

## **Dr Alan Lloyd**

Thank you very much indeed. And it's really my pleasure and honor to be here today to participate in this excellent conference and to participate with my distinguished colleagues on the panel. Most of them are friends and I've known for some while. And I think it's a real honor.

The organizers have indicated that they are exercising strict time limits. So later on, I have to exercise those time limits. So I will move on as quickly as possible.

I think one of the -- what I would like to do is just to go through very quickly California's air quality, the ZEV regulation and what that's developed, the California Fuel Cell Partnership and the new program for us, which is a really exciting program on addressing global climate change emissions from automobiles and then some conclusions.

I think it's important to recognize that the very driver for California continues to be public health, whether it's conventional pollutants, toxic pollutants and, more recently, looking at the impacts of global climate and emissions on public health. This is the very thing that sustains us. And the more we understand about public health and the impact of pollution on public health, the more we recognize that we have to keep, in

fact, on cutting down on pollution. And there are many ways in which pollution can affect human health.

You can see here that if we ozone, the number of days, look at the red days, 100 days over the ozone standard, federal standard. And if you look at the right-hand side that shows the particulates, two of the key pollutants that we have to address.

Things are only going to get more challenging when the EPA promulgates its eight-hour ozone standard. So some of the areas that now have healthful air quality, such as San Francisco, when you get to the eight-hour standards, we predict will become an attainment.

I'd like to address some of the key motor vehicle regulations through the years. And again, I think I'd like to also express my appreciation for the tremendous work that EPA does and of recent years, under Margo Oge. And she'll be speaking later on. But I think Margo has done an outstanding example of the outstanding work at EPA. And we rely very heavily on their expertise and working together as we move through the regulatory aspects to reduce emissions.

And you can see here, as we started off in 1990 and going through to score in time, you will see that we are looking at treating the vehicle and fuels as a system. I

think this is very important and has stimulated the development, low-emitting vehicles and cleaner fuels.

The left too, in fact, required the reduction of NOX and BOC emission from cars but also required light trucks to achieve automobile emission limits. And that was a major advance in that case. And, of course, the auto companies then redefined the light-duty trucks. And so, they tend to go larger and larger.

I think the overall lead program was the first in the world to identify the true zero-emission vehicle, at least zero- emission from a tailpipe of viewpoint. I think it stimulated clearly the development of more efficient and cost-effective vehicles powered by electricity than the hybrid gas and electric and, more recently, by fuel cells.

Just a refresher here on the more recent changes on the ZEV program, this shows the basic cut of recent terms in terms of what was a-10 percent pure battery electric mandate. And so, you've got the two-percent ZEV piece, which basically looks at some of the technologies that can qualify as a true ZEV, the battery electric, the fuels start running on hydrogen and both small and large.

And then you've got the 6-percent, what we call the super clean vehicles, the PZEV. And you have two excellent examples outside. So you are not limited now, you can, in fact, get a super clean car, and you get performance. You don't have to

sacrifice performance for emissions. There is no tradeoff. And I understand that EPA had a very effective event here a few days ago, again, also giving a more expansive display of some of the technology that can be accomplished.

Again, I would like to applaud the manufacturers for the job that they have done. When you look back and this vis-a-vis vehicles which meet our stringent, super ultra-low emission vehicle emission standards, and they have zeroed that. And the warranted that that emission system is warranted for 150,000 miles. To me, that's a challenge which, again, we really owe a debt of gratitude to the auto industry.

So while we cajole and push and what-not, I think the job that has been done has been just outstanding. And we all benefit. Breathers benefit from that. That was also with cleaner, burning gasoline.

And then the other category we have are what we call the advance technology, a partial zero emission vehicle. You've got an example out there of the Prius. It can also be the natural gas vehicle, another example you've got out there. And you can have things like the plug-in hybrid. You can also have the hydrogenized C engine. So a whole menu of vehicles that can satisfy that category.

This is just one example, by the way, if you map out what could be done. And before my good friend Kelly Brown from Ford jumps up and down and looks at

these numbers and says, “Well, wait a minute. You’re going out to 2020.” I would say that, and I see Reg back there as well.

I would put the caveat that, clearly, we are looking at, what’s the years?, in 2005; we are expecting close to 300,000 PZEV type vehicles on the road, 2010 - 750,000 and then 2018 just over a million. These are the super clean car, the PZEVs you see out there – in contention.

The other category in terms of the AT PZEVs, I think we could recognize also the fuel cell truly ZEVs. We could recognize that the recent modification or the regulation called for technology review in the 2006 time frame. And it was agreed that the view of the technology would maybe dictate the numbers in future years.

So if you look at fuel cells, for example, there could be up to 250 vehicles in the 2005 to 2008 time frame. And they were approximately broken down into Ford 51 vehicles, Nissan 17, DaimlerChrysler 17, Honda 48, Toyota 57, GM 62. That’s broken down based on the sales in California.

I mentioned, again, the characteristics of the PZEV super clean. You can see there are 195,000 expected to be sold in California in 2004. Recognize that in the state of this is roughly about 1.7 million new cars sold in the state per year. And you can see already, you’ve got 37 models available. So you can go the full gamut from the

smaller cars to the affordable, all the way to the BMWs. You can, in fact, get performance and low emissions with cleaner burning gasoline.

Then, if we look at the vehicles here. Mentioned the Toyota Prius, the Honda Civic GX and then the recently announced hybrids, which are coming on line from basically all the manufacturers. And you can see we are expecting about 20,000 sales in California in 2005, and maybe larger based on the demand that we see for some of the hybrids. In fact, we see the demand outstripping production.

About the electrics, they are still on the menu, although we recognize the challenges with cost and range. You can see what we've typically seen, smaller vehicles. We've also seen the pairing of battery with fuel cells in terms of the fuel cell vehicles being hybrids. And then, we've seen some of the neighborhood electric vehicles, which are filling niche markets. But a surprising number of vehicles are being sold in California for that purpose.

And again, people said to me recently, "Well, you gave up on battery electrics too early. You haven't seen the recent advance on nickel – on lithium iron batteries." And we say, "Well, we have a technology review coming up in a few years.. If, in fact, your predictions come true, then clearly the auto companies are going to be looking at that as a viable option as well."

Fuel cell vehicles, again, you see an example outside, two examples outside, one cut away from Nissan. The other one is from General Motors. And again, this has promising technology the opportunity for higher fuel economy, greater efficiency, quiet and smooth operation. You can see there.

And also, it's interesting that most of these now are also hybridized. We recognize that the challenge is here in terms of significant cost, manufacturing, performance and challenges, operation at low temperatures and high temperatures. But again, they have a tremendous amount of promise.

And that is being recognized in the California fuel cell partnership. And this was announced in April of 1999 in California by then Governor Davis. And to date, you've got 41 fuel cell vehicles operating at the partnership. You have eight car companies, three of those from Japan, four energy companies, seven government agencies, several associate partners, fuel suppliers operating in California out of Sacramento.

I think it's a wonderful example of a public/private partnership, where we are working together to demonstrate these vehicles, also to address the issue of infrastructure, which is becoming a reality.

Then, of course, two years ago, this program basically was delighted to see the announcement by President Bush, and the large program was announced by DOE. I think it's the first time that we saw Congress and then the president and people recognizing that hydrogen could, in fact, be a fuel which could be operating in the hands of the public and everyday use.

So I think that was a tremendously exciting boost for the partnership. And, of course, the DOE with its Freedom Car program is moving ahead very strongly. And we are expecting some announcements; they're talking about how the energy companies and the car companies are going to go ahead with various demonstrations in different parts of the country. Tremendously exciting. And we've seen other partnerships growing up in Japan. And we work very closely with a partnership in Japan, Mr. Akamatsu. We have exchanged with a partnership to share ideas and see how we can move things ahead.

Fuel infrastructure is a key part at the facility in Sacramento. We have some limited refueling capability for liquid encased. It's another public accessible station. We are looking forward to learning something from Japan, who have more public available stations.

We have plans to spread those throughout California. This is looking at the fuel cell infrastructure that's being aimed for. You can see all the way from northern California to southern California a mixture of public and private stations, many of who only have limited public accessibility.

We in California received a tremendous boost when, in fact, Governor Schwarzenegger, the newly elected governor, has, in fact, made a commitment to develop a hydrogen highway network throughout California. And this is to be accomplished by 2010. So again, you can see another public official stepping out and seeing the benefits of hydrogen this way.

And my boss, Secretary Tamminen wrote their environmental plan, hydrogen plan, and I think it's extremely aggressive. But, on the other hand, it gives us something to shoot for. But it'll have to be done in a public/private partnership.

So, in fact, the first piece of that will be to map out a program in a year's study so that some road map will be developed over the next year. And in this case, South Coast Air Quality Management Districts also have aggressive plans to develop up to 30 hydrogen refueling stations in the area. Next phase of the partnership is get more vehicles in the fleet, get more experience expounding the fueling infrastructure and, obviously, preparing communities and public education.

I'd like to move on to another issue, which we recognize more and more, and that is climate change and the recognition that we have one atmosphere, whether we are looking at greenhouse gases, in the case of our case focusing on CO2 methane, nitrous oxide and some of the CFCs. But they also intermingle in the atmosphere. So really, it's very difficult to separate out.

We've seen the impact of climate change. We see hotter days leading to more smog. We see the impact of time and change on rainfall and snowfall, redistribution, which can have dramatic impacts on California's agriculture. We've seen the potential impact, and seen the increase, on the coastline in California over the last 100 years -- so many reasons.

And then, of course, we see the impact of hotter temperatures on ozone and fine particles, which can give us greater health concern. So, it's going to give us more difficulty reaching our health-based air quality standards. So, I know this is an example where you can see the hotter temperatures lead to more ozone. And you can see the standard California ozone standards. You can see as temperatures go up, you can see ozone levels also go up, correlated also, obviously, with meteorology, not just chemistry.

Climate change legislation: This was landmark legislation passed by, authored by, Assemblywoman Fran Pabli, signed by Governor Davis. And I think it basically recognized that global climate change, global warming, is of increasing concern in California. And there are many efforts underway to address this, not least of which the Western governors are having an agreement to address those issues.

You can see the 1493 itself is very vague. It doesn't tell you very specifically what you should do. But it's very specific in what you can't do. So you cannot limit model availability and such things. So you can see it has to be based on maximum feasible, cost-effective reduction. It has to apply to models 2009 and later model years.

So the regulation will be developed this year. It'll come to the board in September. It will be presented to the legislature and the governor January 1. It will be validated for a year, and then, it will become effective in 2009. And you can see the key parts there to provide flexibility and not mandate specific technologies.

You can see that this will lead to, I think, pretty challenging opportunities to look at technologies. I think this leads to pretty significant opportunities to look at technology. And I think it's something, which has full public support. And for those who look at the changing California, where we moved from a Democratic governor to a

Republican governor, it's amazing that, in fact, this governor has come out even stronger on supporting this legislation than the previous governor because he's said not only will he support it, but he will defend it. And what he meant from that is that we expect significant challenges from our friends to the East. So he will be there to work and defend the bill.

So I think the other good news of that, this is something, in all honesty, that over the years when I visited the auto manufacturers in Japan, they used to ask me, "Why is California and the U.S. not more concerned about climate change?"

Of course, a few years later when I went back and said, "We have legislation which requires us to set tailpipe standards for global climate change," they were pleased that we were addressing the issue. But I don't think they were quite as pleased in the manner that we opted to address those. But I think that it aligns us with many other areas, which are really concerned with climate change.

And we're expecting some interesting developments to come out in terms of what type of technologies can be utilized. At least, I've been surprised so far to see that the evolutionary technologies can be utilized.

So in summary, I think it's very clear that we need to continue to act to protect human health. The issue here is the air quality and climate change. We can say one

of the futures that we are looking at overseas hydrogen, which is a non-carbon fuel, addresses many of the issues although it has many challenges with it there.

The other thing we are reminded of time and again is that we have to keep our focus on where we really want to go. I know it's you can't get there immediately, but as we look at the transport of pollution around the world, as we look at the impact of technology in California, as we look at the problems we have addressing onroad vehicle emissions, we must remind ourselves that the ultimate goal, if we can in fact get to the type of technology -- renewable technologies which will give us true zero emissions with a full fuel cycle analysis -- that will be an objective.

It's going to be a long way coming. But the sooner we start and continue that program, the better. Thank you very much.