coast Air Basin. This is **hardly** consistent with recent State attempts to convey the message to the business **community** that California is "business friendly." Indeed, given the alternatives, the ZEV **mandates** may be the most "business friendly" thing we can do to achieve our clean air goals.

LOCAL LEADERSHIP NEEDED TO SUPPORT ZEV DEVELOPMENT AND DEPLOYMENT

In Southern California we are taking an **aggressive** stance in promoting the electric vehicle as a major contributor to meeting **air quality** requirements. The South Coast AQMD has set an interim market penetration **goal** of 200,000 EVs by the year 2000. The District's 1991 Air Quality Management **Plan**, which SCAG helped to formulate, has projected that 17 percent of the passenger **car** vehicle miles travelled (VMT) in the year 2010 will be in EVs and 33 percent in alternative fueled vehicles (AFVs), including ethanol, liquefied petroleum gas, methanol and natural gas.

SCAG is working with local governments and the private sector, including the public utilities, to assure that the necessary **infrastructure** is in place to meet the forecasted demand for EVs and AFVs. We encourage your Committee to join us in this effort.

SCAG's Advanced Transportation Technology Task Force is developing marketing strategies for the electric vehicle and for other **clean** fuel technologies. We are also looking at ways to accelerate deployment of these **technologies**. We know that it is hard to get people out of their cars - they cherish their mobility. Rather than focusing on restrictive behavioral change strategies, which unduly burden the driving public and the business community, we see the short and long term solutions lying in new technology measures, like the electric vehicle.

STATE LEADERSHIP NEEDED TO SUPPORT ZEV DEVELOPMENT AND DEPLOYMENT

Given the fragile state of our economy and the urgent need to achieve clean air goals, there couldn't be a worse time for the State of California to abandon its leadership role on auto emission standards. Such an **action** would be bad for the environment, it would be bad for the **economy**, and it would be bad for the people of California. It would be a misguided action taken at the **wrong** time for the wrong reasons. In the strongest possible terms, SCAG urges the California Legislature and the California Air Resources Board to stand fast, and to work with us to both clean the air and to help rebuild our economy.

SCAG recognizes the importance of the auto industry - government partnership for ensuring the successful market penetration of ZEV's and for achieving the associated air quality and economic benefits. We remain hopeful that the Big 3 will join with us in this historically crucial effort.

SCAG CONTACTS: Nona Edelen, 213-236-1870; Richard Spicer, 213-236-1887.

dhc:me:scag:katztest



Comments Regarding Clean Fuels and Electric Vehicles Western States Petroleum Association

California's refining industry is well along in the process of making clean gasolines a reality in the marketplace. In addition, WSPA's refiners and marketers are working with ARB, auto makers, and others to do the best they can to identify and avoid the implementation problems experienced with the recent diesel regulation.

According to industry and ARB estimates, the cost of meeting California's clean gasoline regulations will increase the cost of refining gasoline from 14 to 17 cents a gallon and cost refiners 5 to 7 billion dollars to produce clean gasolines between now and 1996.

Low- and ultra-low emission vehicles running on clean gasolines are rapidly becoming a reality. It is hard to understand the support by many public policy makers for market mandates for the much less cost effective electric vehicles (EVs), and hundreds of millions of dollars of subsidies for EVs and alternative fueled vehicles paid for by ratepayers, taxpayers, and vehicle owners.

Examples of these include over \$800 million worth of current state and federal tax expenditures, credits, and other subsidies for alternative fuels and alternative fuel vehicles in California:

- \$260 million direct monetary incentives.
- \$250 million R&D and infrastructure.
- \$291 million regulatory, demonstration, and vehicle conversion programs.

WSPA members are justifiably concerned. The huge refinery capital investments required to produce cleaner gasolines are jeopardized by public policies that give large taxpayer- and ratepayer-funded incentives and other preferential treatment, including government mandates, to uneconomic alternatives. Further, taxpayers and ratepayers are asked to shoulder these additional burdens during tough economic times.

A recent study by DRI/McGraw Hill, confirms that California low emission vehicles operating on clean gasolines are three-to-ten times more cost effective than EV mandates and alternate fuel vehicle subsidies.

ARB's current low-emission vehicle/clean fuels program will reduce hydrocarbon, carbon monoxide, and NOx emissions below 1991 vehicle emission standards by 90,

75, and 50 percent, respectively. At the national level, the auto makers are working with the Administration to develop a high-mileage, low emission "supercar."

While we support the need for research and development of new technologies, we seriously question government-required programs that force consumers to spend hundreds of millions of dollars on transitional and uneconomic technologies that can only be sustained as long as the subsidy exists. If these programs are worthwhile, the utilities should be willing to compete in the marketplace and spend shareholder money.

The CPUC is entertaining applications by the four large investor-owned utilities for \$600 million of ratepayer subsidies for alternative fuels and electric vehicles, of which only nine percent is for research and development. For example, Southern California Edison is applying for over \$190 million (in 1992 dollars) over the 1995-2000 period in ratepayer-supported EV programs that include:

- \$69 million to buy batteries for EV owners.
- \$63 million for customer EV recharging facilities and other EV infrastructure.
- \$11 million in staff overhead.
- \$10 million to purchase EVs for Edison's fleet.

PG&E and San Diego Gas and Electric Company are also proposing battery incentive and EV infrastructure programs amounting to an additional \$61 million and \$30 million, respectively. Not only are the large, investor-owned utilities proposing to become the beneficiaries of tens of millions of dollars of ratepayer subsidies, these programs:

- Force ratepayers to subsidize utility company profits, since the costs of these programs would be put into the rate base. No shareholder money is at risk.
- Go well beyond research and development. They give an unfair advantage in the marketplace to utility monopolies at the expense of companies who provide competing products, and who are utility ratepayers themselves.
- Duplicate each other, diminishing the breadth and creativity of the research.
- Subsidize battery technologies, which increasing numbers of experts suggest is, at best, a transitional technology that may not be acceptable to consumers in the long run, and may pose environmental problems if not recycled or disposed of properly.
- Relocate emissions to the source of electrical generation.

WSPA is opposed to the use of ratepayer money as subsidies. But if they are necessary:

- 1) The use of ratepayer money should be capped at \$15 million per year, used only for research, development, and demonstration in government- or utility-owned fleets, and not used for infrastructure development or market intervention;
- 2) Expenditures should be matched dollar-for-dollar with investor or shareholder money;
- 3) Programs should not duplicate either federal or state taxpayer funded programs or those of other utilities; and
- 4) The benefits should be available to all-comers, utility and private investors, large and small, by competitive bid.

In closing, California is making a huge investment in low emission vehicles and cleaner gasoline. It is a course of action that will lead to significant advances in air quality. Importantly, the state has pursued policies that are consistent with free market economics. Capturing the energy of the marketplace is the way to encourage private-sector innovation to achieve important public goals. This has been the time-tested method for effective progress.

California's problem is not that we are faced with industry resistance to new technologies. Rather we lack the technological breakthrough in achieving electric powered vehicles that are economic and acceptable to the consumer. No amount of government mandates and hidden subsidies will alter that reality.

February 11, 1994



Testimony of Bill Campbell
President, California Manufacturers Association
Assembly Transportation Hearing
February 14, 1994

Thank you for the opportunity to testify today. First, let me say that we agree that electric vehicles are a promising new technology, and that research and development of the electric car, as well as vehicles using compressed natural gas, should be encouraged.

The debate over clean-fueled vehicles has many dimensions. Today, however, I will be addressing only one narrow segment of the issue - that of ratepayer subsidies for clean fuel technologies.

We are aware that there are proceedings currently before the California Public Utilities Commission investigating the request of four of the state's investor-owned utilities to invest more than \$600 million of ratepayer money, to finance compressed natural gas and electric vehicle projects.

The California Manufacturers Association has represented California industry in such CPUC proceedings for nearly 40 years, to ensure that utility rates paid by manufacturers are just, reasonable and reflect the utilities' cost to serve each class of ratepayer. After a long struggle, the CPUC has gradually moved to adopt cost-of-service rates for all ratepayers of the electric and gas utilities. However, the resulting rates are still extremely high,

leaving California manufacturers in a position of competitive disadvantage with other manufacturers across the country.

A recent report issued by Merrill Lynch on U.S. investor owned utilities tells the story. The system average rate for Pacific Gas & Electric is calculated at 10.28¢ per kilowatt hour; for Southern California Edison, the rate is 10.41¢/kwh; and for San Diego Gas and Electric, the rate is 9.23¢/kwh. The national system average rate for the utilities surveyed is 6.6¢ per kilowatt hour. This is a striking difference, and one that results in a huge impact on a company for whom 1/10 of a cent can make a significant difference in the cost of producing a product.

We believe that if there is a promising business opportunity for utilities in the research, development, demonstration and dissemination of clean fuel technologies, that they should **be** encouraged to proceed, but at shareholder risk, not at ratepayer risk.

CMA has testified before the CPUC on a variety of social programs, including energy conservation investments, that ratepayer funding is inappropriate where the cost-benefit of that investment is too speculative or too long term to benefit existing ratepayers, who are already facing high utility rates. We believe that this principle also applies to clean-fuel technologies.

The members of the organization I represent - the California Manufacturers Association - will bear a particularly heavy portion of that burden. The machinery that is

employed in the manufacture of products consumes tremendous amounts of electric power and natural gas. Further, the products manufactured here must compete with other states where costs to produce are lower. To add more than half a billion dollars to that burden - at a time when we are seeking to retain and increase manufacturing opportunities, along with the employment opportunities that will entail, runs counter to the efforts that the state has underway to address some of the negative factors in our business climate.

In the last session, the legislature and the Governor made some significant progress in improving California's business climate. But increasing utility rate by \$600 million will seriously undermine our efforts to put Californians back to work. This legislature, and the California Public Utilities Commission, should reject this initiative, and instead encourage the utilities to invest shareholder money to fund such research efforts.



CALIFORNIA
MOTOR CAR DEALERS
ASSOCIATION

**NUMBER OF ELECTRIC VEHICLES REQUIRE
UNDER THE ZEV MANDATE TO BE CERTIFIED,
PRODUCED, AND DELIVERED FOR SALE IN CALIFORNIA**

(Based upon 1992 California vehicle registrations for passenger and light duty pickup trucks)

<u>Manufacturer</u>	<u>Total Units Sold</u>	<u>1998 (2%)</u>	<u>1999 (2%)</u>	<u>2000 (2%)</u>	<u>2001(5%)</u>	<u>2002 (5%)</u>	<u>2003 (10%)</u>
General Motors	330,000	6,600	6,600	6,600	16,500	16,500	33,000
Ford	320,000	6,400	6,400	6,400	16,000	16,000	32,000
Toyota	195,000	3,900	3,900	3,900	9,750	9,750	19,500
Chrysler	135,000	2,700	2,700	2,700	6,750	6,750	13,500
Honda	125,000	2,500	2,500	2,500	6,250	6,250	12,500
Nissan	90,000	1,800	1,800	1,800	4,500	4,500	9,000
Mazda	45,000	900	900	900	2,250	2,250	4,500
Subtotals:	1,240,000	24,800	24,800	24,000	62,000	62,000	124,000

* Based on the above numbers, the ZEV mandate would require a total of 322,400 electric vehicles to be sold from 1998 through 2003, and 124,000 per year for each year thereafter.

EV COMPARISON WITH INTERNAL-COMBUSTION-ENGINE VEHICLE

GM Impact	Geo Metro
<p>2 - seater Wheelbase - 95.0 in. Length - 163.0 in. Width - 68.2 in Height - 47.5 in. Curb Weight - 2900 lbs. (includes an 1100 lb. battery pack) Frame - 168 - piece alloy space frame. Engine - AC induction motor , 20,000 rpm. Range per Charge - 90 miles highway, 70 miles on federal driving cycle (Regenerative braking contributes some 20% to the range). Energy Source - 312-volt battery pack (26 12-volt lead acid batteries, plus one for the accessories). Charging Time - 2 to 3 hours from a 220-volt (30 amp) source; 8 to 10 hours from a 110-volt (15 amp) source; and, 10 -15 minutes from a 480-volt (100 amp) source. Battery Life - 20,000 to 30,000 miles depending upon how often it is recharged and maintained (replacement cost: \$1,500 to \$2,500) Price - \$25,000 (estimated).</p>	<p>4 - seater Wheelbase - 89.2 Length - 147.4 in. Width - 62.7 in. Height - 52.4 in. Curb Weight -1650 lbs. Engine - 4-cylinder, aluminum block, 52 horsepower. Range - 488/city & 530/hwy. per tank of gas (10.6 gallon gas tank - miles per gallon : 46/city - 49 hwy.) Energy Source - 86 octane gasoline. Refueling Time - 5 minutes. Price - \$7,695 (manufacturer's suggested retail price).</p>

1994
INTERNAL-COMBUSTION-ENGINE VEHICLES

<u>Passenger Vehicles</u>	<u>Number of Models</u>
Under \$10,000	30
\$10,000 - \$14,999	108
\$15,000 - \$19,999	99
\$20,000 - \$24,999	59
 <u>Mini Vans</u>	
\$15,000 - \$19,999	27
\$20,000 - \$24,999	14
 <u>Sport Utilities</u>	
\$10,000 - \$19,999	20
\$20,000 - \$24,999	21
 <u>Pickup Trucks</u>	
Under \$20,000	58

Total Number of Vehicle Models with Manufacturer's Suggested Retail Price of \$25,000 or Less: 436

Under \$10,000

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ³	Five-year costs		
									Mainten- ance ⁴	Repairs ⁵	Total ownership costs ⁶
Chevrolet Cavalier VL 2dr	\$8,970	\$8,477	\$8,731	86%	51%	23/33	No/No	Avg.	\$3,785	\$491	\$23,231
Chevrolet Cavalier VL 4dr	9,120	8,618	8,877	86	50	23/33	No/No	Avg.	3,785	491	22,952
Dodge Colt 2dr	9,319	8,900	9,167	86	61	32/40	Yes/No	Hi	3,428	491	20,096
Dodge Shadow 2dr hatch	8,806	8,263	8,511	85	52	26/33	Yes/No	Hi	3,657	599	21,712
Dodge Shadow 4dr hatch	9,206	8,631	8,890	85	51	26/33	Yes/No	Avg.	3,657	599	21,733
Eagle Summit DL 2dr	9,319	8,900	9,167	86	54	32/40	Yes/No	Hi	3,692	491	20,822
Ford Aspire 2dr hatch	8,240	7,578	7,805	89	56	34/40	Yes/Yes	N.A.	N.A.	N.A.	N.A.
Ford Aspire 4dr hatch	8,855	8,138	8,382	89	55	34/40	Yes/Yes	N.A.	N.A.	N.A.	N.A.
Ford Escort 2dr hatch	9,135	8,413	8,665	89	45	30/37	Yes/No	Hi	3,326	687	22,239
Ford Escort LX 2dr hatch	9,990	9,191	9,467	89	45	30/37	Yes/No	Hi	3,533	420	22,836
Geo Metro 2dr hatch	7,295	6,799	7,003	89	66	46/49	No/No	VHi	3,859	420	18,543
Geo Metro 4dr hatch	7,695	7,172	7,387	89	64	46/49	No/No	VHi	3,859	420	18,843
Honda Civic CX 2dr hatch	9,400	8,460	9,400	84	73	42/46	Yes/Yes	Hi	3,937	420	18,408
Hyundai Elantra 4dr	9,749	8,800	9,064	82	49	23/28	Yes/No	Hi	3,703	420	23,500
Hyundai Excel 2dr hatch	7,190	6,710	6,911	83	44	28/36	No/No	VHi	3,377	420	20,470
Hyundai Excel GL 4dr	8,099	7,476	7,700	88	45	28/36	No/No	VHi	3,691	420	21,345
Hyundai Excel GS 2dr hatch	8,099	7,311	7,530	86	47	28/36	No/No	VHi	3,691	420	21,159
Hyundai Scoupe 2dr	9,499	8,675	8,935	83	46	26/33	No/No	VHi	3,755	420	23,244
Mazda 323 2dr hatch	8,395	7,990	8,230	85	62	29/36	No/No	Hi	3,517	421	20,125
Mazda Protegé 4dr	8,995	N.A.	N.A.	89	64	28/36	No/No	Hi	3,616	421	20,731
Mitsubishi Mirage S 2dr	8,989	8,268	8,516	77	61	32/39	Yes/No	Hi	4,095	420	20,287
Plymouth Colt 2dr	9,319	8,900	9,167	86	62	32/39	Yes/No	Hi	3,795	491	20,441
Plymouth Sundance 2dr hatch	8,806	8,263	8,511	85	52	26/33	Yes/No	Hi	4,052	599	22,269
Plymouth Sundance 4dr hatch	9,206	8,631	8,890	85	51	26/33	Yes/No	Avg.	4,052	599	22,107
Pontiac Sunbird LE 2dr	9,904	9,448	9,731	86	55	23/31 ²	No/No	Avg.	4,249	491	22,959
Pontiac Sunbird LE 4dr	9,904	9,448	9,731	86	53	23/31 ²	No/No	Avg.	4,249	491	22,707
Saturn SL 4dr	9,995	8,996	9,995	90	73	28/37	Yes/No	Avg.	3,492	420	19,348
Suzuki Swift GA 2dr hatch	7,549	6,945	7,153	92	66	37/43	No/No	VHi	4,413	420	19,158
Suzuki Swift GA 4dr	8,529	7,847	8,082	92	60	37/43	No/No	VHi	4,391	420	20,106
Toyota Tercel 2dr	8,958	8,196	8,442	80	61	31/36	Yes/No	Hi	4,487	420	20,897

\$10,000 to \$14,999

Acura Integra RS 2dr	\$14,820	\$12,723	\$13,232	87%	70%	24/31	Yes/Yes	Hi	\$4,240	\$421	\$23,434
Buick Century Special Mktg. Ed. 4dr	14,470	13,689	14,470	N.A.	56	24/34	Yes/No	Lo	3,959	599	24,940
Buick Skylark Custom Mktg. Ed. 2dr	13,734	12,841	13,734	86	49	22/31	Yes/No	Avg.	3,781	491	26,075
Buick Skylark Custom Mktg. Ed. 4dr	13,734	12,841	13,734	86	50	23/31	Yes/No	Avg.	3,781	491	25,266
Chevrolet Beretta 2dr	12,585	11,389	11,845	86	46	21/29	Yes/No	Hi	3,850	599	27,762
Chevrolet Camaro 2dr	13,499	12,355	12,849	86	45	19/28	Yes/Yes	VHi	5,170	599	31,040
Chevrolet Cavalier wgn	11,590	10,837	11,270	86	45	20/28	No/No	Avg.	3,895	491	25,832
Chevrolet Cavalier RS 2dr	10,840	10,135	10,540	86	48	20/28	No/No	Avg.	3,895	491	25,514
Chevrolet Cavalier RS 4dr	11,440	10,696	11,124	86	47	20/28	No/No	Avg.	3,895	491	25,157
Chevrolet Cavalier Z24 2dr	13,995	12,665	13,172	86	47	20/28	No/No	Avg.	5,050	599	28,607
Chevrolet Corsica 4dr	13,315	12,050	12,532	86	44	21/29	Yes/No	Avg.	3,850	491	26,909
Dodge Colt 4dr	11,545	10,953	11,391	86	57	26/33	Yes/No	Hi	3,777	491	23,111
Dodge Colt ES 2dr	10,277	9,773	10,164	86	61	27/34	Yes/No	Hi	3,610	491	21,577
Dodge Colt ES 4dr	12,298	11,581	12,044	86	55	27/34	Yes/No	Hi	4,000	491	23,943
Dodge Shadow ES 2dr hatch	10,252	9,532	9,818	85	52	24/29	Yes/No	Hi	3,755	599	23,476
Dodge Shadow ES 4dr hatch	10,652	9,892	10,189	85	52	24/29	Yes/No	Avg.	3,765	599	23,233
Dodge Spirit 4dr	13,649	12,411	12,907	85	46	24/29	Yes/No	Lo	3,716	491	24,374
Eagle Summit DL 3dr wgn	13,114	12,161	12,648	86	51	20/26	Yes/No	Hi	4,326	491	26,143
Eagle Summit ES 2dr	10,277	9,773	10,164	86	54	27/34	Yes/No	Hi	3,867	491	22,514
Eagle Summit ES 4dr	12,181	11,472	11,931	86	49	27/34	Yes/No	Hi	4,267	491	24,952
Eagle Summit LX 3dr wgn	14,340	13,261	13,791	86	49	20/26	Yes/No	Avg.	4,326	491	26,880
Eagle Summit LX 4dr	11,545	10,953	11,391	86	53	27/34	Yes/No	Hi	4,044	491	23,792
Eagle Talon DL 2dr	11,892	11,083	11,526	85	60	23/32	No/No	Hi	3,785	420	23,736
Eagle Talon ES 2dr	14,362	13,331	13,864	85	59	22/29	No/No	Hi	4,351	420	26,721

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹Dealer's average cost as a percentage of retail price. ²Estimate. ³Compared with other models in its class. ⁴Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts. ⁵Average five-year repair costs not covered by warranty. ⁶Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: IntelliChoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.

\$10,000 to \$14,999

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ³	Five-year costs		
									Maintenance ⁴	Repairs ⁵	Total ownership costs ⁶
Ford Escort GT 2dr hatch	\$12,300	\$11,293	\$11,745	89%	41%	26/31	Yes/No	Hi	\$3,707	\$599	\$26,528
Ford Escort LX 4dr hatch	10,325	9,496	9,781	90	45	30/37	Yes/No	Hi	3,533	420	22,646
Ford Escort LX 4dr	10,550	9,701	9,992	90	44	30/37	Yes/No	Hi	3,533	420	22,977
Ford Escort LX wgn	10,880	10,000	10,400	90	45	29/36	Yes/No	Hi	3,533	420	23,146
Ford Mustang 2dr	13,365	12,050	12,532	89	54	22/29 ²	Yes/Yes	VHi	N.A.	491	N.A.
Ford Probe 2dr hatch	13,755	12,387	12,882	89	48	22/31	Yes/Yes	Hi	5,011	491	27,992
Ford Tempo GL 2dr	10,885	10,006	10,406	89	42	20/23	Yes/No	Avg.	3,194	491	25,813
Ford Tempo GL 4dr	10,885	10,006	10,406	89	44	20/23	Yes/No	Lo	3,194	491	24,719
Ford Tempo LX 4dr	12,710	11,666	12,133	89	39	20/23	Yes/No	Lo	3,194	491	26,826
Geo Prizm 4dr	11,070	10,539	10,961	86	62	27/34	Yes/Yes	Avg.	4,291	420	22,504
Geo Prizm LSI 4dr	11,840	10,916	11,353	86	62	28/34	Yes/Yes	Avg.	4,206	420	22,505
Honda Accord DX 2dr	14,130	12,011	12,491	85	70	23/29	Yes/Yes	Avg.	4,088	420	21,969
Honda Accord DX 4dr	14,330	12,424	12,921	85	68	23/29	Yes/Yes	Avg.	4,088	420	22,318
Honda Civic del Sol S 2dr	14,100	12,126	12,611	86	63	35/41	Yes/Yes	Hi	3,914	420	24,755
Honda Civic DX 2dr	11,220	9,649	9,938	86	63	29/36	Yes/Yes	Hi	4,024	420	21,225
Honda Civic DX 2dr hatch	10,800	9,288	9,567	86	64	29/36	Yes/Yes	Hi	4,024	420	20,943
Honda Civic DX 4dr	11,750	10,105	10,509	86	65	29/36	Yes/Yes	Avg.	4,024	420	21,045
Honda Civic EX 2dr	13,600	11,696	12,164	86	55	26/33	Yes/Yes	Hi	4,104	420	24,644
Honda Civic LX 4dr	12,950	11,137	11,582	86	60	29/36	Yes/Yes	Avg.	4,024	420	22,736
Honda Civic Si 2dr hatch	13,170	11,326	11,779	86	62	29/35	Yes/Yes	Hi	4,299	420	22,771
Honda Civic VX 2dr hatch	11,500	9,890	10,187	84	63	47/56	Yes/Yes	Hi	4,003	420	20,108
Hyundai Elantra GLS 4dr	10,959	9,669	9,959	82	48	21/28	Yes/No	Hi	3,463	420	23,272
Hyundai Scoupe LS 2dr	10,599	9,351	9,632	82	44	26/33	No/No	VHi	3,585	420	23,982
Hyundai Scoupe LS Turbo 2dr	11,399	10,057	10,459	81	46	26/31	No/No	VHi	3,769	420	24,603
Hyundai Sonata 4dr	12,799	11,418	11,875	89	40	18/24	No/No	Hi	4,108	420	29,417
Hyundai Sonata GLS 4dr	14,199	12,383	12,878	89	35	18/24	No/No	Hi	4,108	420	31,349
Mazda 626 DX 4dr	14,255	13,134	13,659	86	60	23/31	Yes/Yes	Avg.	5,309	421	26,511
Mazda MX-3 2dr	13,595	12,251	12,741	85	59	29/37	Yes/Yes	Hi	4,327	421	24,802
Mazda Protegé DX 4dr	11,495	10,475	10,894	83	63	28/36	No/No	Hi	3,616	421	22,007
Mazda Protegé LX 4dr	13,195	11,891	12,367	85	59	24/30	No/No	Hi	4,059	421	24,553
Mercury Capri 2dr convert.	13,190	12,118	12,603	89	46	25/31	Yes/Yes	Hi	3,751	491	25,597
Mercury Topaz GS 2dr	11,270	10,361	10,775	89	42	20/23	Yes/No	Avg.	3,847	491	27,552
Mercury Topaz GS 4dr	11,270	10,361	10,775	89	43	20/23	Yes/No	Lo	4,016	491	26,735
Mercury Tracer 4dr	10,250	9,428	9,711	89	47	29/36 ²	Yes/No	Hi	4,109	420	22,836
Mercury Tracer wgn	10,520	9,674	9,964	89	49	29/36 ²	Yes/No	Hi	4,109	420	22,842
Mercury Tracer LTS 4dr	12,560	11,530	11,991	89	46	29/36 ²	Yes/No	Hi	4,283	420	25,105
Mitsubishi Eclipse 2dr	11,979	10,482	10,901	84	64	23/32	No/No	Hi	4,153	420	23,087
Mitsubishi Eclipse GS 2dr	14,089	12,256	12,746	84	62	23/32	No/No	Hi	4,153	420	24,599
Mitsubishi Expo LRV 3dr wgn	13,019	11,716	12,185	82	56	24/29	Yes/No	Avg.	4,573	420	24,746
Mitsubishi Galant S 4dr	13,600	12,104	12,588	81	50	22/28	Yes/Yes	Avg.	4,750	420	27,505
Mitsubishi Mirage ES 2dr	10,359	9,324	9,604	80	60	32/39	Yes/No	Hi	4,193	420	21,189
Mitsubishi Mirage ES 4dr	11,929	10,740	11,170	81	55	26/33	Yes/No	Hi	4,584	420	23,850
Nissan Altima XE 4dr	13,999	12,351	12,845	85	57	21/29	Yes/Yes	Avg.	3,818	420	24,864
Nissan Sentra E 2dr	10,199	9,571	9,858	89	65	29/38	Yes/No	VHi	3,589	420	21,304
Nissan Sentra GXE 4dr	14,819	13,074	13,597	87	47	29/38	Yes/No	Hi	3,709	420	25,153
Nissan Sentra SE 2dr	13,049	11,513	11,974	85	54	29/38	Yes/No	VHi	3,709	420	23,700
Nissan Sentra SE-R 2dr	14,249	12,572	13,075	85	50	23/31	Yes/No	VHi	3,828	420	26,699
Nissan Sentra XE 2dr	12,549	11,136	11,581	89	55	29/38	Yes/No	VHi	3,709	420	23,281
Nissan Sentra XE 4dr	12,749	11,314	11,767	89	54	29/38	Yes/No	Hi	3,709	420	22,898
Oldsmobile Achieva S R7B Sp. Ed. 4dr	13,510	12,767	13,277	86	51	22/32	Yes/No	Avg.	3,874	491	25,181
Oldsmobile Achieva S R7B Sp. Ed. 2dr	13,510	12,767	13,277	86	51	22/32	Yes/No	Avg.	3,874	491	25,862
Oldsmobile Achieva S R7C Sp. Ed. 2dr	14,510	13,712	14,260	86	50	21/30	Yes/No	Avg.	3,874	491	27,254
Oldsmobile Achieva S R7C Sp. Ed. 4dr	14,510	13,712	14,260	86	51	21/30	Yes/No	Avg.	3,874	491	26,589
Oldsmobile Cutlass Ciera Sp. Ed. B 4dr	13,670	13,054	13,576	86	56	19/29	Yes/No	Lo	4,219	599	28,296
Plymouth Acclaim 4dr	13,649	12,376	12,871	85	44	21/27	Yes/No	Lo	4,501	491	27,172
Plymouth Colt 4dr	11,545	10,953	11,391	86	58	26/33	Yes/No	Hi	4,151	491	23,323
Plymouth Colt GL 2dr	10,277	9,773	10,164	86	61	26/33	Yes/No	Hi	3,976	491	22,239
Plymouth Colt GL 4dr	12,298	11,581	12,044	86	58	26/33	Yes/No	Hi	4,299	491	24,243
Plymouth Colt Vista 3dr wgn	13,114	12,158	12,644	86	55	20/26	Yes/No	Avg.	4,362	491	25,997

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹ Dealer's average cost as a percentage of retail price. ² Estimate. ³ Compared with other models in its class. ⁴ Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts. ⁵ Average five-year repair costs not covered by warranty. ⁶ Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: IntelliChoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.

\$10,000 to \$14,999

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ³	Five-year costs		
									Maintenance ⁴	Repairs ⁵	Total ownership costs ⁶
Plymouth Laser 2dr hatch	\$11,542	\$10,811	\$11,243	85%	64%	23/32	No/No	Hi	\$3,888	\$420	\$23,210
Plymouth Laser RS 2dr hatch	13,910	12,884	13,399	85	61	22/29	No/No	Hi	4,453	420	25,851
Plymouth Sundance Duster 2dr hatch	11,046	10,250	10,660	85	51	17/25	Yes/No	Avg.	4,399	599	25,635
Plymouth Sundance Duster 4dr hatch	11,446	10,606	11,030	85	51	17/25	Yes/No	Avg.	4,399	599	25,560
Pontiac Firebird 2dr	14,099	12,900	13,416	86	45	19/28	Yes/Yes	VHi	5,063	599	31,814
Pontiac Grand Am SE 2dr	12,514	11,450	11,908	86	52	20/29	Yes/No	Avg.	4,105	491	26,806
Pontiac Grand Am SE 4dr	12,614	11,542	12,004	86	51	20/29	Yes/No	Avg.	4,105	491	26,468
Pontiac Sunbird SE 2dr	12,524	11,334	11,787	86	47	20/28	No/No	Avg.	4,671	491	27,429
Saturn SC1 2dr	11,695	10,526	11,695	90	72	26/35	Yes/No	Hi	3,680	420	22,197
Saturn SC2 2dr	12,895	11,606	12,895	90	70	23/32	Yes/No	Hi	4,149	420	24,082
Saturn SL1 4dr	10,795	9,716	10,795	90	73	26/35	Yes/No	Avg.	3,635	420	20,644
Saturn SL2 4dr	11,795	10,616	11,795	90	72	23/32	Yes/No	Avg.	4,104	420	22,185
Saturn SW1 wgn	11,695	10,525	11,695	90	N.A.	25/35	Yes/No	Avg.	3,635	420	N.A.
Saturn SW2 wgn	12,595	11,336	12,595	90	N.A.	23/32	Yes/No	Avg.	4,104	420	N.A.
Subaru Legacy L 4dr	13,999	12,693	13,201	79	60	22/29	Yes/No	Avg.	4,907	420	25,924
Subaru Legacy L wgn	14,999	13,599	14,143	81	59	22/29	Yes/No	Avg.	4,907	420	26,674
Suzuki Swift GS 4dr	10,029	9,027	9,298	90	60	37/43	No/No	VHi	4,391	420	20,748
Suzuki Swift GT 2dr hatch	10,659	9,486	9,771	N.A.	68	28/35	No/No	VHi	4,773	420	21,847
Toyota Corolla 4dr	12,098	10,767	11,198	83	60	27/34	Yes/Yes	Avg.	5,560	420	24,005
Toyota Corolla DX 4dr	13,188	11,340	11,794	83	57	27/33	Yes/Yes	Avg.	5,535	420	24,596
Toyota Corolla DX wgn	14,298	12,295	12,787	81	60	27/33	Yes/Yes	Avg.	5,535	420	24,919
Toyota Tercel DX 2dr	10,458	9,412	9,694	84	58	28/34	Yes/No	Hi	4,573	420	22,770
Toyota Tercel DX 4dr	10,558	9,502	9,787	84	58	28/34	Yes/No	Hi	4,573	420	22,642
Volkswagen Golf III GL 4dr hatch	11,900	10,953	11,391	91	57	24/31	Yes/Yes	Avg.	4,164	493	23,024
Volkswagen Jetta III GL 4dr	13,125	11,866	12,341	93	62	23/31	Yes/Yes	Avg.	4,439	493	23,403

\$15,000 to \$19,999

Acura Integra GS-R 2dr	\$19,650	\$16,870	\$17,545	N.A.	64%	25/31	Yes/Yes	Hi	\$4,015	\$421	\$29,802
Acura Integra GS-R 4dr	19,980	17,153	17,839	N.A.	57	25/31	Yes/Yes	Avg.	4,015	421	28,672
Acura Integra LS 2dr	17,450	14,981	15,580	87%	65	24/31	Yes/Yes	Hi	4,240	421	26,175
Acura Integra LS 4dr	17,450	14,981	15,580	86	59	24/31	Yes/Yes	Avg.	4,240	421	26,686
Acura Integra RS 4dr	15,580	13,375	13,910	86	61	24/31	Yes/Yes	Avg.	4,240	421	24,980
Buick Century Special 4dr wgn	16,650	14,902	15,498	86	50	19/30	Yes/No	Lo	4,101	599	28,319
Buick Century Spec. Mktg. Ed. wgn	15,470	14,666	15,470	N.A.	55	24/34	Yes/No	Lo	3,966	599	25,989
Buick Regal Custom Mktg. Ed. 2dr	17,270	16,407	17,270	86	51	19/30	Yes/No	Lo	4,739	599	29,795
Buick Regal Custom Mktg. Ed. 4dr	18,270	17,302	18,270	86	53	19/30	Yes/No	Lo	4,739	599	29,896
Buick Regal Gran Sport Mktg. Ed. 2dr	18,770	17,888	18,770	86	50	19/29	Yes/No	Lo	5,089	599	31,991
Buick Skylark Gran Sport 2dr	18,434	16,883	17,558	86	46	22/32	Yes/No	Avg.	5,271	491	32,165
Buick Skylark Gran Sport 4dr	18,434	16,683	17,350	86	46	22/32	Yes/No	Avg.	5,271	491	31,283
Buick Skylark Limited 4dr	16,334	14,782	15,373	86	45	23/31	Yes/No	Avg.	4,052	491	28,606
Chevrolet Beretta Z26 2dr	15,310	13,856	14,410	86	43	25/34 ²	Yes/No	Hi	4,595	599	30,535
Chevrolet Camaro 2dr convert.	18,745	17,152	17,838	86	49	19/28	Yes/Yes	VHi	5,170	599	35,522
Chevrolet Camaro Z28 2dr	16,999	15,554	16,176	86	47	17/26	Yes/Yes	VHi	5,815	687	37,544
Chevrolet Caprice Classic 4dr	19,153	16,759	17,429	86	46	18/26	Yes/Yes	Lo	3,583	599	30,199
Chevrolet Cavalier RS 2dr convert.	16,995	15,890	16,526	86	45	20/28	No/No	Avg.	3,895	491	31,691
Chevrolet Cavalier Z24 2dr convert.	19,995	18,095	18,819	86	47	20/28	No/No	Avg.	5,050	599	34,750
Chevrolet Lumina 4dr	15,305	13,392	13,928	86	48	19/29	No/No	Lo	4,613	491	27,133
Chevrolet Lumina Euro 2dr	16,875	14,766	15,357	86	52	19/29	No/No	Avg.	4,756	491	28,185
Chevrolet Lumina Euro 4dr	16,515	14,451	15,029	86	52	17/26	No/No	Lo	4,981	491	28,271
Chevrolet Lumina Z34 2dr	19,310	16,896	17,572	86	47	17/26	No/No	Avg.	5,133	491	32,033
Chrysler Concorde 4dr	19,896	17,427	18,124	85	N.A.	18/26	Yes/Yes	Avg.	3,940	599	N.A.
Chrysler LeBaron GTC 2dr convert.	16,999	15,939	16,577	85	42	21/27	Yes/Yes	Avg.	5,035	599	32,043
Chrysler LeBaron Landau 4dr	17,933	16,072	16,715	85	38	20/28	Yes/No	Lo	4,066	599	30,846
Chrysler LeBaron LE 3.0L 4dr	16,551	14,869	15,464	85	39	21/27	Yes/No	Lo	4,066	599	29,511
Dodge Intrepid 4dr	17,690	15,163	15,770	85	N.A.	18/26	Yes/No	Lo	3,678	599	N.A.
Dodge Intrepid ES 4dr	19,630	16,812	17,484	85	N.A.	18/26	Yes/Yes	Avg.	3,891	599	N.A.

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹Dealer's average cost as a percentage of retail price. ²Estimate. ³Compared with other models in its class. ⁴Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts. ⁵Average five-year repair costs not covered by warranty. ⁶Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: IntelliChoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.

\$15,000 to \$19,999

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ³	Five-year costs		
									Maintenance ²	Repairs ²	Total ownership costs ⁴
Eagle Talon TSI Turbo 2dr	\$15,885	\$14,717	\$15,306	85%	54%	21/28	No/No	Hi	\$4,597	\$599	\$31,570
Eagle Talon TSI Turbo AWD 2dr	17,978	16,620	17,285	85	52	20/25	No/No	Hi	4,541	687	34,687
Eagle Vision ESI 4dr	19,747	17,300	17,992	85	N.A.	20/28	Yes/Yes	Avg.	3,807	599	N.A.
Ford Crown Victoria 4dr	19,420	17,789	18,501	89	47	18/25	Yes/Yes	Lo	3,523	599	31,002
Ford Mustang GT 2dr	17,280	15,534	16,155	89	53	17/24 ²	Yes/Yes	VHi	N.A.	599	N.A.
Ford Probe GT 2dr hatch	16,085	14,461	15,039	89	46	21/26	Yes/Yes	Hi	5,491	491	31,042
Ford Taurus GL 4dr	16,140	14,519	15,100	89	47	19/28	Yes/Yes	VLo	3,958	491	28,074
Ford Taurus GL wgn	17,220	15,481	16,100	89	54	19/28	Yes/Yes	VLo	3,819	491	27,645
Ford Taurus LX 4dr	18,885	16,963	17,642	89	45	19/28	Yes/Yes	VLo	3,958	491	30,387
Ford Thunderbird LX 2dr	16,830	15,124	16,830	89	45	18/25	Yes/Yes	Avg.	3,763	491	29,568
Honda Accord EX 2dr	19,550	16,618	17,283	85	59	23/30	Yes/Yes	Avg.	4,058	420	27,838
Honda Accord EX 4dr	19,750	17,123	17,808	85	56	23/30	Yes/Yes	Avg.	4,346	420	28,309
Honda Accord LX 2dr	17,030	14,476	15,055	85	65	23/29	Yes/Yes	Avg.	4,088	420	24,902
Honda Accord LX 4dr	17,230	14,938	15,536	85	58	23/29	Yes/Yes	Avg.	4,088	420	25,484
Honda Civic del Sol Si 2dr	16,100	13,846	14,400	86	63	29/35	Yes/Yes	Hi	4,299	420	27,338
Honda Civic del Sol VTEC 2dr	17,500	15,050	15,652	84	63	26/30	Yes/Yes	Hi	4,455	420	28,995
Honda Civic EX 4dr	15,740	13,536	14,077	86	50	26/33	Yes/Yes	Avg.	4,296	420	26,669
Honda Prelude S 2dr	18,100	15,385	16,000	86	59	23/28	Yes/Yes	VHi	4,317	420	29,120
Mazda 626 LX 4dr	16,540	14,737	15,326	82	54	20/26	Yes/Yes	Avg.	5,606	492	30,836
Mazda MX-3 GS 2dr	16,095	14,341	14,915	85	55	23/29	Yes/Yes	Hi	5,075	492	28,963
Mazda MX-5 Miata 2dr convert.	16,650	14,835	15,428	84	61	22/27	Yes/Yes	Avg.	4,028	421	29,405
Mazda MX-6 2dr	17,495	15,411	16,027	83	52	23/31	Yes/Yes	Hi	5,418	421	31,659
Mercury Cougar XR7 2dr	16,260	14,617	16,260	89	45	18/25	Yes/Yes	Avg.	4,027	491	29,437
Mercury Sable GS 4dr	17,740	15,948	16,586	89	46	19/28	Yes/Yes	VLo	4,506	491	30,083
Mercury Sable GS wgn	18,900	16,981	17,660	89	54	19/28	Yes/Yes	VLo	4,403	491	29,418
Mitsubishi Eclipse GS 16V 2dr	15,819	13,764	14,315	85	62	22/29	No/No	Hi	4,958	420	26,878
Mitsubishi Eclipse GS 16V Turbo 2dr	18,529	16,117	16,762	84	54	21/28	No/No	Hi	5,430	599	33,368
Mitsubishi Expo wgn	15,689	13,648	14,194	81	61	20/26	Yes/No	Avg.	4,946	420	26,291
Mitsubishi Expo AWD wgn	17,129	14,900	15,496	81	60	19/23	Yes/No	Avg.	4,988	491	27,936
Mitsubishi Expo LRV Sport 3dr wgn	16,799	14,619	15,204	83	51	20/26	Yes/No	Avg.	4,947	420	29,021
Mitsubishi Galant ES 4dr	16,775	14,259	14,829	82	48	22/28	Yes/Yes	Avg.	4,750	420	28,101
Mitsubishi Galant LS 4dr	18,215	15,483	16,102	82	49	22/28	Yes/Yes	Avg.	5,067	420	29,353
Nissan Altima GLE 4dr	19,179	16,628	17,293	85	54	21/29	Yes/Yes	Avg.	3,818	420	27,668
Nissan Altima GXE 4dr	15,154	13,216	13,745	85	52	21/29	Yes/Yes	Avg.	3,818	420	26,125
Nissan Altima SE 4dr	18,179	15,761	16,391	85	51	21/29	Yes/Yes	Avg.	3,775	420	28,308
Olds Achieva SC R7D Spec. Ed. 2dr	16,810	15,885	16,810	86	50	20/29	Yes/No	Avg.	4,677	491	29,866
Oldsmobile Achieva SL 4dr	17,710	16,028	16,669	86	46	21/31	Yes/No	Avg.	4,384	491	29,906
Oldsmobile Achieva SL R7D Sp. Ed. 4dr	16,810	15,885	16,810	86	51	20/29	Yes/No	Avg.	4,677	491	28,947
Olds Cutlass Cruiser Sp. Ed. D wgn	16,470	15,564	16,187	86	49	19/29	Yes/No	Lo	3,633	599	27,885
Olds Cutlass Ciera Sp. Ed. C 4dr	15,470	14,619	15,470	86	53	19/29	Yes/No	Lo	4,219	599	26,987
Olds Cutlass Supreme Sp. Ed. B 2dr	16,670	15,753	16,670	86	51	19/29	Yes/No	Lo	5,252	491	29,574
Olds Cutlass Supreme Sp. Ed. B 4dr	16,670	15,753	16,670	86	51	19/29	Yes/No	Lo	5,252	491	29,350
Olds Cutlass Supreme Sp. Ed. C 2dr	17,670	16,698	17,670	86	51	19/29	Yes/No	Lo	5,252	491	30,323
Olds Cutlass Supreme Sp. Ed. C 4dr	17,670	16,698	17,670	86	51	19/29	Yes/No	Lo	5,252	491	30,105
Olds 88 Royale Sp. Ed. 4dr	19,420	18,546	19,420	86	54	19/28	Yes/Yes	Lo	4,953	599	31,225
Plymouth Laser RS Turbo 2dr hatch	15,444	14,265	14,836	85	54	21/28	No/No	Hi	4,608	599	31,184
Plymouth Laser RS Turbo AWD 2dr hatch	17,572	16,220	16,869	85	55	20/25	No/No	Hi	4,864	599	33,433
Pontiac Firebird Formula 2dr	18,249	16,697	17,365	86	45	17/25	Yes/Yes	VHi	5,713	599	39,180
Pontiac Grand Am GT 2dr	15,014	13,738	14,288	86	48	21/29	Yes/No	Avg.	4,318	491	29,712
Pontiac Grand Am GT 4dr	15,114	13,829	14,382	86	47	21/29	Yes/No	Avg.	4,318	491	27,736
Pontiac Grand Prix SE Val. Price 2dr	17,070	16,285	17,070	86	52	19/29	Yes/Yes	Lo	5,182	599	29,722
Pontiac Grand Prix SE Val. Price 4dr	16,270	15,522	16,270	N.A.	51	19/29	Yes/Yes	Lo	5,054	599	28,921
Pontiac Sunbird LE 2dr convert.	15,524	14,515	15,096	86	43	20/28 ²	No/No	Avg.	4,574	491	31,638
Subaru Legacy Alpine Sport AWD wgn	19,900	17,821	18,534	90	61	21/27	Yes/No	Avg.	4,899	420	29,235
Subaru Legacy GT AWD wgn	19,700	17,621	18,326	90	61	21/27	Yes/No	Avg.	4,899	420	29,090
Subaru Legacy L AWD	18,050	16,024	16,665	79	63	21/27	Yes/No	Avg.	4,907	420	26,540
Subaru Legacy L AWD wgn	16,499	14,959	15,557	81	61	21/27	Yes/No	Avg.	4,907	420	27,432
Subaru Legacy LS 4dr	19,700	17,379	18,074	83	54	22/29	Yes/No	Avg.	4,899	420	29,996
Subaru Legacy Outdoor AWD wgn	19,000	16,921	17,598	89	61	21/27	Yes/No	Avg.	4,907	420	29,066

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\$15,000 to \$19,999

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ²	Five-year costs		
									Maintenance ³	Repairs ⁴	Total ownership costs ⁵
Subaru Legacy Sun Sport wgn	\$18,400	\$16,461	\$17,119	89%	61%	22/29	Yes/No	Avg.	\$4,907	\$420	\$28,106
Toyota Camry DX 2dr	16,428	13,882	14,437	81	67	21/28	Yes/Yes	Avg.	5,098	420	26,491
Toyota Camry DX 4dr	16,718	14,127	14,692	81	66	21/28	Yes/Yes	Lo	5,098	420	25,559
Toyota Camry DX wgn	18,968	16,028	16,669	81	66	21/28	Yes/Yes	Lo	5,098	420	26,606
Toyota Camry LE 2dr	19,268	16,281	16,932	81	63	21/28	Yes/Yes	Avg.	5,098	420	28,050
Toyota Camry LE 4dr	19,558	16,527	17,188	82	62	21/28	Yes/Yes	Lo	5,098	420	27,037
Toyota Celica GT 2dr	18,428	15,664	16,291	81	56	23/30	Yes/Yes	Hi	6,240	420	30,998
Toyota Celica GT 2dr lift	18,898	16,063	16,706	81	57	23/30	Yes/Yes	Hi	6,240	420	31,472
Toyota Celica ST 2dr	16,168	13,824	14,377	82	62	26/32	Yes/Yes	Hi	5,755	420	27,913
Toyota Celica ST 2dr lift	16,508	14,114	14,679	82	62	26/32	Yes/Yes	Hi	5,755	420	28,008
Toyota Corolla LE 4dr	16,328	13,993	14,553	86	53	26/33	Yes/Yes	Avg.	5,817	420	27,706

\$20,000 to \$29,999

Acura Vigor GS 4dr	\$28,350	\$24,052	\$25,495	85%	52%	20/26	Yes/Yes	Avg.	\$5,965	\$421	\$38,527
Acura Vigor LS 4dr	26,350	22,355	23,696	85	53	20/26	Yes/Yes	Avg.	5,965	421	36,521
Alfa Romeo Spider 2dr convert.	22,590	18,975	19,734	84	49	22/30 ²	Yes/No	Hi	3,951	1,138	38,370
Alfa Romeo Spider Veloce 2dr convert.	27,590	23,175	24,566	N.A.	47	22/30 ²	Yes/No	Hi	4,258	1,138	42,523
BMW 318i 4dr	24,675	20,680	21,921	82	60	22/30	Yes/Yes	Hi	3,448	687	33,888
BMW 318is 2dr	25,800	21,625	22,923	82	60	22/30	Yes/Yes	Hi	4,085	687	35,184
Buick LeSabre Custom 4dr	21,080	18,445	19,551	86	54	19/29	Yes/Yes	Lo	4,903	599	30,606
Buick LeSabre Limited 4dr	24,640	21,560	22,854	86	52	19/29	Yes/Yes	Lo	4,997	599	33,705
Buick Park Avenue Spec. Mktg. Ed. 4dr	25,070	23,867	25,299	N.A.	59	19/28	Yes/Yes	VLo	4,954	599	33,983
Buick Regal Gran Sport 4dr	20,624	18,046	18,768	86	45	19/29	Yes/No	Lo	5,089	599	32,425
Buick Regal Limited 4dr	20,124	17,609	18,313	86	45	19/29	Yes/No	Lo	4,837	599	31,710
Buick Roadmaster 4dr	24,184	21,161	22,431	86	46	17/25	Yes/Yes	Lo	3,885	599	34,877
Buick Roadmaster Estate wgn	25,784	22,561	23,915	86	43	17/25	Yes/Yes	Lo	3,570	599	36,889
Buick Roadmaster Limited 4dr	26,584	23,261	24,657	86	47	17/25	Yes/Yes	Lo	3,885	599	36,576
Chevrolet Camaro Z28 2dr convert.	22,075	20,199	21,411	86	50	17/26	Yes/Yes	VHi	5,815	687	41,595
Chevrolet Caprice Classic wgn	21,338	18,671	19,418	86	49	17/25	Yes/Yes	Lo	3,595	599	31,428
Chevrolet Caprice Classic LS 4dr	21,593	18,894	19,650	86	47	18/26	Yes/Yes	Lo	3,621	599	31,521
Chrysler New Yorker 4dr	25,541	22,380	23,723	85	N.A.	18/26	Yes/Yes	VLo	4,683	687	N.A.
Dodge Stealth 2dr	21,145	19,223	20,376	86	62	19/25	Yes/Yes	Hi	4,785	599	34,991
Dodge Stealth R/T 2dr	23,931	21,674	22,974	86	54	19/24	Yes/Yes	Hi	5,911	599	41,623
Eagle Vision TSi 4dr	23,212	20,280	21,497	85	N.A.	18/26	Yes/Yes	Avg.	3,963	599	N.A.
Ford Crown Victoria LX 4dr	20,715	19,096	19,860	89	49	18/25	Yes/Yes	Lo	3,523	599	31,675
Ford Mustang 2dr convert.	20,160	18,098	18,822	89	N.A.	22/29 ²	Yes/Yes	VHi	N.A.	491	N.A.
Ford Mustang GT 2dr convert.	21,970	19,708	20,496	89	56	17/24 ²	Yes/Yes	VHi	N.A.	599	N.A.
Ford Taurus LX wgn	20,400	18,311	19,043	89	52	19/28	Yes/Yes	VLo	3,746	491	29,770
Ford Taurus SHO 4dr	24,815	22,240	23,574	89	42	18/26	Yes/Yes	VLo	5,092	687	39,713
Ford Thunderbird Super 2dr	22,240	19,938	20,736	89	43	18/24	Yes/Yes	Avg.	5,139	687	37,300
Honda Prelude 2dr	24,160	20,536	21,768	86	52	22/27	Yes/Yes	VHi	5,325	491	37,931
Honda Prelude Si 2dr	21,400	18,190	18,918	86	52	22/27	Yes/Yes	VHi	5,312	420	35,078
Honda Prelude VTEC 2dr	24,500	20,825	22,075	84	50	22/26	Yes/Yes	VHi	5,172	420	40,457
Mazda 626 ES 4dr	21,545	18,761	19,511	87	52	20/26	Yes/Yes	Avg.	6,229	492	34,585
Mazda MX-6 LS 2dr	21,495	18,717	19,466	84	49	20/26	Yes/Yes	Hi	5,713	492	35,939
Mercedes-Benz C220 4dr	29,900	25,440	29,900	83	64	22/28	Yes/Yes	N.A.	4,008	687	34,615
Mercury Grand Marquis GS 4dr	20,330	18,690	19,438	89	47	18/25	Yes/Yes	Lo	3,761	599	32,107
Mercury Grand Marquis LS 4dr	21,500	19,852	20,646	89	47	18/25	Yes/Yes	Lo	3,761	599	33,345
Mercury Sable LS 4dr	20,000	17,960	18,678	89	44	19/28	Yes/Yes	VLo	4,530	491	32,215
Mercury Sable LS wgn	21,110	18,948	19,706	89	54	19/28	Yes/Yes	VLo	4,352	491	30,976
Mitsubishi 3000GT 2dr	27,175	22,286	23,623	81	60	19/25	Yes/Yes	Hi	6,592	599	37,557
Mitsubishi Diamante ES 4dr	25,525	21,431	22,717	81	51	18/24	Yes/Yes	Avg.	5,930	599	35,492
Mitsubishi Eclipse GSX Turbo AWD 2dr	21,269	18,504	19,244	85	50	20/25	No/No	Hi	5,395	687	37,196
Mitsubishi Galant GS 4dr	20,494	17,420	18,117	83	39	20/26	Yes/Yes	Avg.	5,127	420	34,754
Nissan 240SX 2dr convert.	23,969	21,025	22,287	85	52	21/26	No/No	VHi	4,596	420	36,678
Nissan Maxima GXE 4dr	22,429	19,445	20,223	85	54	19/26	Yes/No	Avg.	5,052	491	32,024

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹Dealer's average cost as a percentage of retail price. ²Estimate. ³Compared with other models in its class. ⁴Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts. ⁵Average five-year repair costs not covered by warranty. ⁶Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: IntelliChoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.

\$20,000 to \$29,999

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ³	Five-year costs		
									Mainten- ance ⁴	Repairs ⁵	Total ownership costs ⁶
Nissan Maxima SE 4dr	\$23,529	\$20,399	\$21,623	85%	54%	19/25	Yes/No	Avg.	\$5,351	\$491	\$34,024
Olds Cutlass Supreme convert. 2dr	25,470	22,286	23,623	86	43	19/29	Yes/No	Lo	5,289	491	37,442
Oldsmobile 88 Royale 4dr	21,120	18,480	19,219	86	49	19/28	Yes/Yes	Lo	5,007	599	32,365
Olds 88 Royale LS Sp. Ed. 4dr	22,720	21,698	22,720	86	50	19/28	Yes/Yes	Lo	5,105	599	34,572
Olds 98 Regency Elite 4dr	28,270	24,736	26,220	86	45	17/27	Yes/Yes	VLo	5,115	599	41,124
Olds 98 Regency Sp. Ed. 4dr	24,670	23,560	24,670	86	50	19/27	Yes/Yes	VLo	5,111	599	36,210
Pontiac Bonneville SE Val. Price 4dr	21,820	20,816	21,820	N.A.	57	19/28	Yes/Yes	Lo	5,163	599	32,312
Pontiac Bonneville SSE 4dr	25,884	22,649	25,884	86	46	17/25	Yes/Yes	Lo	5,121	599	37,334
Pontiac Firebird Trans Am 2dr	20,385	18,652	19,772	86	44	17/25	Yes/Yes	VHi	5,713	687	40,584
Pontiac Firebird Trans Am GT 2dr	21,509	19,680	20,467	86	44	17/25	Yes/Yes	VHi	6,614	687	42,609
Saab 900 S 4dr hatch	20,990	19,678	20,465	90	45	19/26	Yes/Yes	Hi	5,513	598	36,920
Saab 900 SE 4dr hatch	26,280	23,611	25,028	85	45	19/25	Yes/Yes	Hi	5,862	598	40,730
Saab 9000 CS 4dr hatch	28,725	25,063	26,567	85	40	18/26	Yes/Yes	Lo	5,257	1,138	44,648
Subaru Legacy LS wgn	20,400	17,994	18,714	83	53	22/29	Yes/No	Avg.	4,899	420	30,892
Subaru Legacy LS AWD 4dr	21,300	18,784	19,535	83	55	21/27	Yes/No	Avg.	4,899	420	31,069
Subaru Legacy LS AWD wgn	22,000	19,400	20,176	83	54	21/27	Yes/No	Avg.	4,899	420	31,970
Subaru Legacy LSI AWD wgn	22,850	20,104	21,310	83	53	21/27	Yes/No	Avg.	4,899	420	32,619
Subaru Legacy Sport AWD 4dr	21,400	18,873	19,628	90	54	18/23	Yes/No	Avg.	5,179	599	33,110
Subaru Legacy Touring AWD wgn	23,200	20,454	21,681	83	53	18/23	Yes/No	Avg.	5,179	599	34,330
Toyota Camry LE 4dr wgn	20,968	17,718	18,427	82	64	21/28	Yes/Yes	Lo	5,098	420	27,477
Toyota Camry LE V6 2dr	21,588	18,242	18,972	81	62	18/25	Yes/Yes	Avg.	5,832	491	31,855
Toyota Camry LE V6 4dr	21,878	18,487	19,226	82	61	18/25	Yes/Yes	Lo	5,857	491	30,457
Toyota Camry LE V6 wgn	23,308	19,695	20,483	82	64	18/25	Yes/Yes	Lo	5,857	491	30,702
Toyota Camry SE V6 2dr	22,618	19,112	19,876	81	62	18/25	Yes/Yes	Avg.	6,360	491	32,636
Toyota Camry SE V6 4dr	22,908	19,357	20,131	81	61	18/25	Yes/Yes	Lo	6,360	491	31,748
Toyota Camry XLE 4dr	21,618	18,161	18,887	81	63	21/28	Yes/Yes	Lo	5,098	420	27,858
Toyota Camry XLE V6 4dr	23,978	20,142	21,351	81	62	18/25	Yes/Yes	Lo	5,857	491	31,493
Volkswagen Corrado SLC 2dr	25,150	22,606	23,962	92	50	18/24	No/No	VHi	5,717	687	41,253
Volkswagen Passat GLX 4dr	23,075	20,754	21,999	92	61	18/25	No/No	Avg.	5,708	687	33,709
Volkswagen Passat GLX wgn	23,500	21,132	22,400	95	61	18/25	No/No	Avg.	5,708	687	33,852
Volvo 855 I 4dr	24,300	22,100	23,426	89	60	20/27	Yes/Yes	Avg.	3,676	687	33,829
Volvo 850 II wgn	27,695	24,495	25,965	86	58	20/27	Yes/Yes	Avg.	3,676	687	35,744
Volvo 850 Turbo 4dr	29,985	25,785	29,985	80	57	19/26	Yes/Yes	Avg.	3,676	1,019	39,217
Volvo 940 I 4dr	22,900	21,700	23,002	N.A.	47	19/27	Yes/Yes	Lo	3,819	599	34,125
Volvo 940 I wgn	24,000	22,800	24,168	N.A.	51	19/27	Yes/Yes	Lo	3,819	687	34,149
Volvo 940 II Turbo wgn	27,295	25,095	26,601	N.A.	56	19/24	Yes/Yes	Lo	4,314	687	36,367
Volvo 960 I 4dr	28,950	26,750	28,355	N.A.	43	17/25	Yes/Yes	Lo	4,966	599	42,803

\$30,000 and over

Acura Legend GS 4dr	\$40,700	\$34,119	\$36,507	83%	46%	18/23	Yes/Yes	Lo	\$5,257	\$421	\$48,685
Acura Legend L 2dr	37,700	31,604	33,816	N.A.	47	18/23	Yes/Yes	Avg.	5,625	421	45,717
Acura Legend L 4dr	33,800	28,335	30,035	84	49	18/23	Yes/Yes	Lo	5,154	421	39,754
Acura Legend LS 2dr	41,500	34,789	37,224	N.A.	44	19/24	Yes/Yes	Avg.	5,727	421	49,819
Acura Legend LS 4dr	38,600	32,358	34,623	N.A.	47	18/23	Yes/Yes	Lo	5,154	421	43,834
Alfa Romeo 164 LS 4dr	34,890	28,610	30,327	82	37	15/22	Yes/No	Avg.	5,569	1,138	44,543
Audi 100 CS Quattro 4WD 4dr	43,020	35,952	38,469	86	29	18/22	Yes/Yes	Lo	3,871	1,650	55,122
Audi 100 CS Quattro 4WD wgn	47,020	39,358	42,113	80	33	18/22	Yes/Yes	Lo	3,871	1,650	56,459
Audi 100 S 4dr	35,120	29,395	31,159	84	32	18/24	Yes/Yes	Lo	3,576	1,138	45,289
Audi 100 S wgn	38,070	31,929	34,164	80	33	19/26	Yes/Yes	Lo	3,544	1,138	46,421
Audi 90 CS Quattro Sport 4WD 4dr	34,420	29,158	30,907	80	37	19/24	Yes/Yes	Avg.	5,629	1,138	45,309
BMW 325 I 4dr	30,850	25,855	27,406	82	54	20/28	Yes/Yes	Hi	4,361	1,019	39,940
BMW 325 IC 2dr convert.	38,800	32,520	34,796	82	58	18/26	Yes/Yes	Hi	3,532	1,019	43,901
BMW 325 IS 2dr	32,200	26,985	28,604	82	51	20/28	Yes/Yes	Hi	4,361	1,019	40,951
BMW 525 I 4dr	38,425	32,200	34,454	82	50	18/25	Yes/Yes	Avg.	3,500	1,019	46,290
BMW 530 I 4dr	41,500	34,760	37,193	82	50	16/25	Yes/Yes	Avg.	3,938	1,139	47,820
BMW 540 I 4dr	47,500	39,805	42,591	82	48	16/23	Yes/Yes	Avg.	4,035	1,139	58,918

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\$30,000 and over

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ²	Five-year costs		
									Maintenance ³	Repairs ⁴	Total ownership costs ⁵
BMW 740i 4dr	\$55,950	\$45,745	\$48,947	81%	46%	16/23	Yes/Yes	Avg..	\$4,411	\$1,139	\$63,397
BMW 740iL 4dr	59,950	49,015	52,446	81	45	16/23	Yes/Yes	Avg..	4,411	1,139	67,167
BMW 750iL 4dr	83,950	68,640	73,445	80	34	12/18	Yes/Yes	Avg..	3,053	1,651	99,913
BMW 840Ci 2dr	68,100	57,075	61,070	80	49	12/18	Yes/Yes	Avg..	3,937	1,139	70,749
BMW 850CSI 2dr	98,500	82,545	88,323	80	42	12/20	Yes/Yes	Avg..	2,066	1,651	99,321
Buick Park Avenue Ultra 4dr	31,864	27,562	29,216	86	45	17/26	Yes/Yes	VLo	5,003	599	39,020
Cadillac DeVille 4dr	32,990	30,186	32,299	85	38	16/25	Yes/Yes	VLo	6,291	599	47,240
Cadillac Eldorado 2dr	37,690	32,602	34,884	85	37	16/25	Yes/Yes	Lo	7,004	599	52,668
Cadillac Eldorado Touring 2dr	40,990	35,456	37,938	85	39	16/25	Yes/Yes	Lo	6,400	599	53,949
Cadillac Fleetwood 4dr	33,990	31,101	33,278	85	34	17/25	Yes/Yes	Lo	4,309	599	48,118
Cadillac Seville SLS 4dr	41,430	35,837	38,346	85	43	16/25	Yes/Yes	VLo	7,004	687	52,319
Cadillac Seville Touring 4dr	45,330	39,210	41,955	85	42	16/25	Yes/Yes	VLo	7,499	687	56,242
Chevrolet Corvette 2dr convert.	43,060	36,816	39,393	84	N.A.	17/24	Yes/Yes	Avg..	6,794	1,017	N.A.
Chevrolet Corvette 2dr	36,285	31,024	33,196	84	46	17/24	Yes/Yes	Avg..	6,794	1,017	52,603
Chrysler LHS 4dr	30,283	26,491	28,080	85	N.A.	18/26	Yes/Yes	N.A.	4,835	599	N.A.
Dodge Stealth R/T Turbo AWD 2dr	37,894	33,962	36,339	86	55	18/24	Yes/Yes	Hi	6,783	599	51,671
Infiniti J30 4dr	36,950	29,930	31,726	81	N.A.	18/23	Yes/Yes	Avg..	3,665	492	N.A.
Infiniti Q45 4dr	50,450	41,055	43,929	81	49	17/22	Yes/Yes	Avg..	3,737	492	53,815
Jaguar XJ6 4dr	51,750	42,228	45,184	80	37	17/24	Yes/Yes	Avg..	6,390	1,651	62,938
Jaguar XJS 4.0L 2dr convert.	59,950	48,919	52,343	80	50	17/23	Yes/Yes	Avg..	6,432	1,651	68,745
Jaguar XJS 4.0L 2dr	51,950	42,391	45,358	80	47	17/23	Yes/Yes	Avg..	6,494	1,651	63,842
Lexus ES 300 4dr	31,200	25,584	27,119	78	55	18/24	Yes/Yes	Avg..	5,112	492	35,707
Lexus GS 300 4dr	41,100	33,702	36,061	78	N.A.	17/23	Yes/Yes	Avg..	5,374	492	N.A.
Lexus LS 400 4dr	51,200	40,960	43,827	78	59	18/23	Yes/Yes	Lo	6,034	492	49,095
Lexus SC 300 2dr	38,000	31,160	33,341	79	N.A.	17/23	Yes/Yes	Avg..	5,691	492	N.A.
Lincoln Continental Executive 4dr	33,750	29,296	31,054	86	28	18/26	Yes/Yes	VLo	6,045	599	47,830
Lincoln Mark VIII 2dr	38,050	33,034	35,346	86	48	18/25	Yes/Yes	Avg..	4,419	599	46,797
Lincoln Town Car Executive 4dr	34,750	30,166	32,278	86	31	18/25	Yes/Yes	VLo	4,188	599	46,485
Mazda 929 4dr	31,500	26,791	28,398	82	46	19/24	Yes/Yes	Avg..	5,870	492	40,485
Mazda RX-7 2dr	36,000	30,618	32,761	83	43	17/25	Yes/Yes	Avg..	5,619	492	50,484
Mercedes-Benz C280 4dr	34,900	29,690	34,900	83	57	20/26	Yes/Yes	N.A.	4,129	1,019	39,223
Mercedes-Benz E320 4dr	42,500	36,160	38,691	83	58	19/25	Yes/Yes	Lo	4,347	1,019	44,152
Mercedes-Benz E320 wgn	46,200	39,310	42,062	83	58	18/24	Yes/Yes	Lo	4,778	1,019	47,888
Mercedes-Benz E420 4dr	51,000	42,330	45,293	83	54	18/24	Yes/Yes	Lo	5,106	1,019	55,094
Mercedes-Benz S320 4dr	70,600	58,600	62,702	83	57	17/24	Yes/Yes	Lo	5,023	1,019	64,679
Mercedes-Benz S420 4dr	79,500	65,990	70,609	83	56	15/20	Yes/Yes	Lo	5,024	1,019	74,061
Mercedes-Benz S600 2dr	133,300	110,640	118,385	83	N.A.	12/16	Yes/Yes	Avg..	6,491	1,651	N.A.
Merc.-Benz SL320 Rdster. 2dr convert.	85,200	70,720	75,670	83	61	17/24	Yes/Yes	Avg..	6,526	1,019	81,293
Mitsubishi 3000GT SL 2dr	31,650	25,955	27,512	81	47	19/25	Yes/Yes	Hi	6,738	599	43,123
Mitsubishi Diamante LS 4dr	32,500	26,006	27,566	82	41	18/24	Yes/Yes	Avg..	5,997	599	40,120
Porsche 911 Carrera 2 2dr convert.	74,190	62,070	66,415	81	60	17/25	Yes/Yes	Avg..	7,986	1,650	74,402
Porsche 911 RS America 2dr	54,800	45,875	49,086	N.A.	58	17/25	Yes/Yes	Avg..	8,277	1,650	63,839
Porsche 968 2dr	39,950	32,760	35,553	80	37	17/26	Yes/Yes	Hi	6,357	1,138	57,333
Porsche 968 2dr convert.	51,900	42,555	45,534	80	45	17/26	Yes/Yes	Hi	6,357	1,138	65,052
Saab 900 S 2dr convert.	33,275	29,748	31,533	81	56	18/21	Yes/Yes	Hi	5,183	598	41,452
Saab 9000 Aero 4dr hatch	38,690	33,815	36,182	85	N.A.	18/26	Yes/Yes	Lo	6,315	1,138	N.A.
Saab 900T Turbo 2dr convert.	38,415	33,882	36,254	84	54	18/21	Yes/Yes	N.A.	5,773	1,018	47,485
Toyota Supra 2dr lift	36,900	30,258	32,376	81	N.A.	18/23	Yes/Yes	Avg..	N.A.	491	N.A.
Toyota Supra Turbo 2dr lift	44,100	36,162	38,693	81	N.A.	17/23	Yes/Yes	Avg..	N.A.	599	N.A.
Volvo 850 Turbo wgn	30,985	26,785	28,392	80	49	19/26	Yes/Yes	Avg..	3,676	1,019	40,593
Volvo 960 II wgn	34,450	30,250	32,368	N.A.	41	17/25	Yes/Yes	Lo	4,966	599	44,045

Minivans

Chevrolet Astro 3dr	\$16,525	\$14,955	\$15,553	86%	69%	16/21	Yes/No	VLo	\$3,861	\$599	\$24,270
Chevrolet Astro AWD 3dr	18,854	17,063	17,746	86	69	15/19	Yes/No	VLo	5,670	687	28,495
Chevrolet Astro 3dr ext.	16,827	15,228	15,837	86	69	16/21	Yes/No	VLo	3,890	599	24,284

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Minivans

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy)	Air bags available (driver/pass.)	Cost to insure ³	Five-year costs		
									Maintenance ⁴	Repairs ⁵	Total ownership costs ⁶
Chevrolet Lumina 3dr	\$17,015	\$15,399	\$16,015	86%	62%	17/25	Yes/No	Lo	\$4,638	\$491	\$27,147
Chrysler Town & Country 3dr ext.	27,484	24,876	25,871	85	57	16/22	Yes/Yes	VLo	4,635	599	34,299
Chrysler Town & Country AWD 3dr ext.	29,580	26,720	27,789	85	57	16/22	Yes/Yes	VLo	4,708	687	35,717
Dodge Caravan 3dr	15,520	14,158	14,724	85	66	19/23	Yes/Yes	VLo	4,040	599	23,831
Dodge Caravan LE 3dr	21,963	19,827	20,620	85	56	17/22	Yes/Yes	VLo	3,769	599	29,227
Dodge Caravan SE 3dr	18,139	16,462	17,120	85	63	17/22	Yes/Yes	VLo	3,769	599	25,244
Dodge Grand Caravan 3dr ext.	18,178	16,522	17,183	85	65	19/23	Yes/Yes	VLo	4,154	599	25,490
Dodge Grand Caravan LE 3dr ext.	22,883	20,662	21,488	85	58	18/23 ²	Yes/Yes	VLo	3,962	599	29,165
Dodge Grand Caravan LE AWD 3dr ext.	25,560	23,018	23,939	85	59	17/22	Yes/Yes	VLo	3,962	687	30,803
Dodge Grand Caravan SE 3dr ext.	19,304	17,513	18,214	85	66	18/23 ²	Yes/Yes	VLo	3,962	599	25,359
Dodge Grand Caravan SE AWD 3dr ext.	21,982	19,869	20,664	85	66	17/22	Yes/Yes	VLo	3,962	687	27,278
Ford Aerostar Eddie Bauer 4WD 3dr	25,210	22,345	23,239	85	52	16/20	Yes/No	Lo	3,836	687	32,829
Ford Aerostar XL 4WD 3dr	18,450	16,397	17,053	85	61	16/20	Yes/No	Lo	3,836	687	27,467
Ford Aerostar XL 3dr	14,980	13,342	13,876	85	63	16/20	Yes/No	Lo	3,547	599	25,018
Ford Aerostar XL 4WD 3dr ext.	19,345	17,183	17,870	85	59	15/20	Yes/No	Lo	3,836	687	28,595
Ford Aerostar XL 3dr ext.	16,425	14,614	15,199	85	59	16/20	Yes/No	Lo	3,547	599	26,729
Ford Aerostar XLT 4WD 3dr	21,975	19,498	20,278	85	55	16/20	Yes/No	Lo	3,836	687	30,174
Ford Aerostar XLT 3dr	20,420	18,130	18,855	85	51	16/20	Yes/No	Lo	3,547	599	29,459
GMC Safari SLX 3dr	16,746	15,155	15,761	86	67	16/21	Yes/No	VLo	3,881	599	24,395
GMC Safari SLX AWD 3dr	19,075	17,263	17,954	86	66	15/19	Yes/No	VLo	5,669	599	28,844
GMC Safari SLX XT 3dr	17,048	15,428	16,045	86	68	16/21	Yes/No	VLo	3,910	599	24,625
GMC Safari SLX XT AWD 3dr ext.	19,377	17,536	18,237	86	66	15/19	Yes/No	VLo	5,669	599	29,093
Mazda MPV wgn 4WD 3dr	23,395	20,845	21,679	83	65	15/19	Yes/No	Avg.	4,418	599	30,178
Mazda MPV wgn 3dr	19,195	17,103	17,787	83	69	16/22	Yes/No	Avg.	4,021	492	26,535
Mercury Villager GS 3dr	18,375	16,355	17,009	85	N.A.	17/23	Yes/No	Avg.	4,457	599	N.A.
Mercury Villager LS 3dr	23,155	20,562	21,384	85	N.A.	17/23	Yes/No	Avg.	4,457	599	N.A.
Mercury Villager Nautica 3dr	24,635	21,864	22,739	85	N.A.	17/23	Yes/No	Avg.	4,457	599	N.A.
Nissan Quest GXE 3dr	23,589	20,452	21,270	85	N.A.	17/23	Yes/No	Avg.	3,816	599	N.A.
Nissan Quest XE 3dr	19,079	16,542	17,204	85	N.A.	17/23	Yes/No	Avg.	3,721	599	N.A.
Oldsmobile Silhouette Spec. Ed. 3dr	19,665	18,780	19,665	86	56	17/25	Yes/No	Lo	4,670	599	29,928
Plymouth Grand Voyager 3dr ext.	18,178	16,522	17,183	85	67	19/23	Yes/Yes	VLo	4,464	687	25,206
Plymouth Grand Voyager LE 3dr ext.	22,883	20,662	21,488	85	57	17/22 ²	Yes/Yes	VLo	4,311	687	30,031
Plymouth Grand Voyager SE 3dr ext.	19,304	17,513	18,214	85	66	17/22 ²	Yes/Yes	VLo	4,250	687	25,951
Plymouth Gr. Voyager SE AWD 3dr ext.	21,982	19,869	20,664	85	69	17/22	Yes/Yes	VLo	4,442	687	27,094
Plymouth Voyager 3dr	15,520	14,158	14,724	85	66	19/23	Yes/Yes	VLo	4,487	687	24,206
Plymouth Voyager LE 3dr	21,963	19,827	20,620	85	56	17/22 ²	Yes/Yes	VLo	4,237	687	29,614
Plymouth Voyager SE 3dr	18,139	16,462	17,120	85	62	17/22 ²	Yes/Yes	VLo	4,148	687	25,902
Pontiac Trans Sport SE 3dr	17,469	15,810	16,442	86	55	17/25	Yes/No	Lo	4,531	599	28,794
Toyota Previa DX 3dr	22,818	19,509	20,289	80	67	17/22	Yes/Yes	Lo	5,494	491	29,372
Toyota Previa DX All-Trac 4WD 3dr	26,148	22,226	23,115	80	67	17/21	Yes/Yes	Lo	5,494	491	31,504
Toyota Previa LE 3dr	26,578	22,591	23,495	82	65	17/22	Yes/Yes	Lo	5,505	491	30,749
Toyota Previa LE All-Trac 4WD 3dr	29,718	25,260	26,270	82	62	17/21	Yes/Yes	Lo	5,505	491	33,830

Utility vehicles

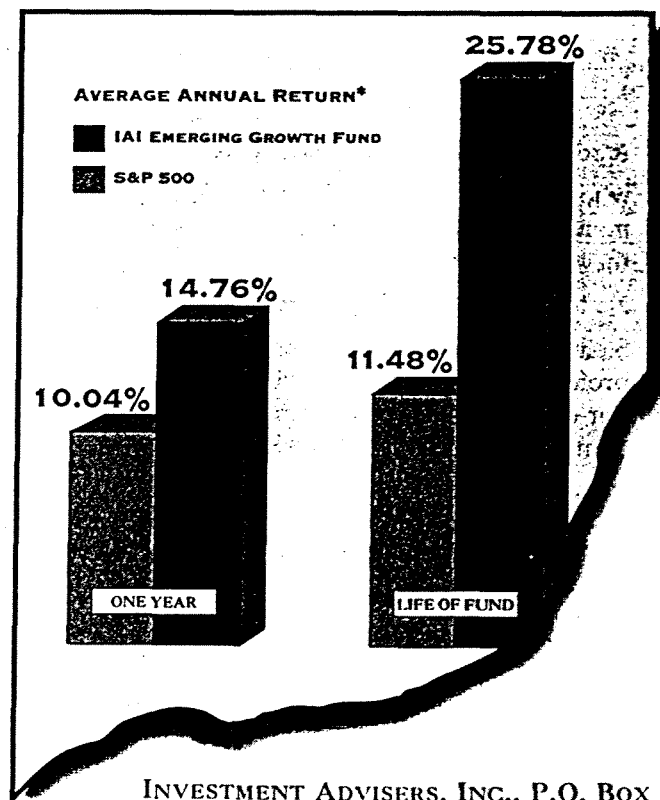
Chevrolet Blazer 4WD 2dr	\$21,330	\$18,660	\$19,406	86%	73%	12/16	No/No	Avg	\$4,816	\$687	\$33,068
Chevrolet S-10 Blazer 2dr	15,641	14,155	14,721	86	63	16/21	No/No	Avg	3,689	599	27,269
Chevrolet S-10 Blazer 4dr	16,931	15,323	15,936	86	62	16/21	No/No	Avg	3,689	599	28,893
Chevrolet S-10 Blazer 4WD 2dr	17,347	15,780	16,411	86	64	16/21	No/No	Avg	4,678	687	30,013
Chevrolet S-10 Blazer 4WD 4dr	19,165	17,344	18,038	86	62	16/21	No/No	Avg	4,678	687	31,617
Chevrolet Suburban C1500 5dr	20,406	17,855	18,569	86	82	13/17	No/No	Avg	4,405	687	29,154
Chevrolet Suburban K1500 4WD 5dr	22,657	19,825	20,618	86	84	13/15	No/No	Avg	4,798	687	30,653
Ford Bronco XL 4WD 2dr	21,515	18,497	19,237	85	66	13/18	Yes/No	Lo	4,040	687	30,095
Ford Explorer Eddie Bauer 4WD 2dr	22,950	20,387	21,202	85	64	17/21	No/No	Lo	3,415	599	29,853
Ford Explorer Eddie Bauer 4WD 4dr	25,205	22,370	23,265	85	64	17/21	No/No	Lo	3,415	599	31,418
Ford Explorer Limited 4WD 4dr	28,535	25,301	26,313	85	N.A.	15/20	No/No	Lo	3,712	599	N.A.
Ford Explorer 2dr	18,290	16,286	16,937	85	72	18/22	No/No	Lo	3,259	491	25,029

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹Dealer's average cost as a percentage of retail price ²Estimate ³Compared with other models in its class ⁴Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts ⁵Average five-year repair costs not covered by warranty ⁶Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: Intellichoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.

Utility vehicles

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ²	Five-year costs		
									Maintenance ³	Repairs ⁴	Total ownership costs ⁵
Ford Explorer 4WD 2dr	\$20,000	\$17,790	\$18,502	85%	72%	17/21	No/No	Lo	\$3,387	\$599	\$26,553
Ford Explorer XL 4dr	18,130	16,145	16,791	85	76	18/22	No/No	Lo	3,259	491	24,303
Ford Explorer XL 4WD 2dr	18,990	16,902	17,578	85	72	17/21	No/No	Lo	3,387	599	26,100
Ford Explorer XL 4WD 4dr	19,900	17,702	18,410	85	75	17/21	No/No	Lo	3,387	599	25,865
Ford Explorer XLT 4WD 4dr	22,410	19,911	20,707	85	71	17/21	No/No	Lo	3,387	599	27,991
Geo Tracker Hardtop 4WD 2dr	12,445	11,848	12,322	89	72	25/27	No/No	VHi	4,554	599	24,254
Geo Tracker LSI Hardtop 4WD 2dr	13,915	13,247	13,777	89	64	25/27	No/No	VHi	4,554	599	26,095
Geo Tracker Soft Top 2dr	11,015	10,486	10,905	88	72	25/27	No/No	VHi	4,495	491	23,057
Geo Tracker Soft Top 4WD 2dr	12,285	11,695	12,163	89	72	25/27	No/No	VHi	4,610	599	24,210
GMC Jimmy SL 4WD 2dr	17,761	15,541	16,163	86	63	16/21	No/No	Avg.	4,538	687	29,196
GMC Jimmy SLE 4dr	17,144	15,001	15,601	86	62	17/22	No/No	Avg.	3,835	687	28,065
GMC Jimmy SLE 4WD 4dr	19,501	17,063	17,746	86	63	16/21	No/No	Avg.	4,538	687	30,494
GMC Suburban C1500 5dr	20,476	17,666	18,373	86	81	13/17	No/No	Avg.	4,432	687	28,367
GMC Suburban K1500 4WD 5dr	22,727	19,631	20,416	86	84	13/15	No/No	Avg.	4,788	687	29,449
Isuzu Amigo S 2dr	14,849	13,067	13,590	80	69	16/20	No/No	Hi	3,768	492	24,722
Isuzu Amigo S 4WD 2dr	16,799	14,783	15,374	80	76	16/20	No/No	Hi	3,929	599	25,299
Isuzu Rodeo S 4dr	14,969	13,921	14,478	81	74	16/20	No/No	Avg.	3,099	599	24,462
Isuzu Rodeo S 4WD 4dr	19,249	17,323	18,016	85	70	16/19	No/No	Avg.	3,361	687	27,821
Isuzu Trooper LS 4WD 4dr	26,850	23,628	24,573	83	57	15/17	No/No	Lo	4,439	687	35,457
Isuzu Trooper RS 4WD 2dr	24,000	21,840	22,714	85	59	16/18	No/No	Lo	4,439	687	33,601
Isuzu Trooper S 4WD 4dr	21,250	19,019	19,780	84	61	16/18	No/No	Lo	4,439	687	30,948
Jeep Cherokee Country 4WD 4dr	19,716	18,867	19,622	85	72	17/21	No/No	Avg.	4,111	687	29,180
Jeep Cherokee SE 4WD 4dr	15,922	14,979	15,578	85	76	19/22	No/No	Avg.	3,976	687	25,302
Jeep Cherokee 4dr	16,594	15,073	15,676	85	73	17/21	No/No	Avg.	3,543	599	25,679
Jeep Cherokee 4WD 4dr	18,079	16,400	17,056	85	75	17/21	No/No	Avg.	4,100	687	27,004
Jeep Grand Cherokee Laredo 4dr	22,442	20,422	21,239	85	N.A.	15/21	Yes/No	Avg.	3,913	687	N.A.
Jeep Grand Cherokee Laredo 4WD 4dr	23,382	21,277	22,128	85	N.A.	16/20	Yes/No	Avg.	4,118	1,017	N.A.

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹ Dealer's average cost as a percentage of retail price. ² Estimate. ³ Compared with other models in its class. ⁴ Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts. ⁵ Average five-year repair costs not covered by warranty. ⁶ Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: IntelliChoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.



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Utility vehicles

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ²	Five-year costs		
									Maintenance ³	Repairs ⁴	Total ownership costs ⁵
Jeep Grand Cherokee Limited 4WD 4dr	\$29,643	\$26,751	\$27,821	85%	N.A.	15/20	Yes/No	Avg.	\$4,432	\$1,017	N.A.
Jeep Grand Cherokee SE 4WD 4dr	22,096	20,109	20,913	85	N.A.	16/20	Yes/No	Avg.	4,095	1,017	N.A.
Jeep Wrangler S 4WD 2dr	11,480	11,075	11,518	85	78%	19/20	No/No	Avg.	3,879	599	\$22,943
Jeep Wrangler Sahara 4WD 2dr	17,089	15,506	16,126	85	66	16/18	No/No	Avg.	4,010	599	26,651
Land Rover Defender 90 4WD 2dr	27,900	25,100	26,104	85	N.A.	13/16	No/No	Avg.	N.A.	1,138	N.A.
Land Rover Range Rover Cty. 4WD 4dr	46,900	41,000	42,640	83	53	12/15	No/No	Avg.	5,575	1,138	55,555
Mazda Navajo LX 4WD 2dr	20,785	18,309	19,041	85	69	17/22	No/No	Lo	3,819	599	27,109
Mitsubishi Montero LS 4WD 4dr	23,975	20,505	21,325	82	57	15/18	Yes/No	Avg.	4,880	491	34,467
Mitsubishi Montero SR 4WD 4dr	31,475	26,290	27,342	80	50	14/17	Yes/No	Avg.	5,273	491	40,307
Nissan Pathfinder LE-V6 4WD 4dr	29,239	25,649	26,675	85	71	15/18	No/No	Hi	4,052	599	34,628
Nissan Pathfinder SE-V6 4WD 4dr	25,249	22,149	23,035	86	73	15/18	No/No	Hi	4,247	599	32,230
Nissan Pathfinder XE-V6 4dr	19,669	17,254	17,944	85	75	15/18	No/No	Hi	3,673	491	28,513
Oldsmobile Bravada Spec. Ed. 4WD 4dr	24,820	23,703	24,820	86	60	16/21	No/No	Avg.	5,483	1,017	38,133
Suzuki Samurai JL Soft Top 4WD 2dr	9,689	8,914	9,271	N.A.	55	28/29	No/No	Hi	4,156	420	21,927
Suzuki Samurai JL Hardtop 4WD 4dr	14,309	12,735	13,244	89	59	23/26	No/No	VHi	4,703	420	26,495
Suzuki Sidekick JX Soft Top 4WD 2dr	12,849	11,821	12,294	92	63	25/27	No/No	VHi	4,400	420	24,897
Toyota 4Runner SR5 4WD 4dr	20,308	17,262	17,952	83	78	19/22	No/No	Hi	4,248	687	27,682
Toyota 4Runner SR5 V6 4WD 4dr	21,348	18,039	18,761	85	81	15/18	No/No	Hi	4,857	687	29,596
Toyota Land Cruiser 4WD 4dr	35,298	29,474	35,298	81	67	12/15	No/No	Hi	6,364	599	41,350

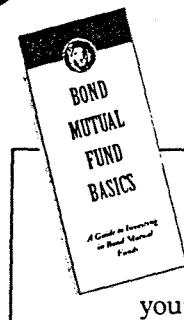
Pickups

Chevrolet C1500 Fleetside 2dr	\$14,027	\$12,274	\$12,765	86%	73%	14/18	No/No	Avg.	\$4,114	\$599	\$25,802
Chevrolet C1500 Fleetside 2dr ext.	15,854	13,872	14,427	86	80	14/18	No/No	Avg.	4,153	599	25,629
Chevrolet C1500 Sportside 2dr	14,690	12,854	13,368	86	72	14/18	No/No	Avg.	4,114	599	26,301
Chevrolet C3500 Fleetside 2dr	16,648	14,654	15,240	86	67	13/18 ²	No/No	Avg.	4,686	599	28,421

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹Dealer's average cost as a percentage of retail price. ²Estimate. ³Compared with other models in its class. ⁴Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts. ⁵Average five-year repair costs not covered by warranty. ⁶Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: IntelliChoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.

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Pickups

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ³	Five-year costs		
									Maintenance ⁴	Repairs ⁵	Total ownership costs ⁶
Chevrolet K1500 Sportside 4WD 2dr	\$17,031	\$14,902	\$15,498	86%	73%	13/17	No/No	Avg.	\$4,803	\$599	\$28,593
Chevrolet K2500 Fleetside H/D 4WD 2dr	19,035	16,652	17,318	86	N.A.	12/16	No/No	Avg.	4,869	599	N.A.
Chevrolet K3500 Fleetside 4WD 2dr	19,259	16,848	17,522	86	68	13/18 ²	No/No	Avg.	4,903	599	30,264
Chevrolet S-10 Long Bed 2dr	9,955	9,407	9,783	86	59	18/23	No/No	Avg.	3,660	599	23,526
Chevrolet S-10 Long Bed 4WD 2dr	14,455	13,660	14,206	86	60	16/21	No/No	Avg.	4,494	687	27,682
Chevrolet S-10 LS Short Bed 2dr	10,790	9,765	10,156	86	60	18/23	No/No	Avg.	3,697	599	23,386
Chevrolet S-10 Short Bed 2dr	9,655	9,124	9,489	86	61	18/23	No/No	Avg.	3,697	599	23,135
Dodge Dakota 2dr	11,472	10,460	10,878	85	53	17/22	Yes/No	Avg.	3,058	599	24,202
Dodge Dakota 4WD 2dr	15,838	14,342	14,916	85	50	16/20	Yes/No	Avg.	3,330	687	28,225
Dodge Dakota Club Cab Sport 4WD 2dr	17,471	15,779	16,410	85	58	16/20	Yes/No	Avg.	3,538	687	27,921
Dodge Dakota Sport 2dr	10,782	10,069	10,472	85	56	17/22	Yes/No	Avg.	3,202	599	23,543
Dodge Ram BR1500 2dr	14,389	12,686	13,193	85	56	13/17	Yes/No	Avg.	3,954	599	28,610
Dodge Ram BR1500 4WD 2dr	17,376	15,122	15,727	85	60	12/16	Yes/No	Avg.	3,976	687	30,200
Dodge Ram BR2500 Light Duty 2dr	15,916	13,984	14,543	85	61	13/17	Yes/No	Avg.	4,245	599	28,762
Dodge Ram BR3500 2dr	18,417	16,109	16,753	85	N.A.	12/16	Yes/No	Avg.	4,287	599	N.A.
Ford F150 Flareside XL 2dr	14,834	12,764	13,275	85	70	13/18	Yes/No	Lo	3,685	491	25,064
Ford F150 Styleside S 2dr	12,348	11,021	11,462	85	77	15/20	Yes/No	Lo	3,436	491	21,676
Ford F150 Styleside XL 2dr	13,956	12,018	12,499	85	74	13/18	Yes/No	Lo	3,622	491	23,987
Ford F250 Styleside XL 2dr	14,802	12,737	13,246	85	74	13/17	Yes/No	Lo	3,822	491	25,090
Ford F350 Styleside XL 4WD 2dr	19,336	16,591	17,255	85	71	11/15 ²	No/No	Lo	4,259	599	29,261
Ford Ranger Splash 2dr	12,545	11,154	11,600	85	N.A.	18/24	No/No	Avg.	3,031	491	N.A.
Ford Ranger Splash 4WD 2dr	17,413	15,438	16,056	85	N.A.	17/22	No/No	Avg.	3,324	599	N.A.
Ford Ranger Splash Supercab 4WD 2dr	18,328	16,244	16,894	85	N.A.	17/22	No/No	Avg.	3,324	599	N.A.
Ford Ranger STX 2dr	12,220	11,354	11,808	85	61	18/24	No/No	Avg.	3,366	491	23,001
Ford Ranger XL 2dr	9,449	8,808	9,160	85	61	18/24	No/No	Avg.	3,201	491	22,291
Ford Ranger XLT 2dr	11,171	9,945	10,343	85	62	18/24	No/No	Avg.	3,201	491	22,578
Ford Ranger XLT Supercab 4WD 2dr	16,828	14,924	15,521	85	55	17/22	No/No	Avg.	3,207	599	27,734

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹Dealer's average cost as a percentage of retail price. ²Estimate. ³Compared with other models in its class. ⁴Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts. ⁵Average five-year repair costs not covered by warranty. ⁶Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: IntelliChoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.

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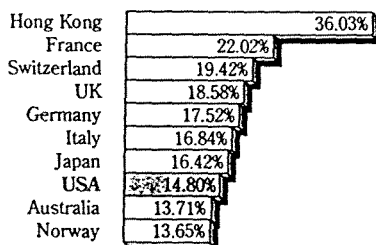
Pickups

Make and model	Suggested retail price	Estimated dealer's cost	Your target price	Option price as a % of retail ¹	Five-year resale as a % of original	Miles per gallon (city/hwy.)	Air bags available (driver/pass.)	Cost to insure ³	Five-year costs		
									Maintenance ⁴	Repairs ⁵	Total ownership costs ⁶
GMC Sierra C1500 2dr	\$14,267	\$12,484	\$12,983	86%	79%	14/18	No/No	Avg.	\$4,177	\$599	\$24,555
GMC Sierra C2500 Club 2dr ext.	17,882	15,647	16,273	87	78	13/17	No/No	Avg.	4,488	599	27,397
GMC Sierra C3500 2dr	16,820	14,717	15,306	86	68	13/17 ²	No/No	Avg.	4,735	599	28,726
GMC Sierra K1500 4WD 2dr	16,709	14,620	15,205	86	76	13/17	No/No	Avg.	4,840	599	27,591
GMC Sierra K2500 4WD 2dr	17,183	15,035	15,636	86	79	8/9	No/No	Avg.	4,874	599	32,125
GMC Sierra K3500 4WD 2dr	19,431	17,002	17,682	86	72	12/16 ²	No/No	Avg.	5,319	599	30,485
GMC Sonoma SL Long Bed 2dr	10,106	9,550	9,932	87	60	18/23	No/No	Avg.	3,712	599	23,475
GMC Sonoma SL Short Bed 2dr	9,806	9,267	9,638	87	61	18/23	No/No	Avg.	3,683	599	23,135
GMC Sonoma SLS Club 4WD 2dr ext.	16,613	15,035	15,636	87	61	16/21	No/No	Avg.	4,714	687	28,620
GMC Sonoma SLS Short Bed 2dr	11,138	10,080	10,483	87	61	18/23	No/No	Avg.	3,683	599	23,446
Isuzu Pickup S 2dr	9,399	8,506	8,846	83	55	22/24	No/No	Hi	2,940	492	21,439
Isuzu Pickup S 4WD 2dr	13,519	11,897	12,373	84	59	15/18	No/No	Hi	3,072	687	26,196
Mazda B2300 2dr	9,390	8,652	8,998	88	66	22/26	No/No	Hi	3,427	492	20,483
Mazda B2300 Cab Plus 2dr ext.	12,020	10,588	11,012	82	72	22/26	No/No	Hi	3,427	492	21,055
Mazda B4000 LE Cab Plus 4WD 2dr	19,500	17,177	17,864	82	67	16/21	No/No	Hi	3,881	599	28,137
Mazda B4000 SE 2dr	12,500	11,011	11,451	82	63	18/24	No/No	Hi	3,541	492	23,032
Mitsubishi Mighty Max 2dr	9,429	8,512	8,852	75	58	21/25	No/No	Hi	4,034	491	22,426
Mitsubishi Mighty Max 4WD 2dr	14,219	12,510	13,010	78	55	17/22	No/No	Hi	4,484	687	27,580
Nissan King Cab XE 2dr ext.	11,979	10,753	11,183	82	65	23/27	No/No	Hi	2,820	491	21,980
Nissan Pickup 2dr	9,459	8,876	9,231	74	58	23/27	No/No	Hi	2,820	491	21,339
Nissan Pickup V6 2dr	11,589	10,638	11,064	85	63	19/23	No/No	Hi	2,894	491	22,701
Nissan Pickup XE 4WD 2dr	14,069	12,629	13,134	79	65	18/22	No/No	Hi	3,184	599	24,552
Toyota Pickup 2dr	10,118	9,106	9,470	79	60	22/27	No/No	Hi	3,968	491	22,463
Toyota Pickup DX 2dr	10,998	9,733	10,122	83	64	22/27	No/No	Hi	3,968	491	22,555
Toyota T100 2dr	12,998	11,698	12,166	80	N.A.	21/25	Yes/No	Avg.	4,205	491	N.A.
Toyota T100 DX 4WD 2dr	18,438	15,857	16,491	82	N.A.	14/17	Yes/No	Avg.	5,486	599	N.A.
Toyota Xtracab DX 4WD 2dr ext.	16,328	14,042	14,604	81	76	19/22	No/No	Hi	4,393	491	25,115

Notes: Insurance, maintenance and repair costs are based on 1993 model history. ¹Dealer's average cost as a percentage of retail price. ²Estimate. ³Compared with other models in its class. ⁴Includes scheduled maintenance plus replacement of tires, brake pads, batteries and other parts. ⁵Average five-year repair costs not covered by warranty. ⁶Includes depreciation, maintenance, repairs, state taxes and registration fees, insurance and fuel. N.A.: Not available. Sources: IntelliChoice Inc., AutoAdvisor Inc., Insurance Services Office and the manufacturers.

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Stock Market Returns¹



Average annual total returns for the 10 years ended 12-31-93.

Source: Morgan Stanley Capital International.

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Feb. 14, 1994

The Hon. Richard Katz
Chairman
Assembly Committee on
Transportation - Room 4202
State Capitol

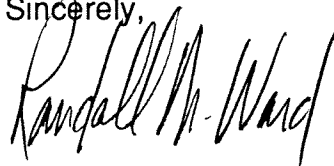
Dear Mr. Chairman:

On behalf of the Hybrid Electric Vehicle Coalition for Clean Air, we respectfully submit for the review and consideration of your committee the attached testimony on California's plan for fuel standards and clean vehicles.

Included in this package is a June 9, 1994, report on proposed modifications to the California Air Resources Board's low emission vehicle regulations prepared for the Coalition by Sierra Research, inc., of Sacramento.

If the members of the Coalition, or its representatives, can be of any assistance to you or to your committee, please do not hesitate to call.

Sincerely,



Randall M. Ward
Sacramento Representative
HEV Coalition for Clean Air

**Testimony of The Hybrid Electric Vehicle Coalition
For Clean Air
Submitted to the Assembly Committee on Transportation
Hon. Richard Katz, Chairman
February 14, 1994**

Mr. Chairman, members of the Committee, the Hybrid Electric Vehicle Coalition for Clean Air appreciates the opportunity to submit testimony on California's plan for fuel standards and clean vehicles. The Coalition is composed of a number of companies involved in the production of batteries and materials used to manufacture batteries.

The Coalition respectfully submits this testimony for the single and simple purpose of explaining how the Hybrid Electric Vehicle (HEV) works and why it should be a part of the solution to the air quality problem.

HEVs are battery-powered vehicles that use a small auxiliary power unit (APU) to either extend the range of the vehicles or keep the batteries charged. The APU can also be used to drive the vehicle directly, but the Coalition recommends the first type. The APU would be optimized for low emissions, fuel economy and durability.

For the type of HEV we recommend, battery charging would primarily occur at stationary outlets, just like pure electric vehicles. On shorter trips the auxiliary power unit would not be needed and the HEV would operate as a zero-emission vehicle. On longer trips, the auxiliary power unit would "kick in" when the batteries reach a "low charge" condition. Enough voltage would be supplied to the batteries to continue operation until the vehicle can be fully recharged at a stationary outlet.

The type of vehicle described above gives the HEV what cannot be achieved by a pure electric vehicle at this time: The performance, range and carrying capacity of a conventional vehicle. You get zero emissions on all short trips and zero emissions on a portion of all longer trips.

A recent report by Sierra Research (attached) documents that HEVs will actually produce lower emissions than pure electric vehicles. That is because HEVs can be used on trips of any length, while pure electric vehicles must be replaced by a conventional polluting vehicle on longer trips. For example, you could drive most pure electric vehicles from Sacramento to Stockton, but you couldn't make the return trip without a recharge that could take up to seven hours. Similarly, a trip to Los Angeles would take over 30 hours.

As shown in the Sierra Research report, use of Hybrids result in more all-electric miles than some pure electric vehicles (PEV) even if the PEV has a range of 100 miles. Average HEV emissions would be less than a third of those of a PEV and a conventional polluting vehicle in combination.

In 1990, when the Air Resources Board adopted its regulation requiring two per cent of the automotive fleet being offered for sale in 1998 to emit zero emissions, they were, in effect, mandating pure electric vehicles. No other economically available technology can achieve zero emission status.

In 1998 pure electric vehicles are expected to have a range of between 50 and 100 miles. The upper range is achieved by sacrificing passenger space and luxuries such as air conditioning. The lower range allows the vehicle to transport a passenger.

As the technology has evolved to date, pure electric vehicles have considerable drawbacks as a family vehicle or for longer trips. Most pure electric vehicles will not be able to take a family to the movies on a Saturday night. The passenger space is needed for the batteries. A 50 mile range limits use to less than 50 per cent of an average motorist's travel. If the range is 100 miles, it still is limited to only 70 per cent of all travel.

The "Achilles Heel" of the pure electric vehicle is the battery. While much research and development is occurring, it is highly unlikely that we will see a

battery that more fully satisfies the driving time and distance requirements of most motor vehicle purchasers for at least 10 years.

Hybrids overcome those problems while making important contributions in the fight for cleaner air. By reducing the number of batteries required, and utilizing an auxiliary engine that meets all existing low emission standards, HEVs reclaim space for passengers and cargo and give the vehicles useful range. In short, emission-free miles can be driven by hybrids where pure electric vehicles would be left in the garage.

Unfortunately, when the Air Resources Board adopted its zero emission regulation in 1990, it did not give proper credit to the zero emission part of every trip made by a ZEV.

When the Air Resources Board reviews its zero emission regulation later this year, the Coalition hopes to gain recognition for hybrid technology. If improving air quality is truly the goal, hybrids are far too important to be left in the garage.

**Hybrid Electric Vehicle Coalition
For Clean Air**

Membership List

GNB Battery Technologies

Johnson Controls, Inc.

Asarco Incorporated

The Doe Run Company

Trojan Battery Company

Cominco

RSR Corporation

Yuasa-Exide, Inc.