



Institute of Transportation Studies
Center for Urban Infrastructure

In partnership with
**National Fuel Cell Research Center
Advanced Power & Energy Program**

and in collaboration with
**Caltrans, California Air Resources Board, US Department of Energy and
the American Association of State Highway & Transportation Officials**

White Paper
Results of March 3, 2005
Workshop in Irvine, CA



Sponsored by the South Coast Air Quality Management District

Moving Forward:
**A Second National Workshop for State DOTs, DEQs,
MPOs & Alternative Fuel Stakeholders**

**Workshop Transcripts, Findings & Recommended
Steps Toward a National Strategy for New Fuels**

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1 Introduction & Background

1.1 Background

On December 9-10, 2003, the Center for Urban Infrastructure at the University of California, Irvine's Institute of Transportation Studies, (CUI), convened a first-of-its-kind gathering to link state Departments of Transportation to the diverse range of stakeholders within the alternative fuels community—including oil companies, automakers, alternative energy providers, infrastructure companies, university and private research and development units, environmental organizations and public interest groups. Ten states—including four of the most populous, California, New York, Florida and Texas and some of the least populous—Vermont and Idaho, were represented, as were the states of Washington, Hawaii, Nevada and Missouri. After a day of review of pertinent issues related to the conference theme, "The Transition to Alternative Fuels: What that means for transportation, homes, businesses and communities" the second morning was spent in an intense review of state initiatives, policies (or the lack thereof) and concerns.

Following is a list of issues discussed.

- ❑ US DOE will not be making a decision on a technology choice until 2015
- ❑ Without immediate action, at least 11 years of trend-line emissions (criteria pollutants as well as greenhouse gases) will occur until that time, and national fleet turnover will add to the time lag needed to reduce serious global warming impacts
- ❑ Introduction of alternative fuels will have significant impacts on revenue in a context of ever-increasing congestion
- ❑ Currently, ad hoc decision-making occurs in many states, and it does not appear that top leaders in state DOTs are completely aware either of their own or other states' key technology decisions
- ❑ Lack of uniformity has a price tag
- ❑ DOT fleet decisions can have a bigger technology and economic impact if made in a coordinated fashion (not necessarily the same, but complementary!)
- ❑ Slows down technology development
- ❑ Makes infrastructure application and consumer adoption more expensive
- ❑ Adds to uncertainty for industry and the public
- ❑ Lack of communication has a price tag
- ❑ States like Florida are ahead of the curve and can save the rest of us from reinventing the wheel
- ❑ Program innovation, partnerships and lessons learned can be usefully shared

A follow up conference call including Caltrans and the other nine DOTs resulted in consensus on the value of CUI's forum and the importance of continuing the discussions and to begin to resolve identified obstacles to implementing alternative fuel solutions.

Given these and other issues, California DOT (Caltrans) gave CUI the signal to reconvene the group for a focused, one-day workshop to address policy uniformity. Interested states would have the opportunity to work with CUI to develop a core of draft policies and/or practices that could be adopted by the states, and advanced at the federal level.

The full conference white paper can be downloaded from CUI's website at: <http://www.c-u-i.org/uploadFiles/edited%20white%20paper%20for%20publisher.pdf>

1.2 The March 3, 2005 Workshop

The Center for Urban Infrastructure developed the March 3, 2005 workshop, entitled *Moving Forward: A Second National Workshop for State DOTs, DEQs, MPOs & Alternative Fuel Stakeholders* in close coordination and with critical assistance from Scott Samuelsen, Director of UC Irvine's Advanced Power and Energy Program. Additional input was provided from Caltrans, UC Irvine, UC Berkeley, UC Davis and, through use of an on-line poll, many of the state DOTs and DEQs themselves.

This white paper was funded through the generosity and commitment of the South Coast Air Quality Management District.

The workshop was funded in part through a grant from the United States Department of Energy, and from the following sponsors:

American Honda
Automobile Club of Southern California
California Hydrogen Business Council
Clean Energy
Nossaman, Guthner, Knox & Elliott, LLP
Orange County Transportation Authority
Parsons Brinckerhoff
Parsons Corporation
South Coast Air Quality Management District
Trillium, USA
University of California, Irvine, Department of Planning, Policy & Design

2 Transcript of March 3, 2005 Workshop Proceedings

The oral presentations of each speaker are presented in this section, with very little editing. Keep in mind the difference between spoken remarks and formal written material, and do not fault the presenters for occasional sentence fragments and the like. For the convenience of readers of this report, hyperlinks to slide shows housed at CUI's website are included below the names of all workshop speakers who referred to PowerPoint presentations during their remarks.

2.1 Welcome & Opening Remarks

2.1.1 Sarah L. Catz, Director of UC Irvine's Center for Urban Infrastructure

Good morning. I'm Sarah L. Catz, and on behalf of the UC Irvine Institute of Transportation Studies', Center for Urban Infrastructure. I'd like to welcome you to our 2nd national workshop for State Dept. of Transportations, Environmental Quality agencies, Metropolitan Planning Organizations and other stakeholders.

A little over a year ago, CUI in collaboration with Scott Samuelsen, then Caltrans Director Jeff Morales, and the National Fuel Cell Research Center, the Advanced Power & Energy Program, the California Department of Transportation and AASHTO, brought together a group of very diverse stakeholders as well as 10 DOTs, including New York, Florida, California, Texas, Hawaii, Nevada, WA and Vermont to start the dialogue about the need for an alternative fuels national coordinated policy. At this first of its kind gathering, several issues were discussed. You'll find a yellow one-page summary of that conference in your packet. I urge all of you to take a moment this morning to read it. Many issues were discussed. But one of the most striking issues uncovered was that lack of communication—whether it's within your own organization and state, or with each other, has a huge price tag. And we can't risk harming the gains that we've seen to date.

The overwhelming consensus upon the conclusion of that gathering was that we needed to reconvene on a regular basis. That is why we are here today.

We wanted to keep this gathering fairly intimate and interactive. We will have brief presentations today, but we urge all of you to participate by asking questions and sharing your experiences and background.

One housekeeping item, when you do take the microphone, please identify yourself because we are audio taping today.

Our first short break will be at 10:15am, and we will have a working lunch right outside in the atrium. Like breakfast, you will go to the back of the hall and select your food, and then be seated outside the auditorium.

We've also added a reception today, from 4:30pm to 5:30pm. Unfortunately, Caltrans Director Will Kempton had to make a last minute appearance at the California Transportation Commission meeting this morning. But he will be joining us in the afternoon, at the 4:30pm

reception. He also has put together a relevant video message for us, which we will see in just a minute.

Today's workshop is being hosted by the same agencies I mentioned just a minute ago, as well as the US Department of Energy and the California Air Resources Board. We'd also like to especially thank our sponsors today—highlighted in back of me.

I also want to recognize and thank Deborah Redman, CUI's Program Director. She was responsible for conceiving the program agenda, and pulling the specific workshop contents, speakers and issues together.

I'd now like to introduce Scott Samuelsen, the amazing director of the Advanced Power and Energy Program at UCI. If you don't already know Scott, I urge you to read his bio in your biography package and get to know him today. It will be well worth your time.

2.1.2 Scott Samuelsen, Director, Advanced Power and Energy Program

Good morning. I want to welcome you to the conference and applaud your participation in this major endeavor under the leadership of Sarah Catz. We are indeed at the crossroads of two major paradigm shifts in the manner by which we propel and fuel vehicles. Either one would be monumental in its own right. On the one hand, the world is moving rapidly toward an alternative to gasoline and diesel fuel with hydrogen rising much more rapidly as a principal candidate than we could have imagined just two years ago. Secondly, the replacement of the reciprocating engine with a fuel cell powerplant is emerging with remarkable investments by major automobile manufacturers world wide. You are attending here today to both understand these options and, most important, to plan for and facilitate the regional, state, and federal policy and regulatory evolution that must anchor these two major paradigm shifts going forward.

A coordination amongst the states will substantially promote a clearer message to the market and, as a result, to the welfare of the public. The format and the series of conferences that Sarah Catz has outlined is designed to provide a path toward this goal. The speakers have been specifically selected to assure that you receive the most comprehensive perspective and latest thinking from those actively engaged today, from industry to governmental strategic planning, in evaluating and planning the various realistic and spanning scenarios for the future of transportation fuels.

Working with a variety of stakeholders including industry and government agencies, we are operating and leasing hydrogen-fueled fuel-cell vehicles to corporations in order to research and understand both the deployment of the technology and the associated refueling, but to also research and understand the attitude and behavior of the public and municipalities in reacting to and accommodating these paradigm changes. Please feel welcomed to contact the center at any time in order to visit and review these activities. For the moment, please enjoy today's agenda and, again, we welcome you.

2.1.3 Will Kempton, Director of California DOT (CALTRANS)

(Videotaped Greeting)

Good morning. I'm Will Kempton, Director of the California Department of Transportation. Welcome to California, and thank you for attending "Moving Forward: The Second National Workshop on Transitioning to Alternative Fuels, sponsored by the University of California, Irvine. Pressing business keeps me in Sacramento tonight, but I appreciate the opportunity to speak with you via the magic of this video.

This workshop is designed to bring together a variety of parties interested in advancing the use of alternative fuels. You come from public and private entities, industry and academia, environmental organizations, and public interest groups.

On behalf of Governor Arnold Schwarzenegger, I thank you for attending this historic meeting, which has the potential to influence the national discussion on transportation and urban planning as well as business and the development of communities in the future.

First, let me assure you, California is committed to researching, developing and implementing alternative fuels.

In his January 2004 State of the State address, the Governor set a goal for California to establish a Hydrogen Highway Network. This initiative is intended to help the state make a rapid transition into a clean, hydrogen-based transportation economy.

Through his action, the Governor has moved the state toward reducing our dependence on foreign oil, and to protecting Californians from the unhealthy effects of vehicle emissions.

Along a parallel path, I am pleased to report that Caltrans is continuing its work on the development of other alternative fuels. We are proposing a study of the viability of soy or other vegetable oils as a mix for diesel equipment in our 14,000-vehicle fleet. We are also "greening our fleet" by adding to it approximately one thousand fuel vehicles that can run on either gasoline or propane.

We now own 80 hybrid electric vehicles and are in the process of buying another 20. Our maintenance and construction workers employ nearly 350 portable, solar-powered "arrow boards" and changeable message signs to direct traffic on our 15,000-mile State Highway System.

Your agency or organization no doubt has its own alternative fuel success stories. So, I invite you to share those successes, strategies and the lessons you have learned with the rest of us during this workshop.

Many of you were here in December 2003 when the UCI Institute of Transportation Studies hosted the first-of-its-kind gathering of state departments of transportation and a wide range of others within the alternative fuel community.

The list of attendees was comprehensive and included oil companies, automakers, alternative energy providers, researchers, environmental organizations, public interest groups -- along with 10 state departments of transportation from across the United States, and in association with the American Association of State Highway and Transportation Officials.

After the successes of that meeting, many of you felt the need to continue working toward establishing a national policy for alternative fuels.

Now, you've been asked here again, or perhaps for the first time, to begin developing a core of policies and practices on alternative fuels technology that eventually will be advanced to the federal level.

I ask you to address that charge with the energy and initiative that the task deserves. Our generation is fortunate to be at the starting line in a marathon effort that may eventually result in unimagined new fuels and methods to harness them for transportation uses.

I commend you for being involved, and I wish you great success.

2.1.4 Catherine Witherspoon, Executive Director, California Air Resources Board

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/witherspoon.ppt>

Good morning. I'm very happy to be here this morning. I'm going to talk about the role of air quality mandates as they affect alternative fuels. A little bit of cold data about what Californians want in their vehicles. The applicability of some of the lessons we've learned to hydrogen, and some concluding remarks.

I realize this morning the utter hubris of this slide, because air quality is not the only driver of alt fuels. We of course have EPCRA, we have other energy mandates. But in California, where air quality is king, air quality has been used over and over again as the transcendent reason why we ought to pay the added expense to have alt fuels, force them into the marketplace, et cetera, and we have been losing force in that as a driver, because conventional fuels keep catching up to their alternative fuel competitors. And then there are contrary outcomes from alt fuels that complicate the picture. Some of them are bad for air quality. Some of them don't achieve as much as other technology packages would with respect to reducing air pollution or risk to public health, and when you add climate change, the picture shifts, and there are different winners and losers, but it also gets quite a bit more complicated and you have to figure out what the climate change impacts mean and if they're different from the air quality impacts, directionally, how you weigh one against the other. So we've concluded that overall, you don't have a sustainable path on the air quality side alone to justify alternative fuels. So what's missing, in my view, is a stable policy that keeps alternative fuels in the market for their own sake. Stable policies or mandates. I'm not an expert on the history of funding in alt fuels, but my impression is that it's feast or famine. Some getting consistent funding, others sort of going with historical swings. So we do need to value alternative fuels for their own sake. And one of the things that we've been kicking around is whether or not we ought to have a renewable portfolio standard in the transportation sector such as we have in the electricity sector, where we've just decided as a matter of policy that we want 33 percent of our power

to come from renewable sources. One could conceive of a similar policy for transportation. It needn't take this form. You could express fuel diversity in other ways. You could talk about carbon policy. But what I need to convey is that there needs to be an argument around which people can sort of crystallize their ideas and their energies. Ok. So where are we?

Ethanol is the most enduring alternative fuel, to our great chagrin, in some cases. We don't dislike ethanol—we'd love to embrace it, from the air quality side. But it's harmful to air quality in the summer months. It's more volatile in blending with gasoline, and we've been doing research over the last year about the effect that ethanol has on the hoses and the gasoline control system, and it's permeating out through those hoses and taking the hydrocarbons with it. And so we're losing air quality benefits, and if we ever get a waiver from the federal government for oxygenated fuels as an ozone strategy, it would be our desire to push ethanol into the winter, and to push toward E-85 blends where you don't have the same volatility problem. That, of course, is more expensive.

Biodiesel. Very popular. In California, we have some cities that have embraced it completely, for their entire city-owned fleet, like the City of Berkeley. But the blends do not meet our diesel control rules. Biodiesel in general has less particulate emissions than conventional diesel, 25 to 50 percent less. But we have control rules that aim at 85 percent control. And so as they are adopted and as they take effect, they are going to push biodiesel out of the market. That's not sufficient. So this is an issue that has come up to our board. We're going to be looking at it more closely and trying to figure out, can we reconcile that or not. And there are more official specifications for biodiesel, which has been a problem. There have been warranty issues. Some manufacturers will void their warranties when biodiesel is used in their engines. Not all. And it hasn't been subjected to multi-media review, which conventional rules are required to go through in California when they are mandated for use in the market. So some people think biodiesel needs to be more rigorously defined, more rigorously evaluated, before we rely on it more.

Natural gas has been a success story when it's wanted. When you have mechanics and transit districts and politicians all working in harmony and wanting to make it succeed. And where you don't have those ingredients, some of the troubles you encounter in the field become fatal. "We didn't want to buy this in the first place, you made us buy it. Take these away from us. We want to go back to diesel." Also, diesel is catching up on performance. By 2010 you see convergence in performance of the two. We have the living problem of hot gas on the horizon as LNG is brought into California from other countries. And that won't hurt new natural gas engines, but it could damage some of the older ones on the road.

Propane's very attractive. We've always liked propane. But it's not really expanding in California. We see it more in niche applications. And also, the propane industry, where they've been doing retrofit kits for gasoline vehicles, they're not stepping up to have those tested and verified to meet the more stringent standards, so there might be an issue, too, of it being pushed out, too as the standards get ever more stringent.

Electricity. Hybrids. We think hybrids are the success story of our zero-emission vehicle mandates. We didn't get mass produced battery electric power cars, but we are seeing hybrids enter the market. Neighborhood electric vehicles, NEVs, are still here and still being sold in

California. Plug-ins are on the verge, I'm not sure of what—but you hear about them everywhere you go. And there are a couple of prototypes and demo vehicles and they're looking for their home in regulatory incentive programs.

I didn't put the heavy-duty categories on here and the utility categories. And of course we have electric forklifts. We've got electric equipment at airports, and there's a lot of dialogue going on in California about electricity for marine ship powering when they're in port, and electrifying rail lines to reduce their enormous emissions impacts.

I'm not going to go into hydrogen in great detail because Daniel Emmett's here and he'll talk about that. And you heard Will Kempton's remark about the Governor's hydrogen highway initiative and DOE. I'll just say it's all the promises of the other alt fuels, but with some unique hurdles of its own.

Polls have been done over the years, and Californians overwhelmingly support our air quality programs. I think that's why you see bipartisan support and have for several decades here. They also want cleaner cars. But they don't want any compromises. And so, for example, when we got into our greenhouse gas standards, it was mandated to us that we not in any way affect weight by our regulations, and certainly not performance, we wouldn't want to. And certainly not performance, we wouldn't want to. And price and value is an issue and it's the one that's going to come up in our technology reviews about whether we have a mass market product or not, as we're increasing the penetration of hybrid vehicles, for example.

These are some questions that have come up lately. Do we want home refueling, such as the Honda natural gas system, with Phil, for in your garage? Do they want the plug in option? The plug-in vehicle advocates think they do. Do they want the ability to power their house off their transportation fuel source, which is one of the promises of fuel cells? Will the value proposition change?

Some of the applicability to hydrogen, looking ahead. The vehicles have to be better than what's out there. They're going to be more costly for a long time. They have to be better. They have to be different. The near zero competition is fierce. There's a face-down going on between hybrids and diesel at the moment, sort of looking ahead at the 2010, 2015 timeframe. And when hydrogen arrives, how it will equate with those rivals. We've also seen that if you want mass market, you've got to think mass market from the beginning. Niche vehicles don't escape their niche. And so, certainly for passenger cars, we've found that to be true. And then infrastructure's key, which is why the Governor's investing so much in the highway network.

Some things to consider. If we were to have policies such as I've talked about at the outset, who's going to pay for them and how are they going to pay for them? In the electricity sector, it's easier, because you have a partially regulated, pretty heavily regulated market. You've got rates, you've got opportunities to use those revenue streams and divert resources in a particular way. We don't have that in the fuel sector at the moment, not really. And as for making these choices in California, and in any other state that's here, what premium do you put on in-state production? For ethanol, one of the big attractions is that we wouldn't be buying Midwest corn, but be buying cellulose produced in California, dealing with waste issues, etc. One would think you'd put a high premium on that. What about the negative impacts? They

don't necessarily go away just because you're an alt-fuel policy and what impact outweighs the other? And that's particularly important for us on ethanol and biodiesel. And then a few years back, the Air Resources Board and the California Energy Commission did a report on reducing California's petroleum dependency. And we analyzed what is was possible to do, and what might one have to implement in order to achieve that, and in that report, we said yeah, you could do that, you could get 15 percent below 1990 demand, if, among other things, Congress adopted a 40 mpg CAFÉ standard, which they have not. If you add hydrogen early and were able to go to mass market, I think it was 2015. And then we also recommended, for fuel diversity, 20 percent alt fuel penetration by 2020, and 30 percent by 2020. Is that realistic?

We need a sustainable policy driver to make this go. I think we had a chance with producing one in California. This administration—Governor Schwarzenegger—came to office with a desire to reduce petroleum dependency, with a huge commitment to hydrogen, and we detect some of the same commitments to other alt fuels. If he hasn't fully articulated his views, certainly other people in the cabinet are thinking along these lines. Air quality effects are not enough and are not always supportive, and it's all about money in the end. But one of the way to get the money is to get more rigorous about quantifying the benefits so that public policy makers and those taking the hit for changes in tax policy, changes in fees, redistribution in wealth—whatever, have the arguments to justify those policies.

2.2 The Lay of the Land: What the States Are Doing

2.2.1 Deborah Redman, Program Director, UC Irvine's Center for Urban Infrastructure

I'm going to talk for a few minutes about the surveys we had on line for several months this past year. Many of you have filled out the survey, and I thank you for taking the time to do that, because we used that information to structure this program. We tried to make sure we were responsive to what you were interested in. We had about 45 total responses. Twenty-four—almost half—of the state DOTs responded, so that's pretty good representation. We received responses from eight state DEQs and 10 state air resources boards/air districts—mostly from California, because we strong-armed them.

We asked the DOTs what fuels they were using, for which purposes. Not surprisingly, for light duty vehicles, we see a tie between ethanol and CNG. And for the heavier-duty we see clean diesel and biodiesel. Not too much happening with stationary—only one response. And people aren't doing, or have moved away from employee fleet vehicles.

Then we asked DOTs how they felt about the programs they were implementing, whether they though they were effective in achieving their stated goals. The kinds of programs, obviously, were fleet vehicles, more doing promotion and public outreach and bringing internal staff up to speed. The majority of responses indicate these programs basically met expectations. What I would be interested in hearing from people today is really, what about the folks who responded, "Has exceeded expectations?" What did you do to make the program go beyond what you hoped for? And also, tell us what happened in cases where the programs didn't meet

expectations. Where were the problems? Because those two sides of the issue I think will be most helpful.

Next, we asked the DOTs and DEQs to identify roadblocks and obstacles. For both DOTs and DEQs, the first two responses were “lack of funding” and “technical obstacles associated with the preferred fuel.” And then we go down to seven responses in both categories was that there was competing or conflicting institutional rules. And that’s something that Catherine has started getting at—are you going for air quality, or global warming, or energy savings, or availability of infrastructure, or what exactly are you keying off of? Surprising to me was that “lack of political support” was a less frequent response in both, though higher in DEQs’ responses. What I’m thinking is that hidden within the “lack of funding” and “technical obstacles” are these other issues of institutional support, political will, internal education, that if we actually galvanized to solve some of these other problems and articulated the reasons why we need to do these things—if we keep on coming up with the reasons and benefits of doing this for different interest groups, we should be able to be more effective in getting the funding that we lack, to move forward and solve the technical obstacles. I think all of these roadblocks are interrelated and I think our job here today is to figure out how to start tackling in them a way that addresses them all at the same time.

2.2.2 Bill Van Amberg, CALSTART

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/Van%20Amburg%20UCI.ppt>

Welcome. I hope everyone’s awake. I am really pleased to be here, and thanks for the invitation from UCI and the sponsors of this event. I think we’ve got a tremendous panel here this morning with an awful lot of expertise on what does it take, and where are some of the pitfalls moving forward. I think Catherine did talk about that I think, from the perspective of CALSTART, which is an advanced transportation technology consortium, that we have certainly seen over the last 13 years of our life, one of the things that we’re really starting to come to is the tremendous need for integrated solutions. We have been driven by individual efforts. There’s been EPACKT and there’s been the tremendous air quality needs, especially urban air quality needs, and California has been as far along as anybody in the world on some of that. But now we’re facing energy security issues, we’re facing global warming issues.

So the supply nature of that fuel—have we reached a peak, and are we getting into a more and more expensive mode for some of those fuels? These are becoming some of the things that we have to consider as we look forward in our programs. And I think from the state levels, we are all frustrated at times, that there is no national energy policy. We’re seeing an awful lot of those policies—air quality, energy and a variety of others, starting to really come from the state levels. And states and agencies working together. There’s almost a groundswell of a de facto policy that’s starting to coalesce around an awful lot of innovated and motivated people at the state and regional levels who are starting to push things forward. So what I’d like to do is set a framework, certainly from the perspective—this isn’t to be the only example of the way things might work, but it’s an example of how things maybe have worked from our experience level. And one other thing, if you happen to look at my bio, and it mentions that I’m an anthropologist by training, and you think, well why is this guy talking about advanced technology—well, it’s because it’s not about the technology. It’s about people. Why do people

change? We have tremendous technology and potential fuel changes that we can make. But what's going to make people make a decision choice? What's going to help them move along that path? That's why anthropologists have work these days.

Quick perspective. Calstart represents in many ways a knowledge network. And I think in many ways what you're seeing here is people who have tapped different versions of a knowledge network. They really do work. There's a tremendous amount of innovation and energy. They're inherently loosely structured, and in some ways, some people call that herding cats. But it is not top-down. There's an awful lot of innovation and new ideas when you tap a lot of people on a network. There's incredibly rapid information dissemination and they're very adaptable to change. They can move in different directions very quickly and tap different capabilities. They also really respond best—and Catherine mentioned this about having some longer term policy targets to aim toward. That's what these knowledge networks and probably all of us respond best to. What's the big target? What's the big bogey we need to head towards, and then allow people to move towards that solution with some kinds of built-in policy and incentives that are going to be there for a while.

Quickly for those who aren't aware of Calstart, and now we use the name WestStart. We're kind of Hellman's and Best Foods mayonnaise. If you're on the east side of the Sierra Nevada, you know us as WestStart. I think we realized just about two years into our launch in 1992 as Calstart, that obviously, the whole industry doesn't start and stop at the boundary of the state of California. So we are a nationwide organization. We obviously even have participating companies internationally, but mostly it's based in North America and the US. But it really is a consortium or a network of almost 120 now different companies, mostly private firms, but also public agencies, involved, in looking at how to move forward advanced transportation and the technology industry that supports. You don't have to read all of these slides, it's just to give you an idea. This is the kind of range of companies that are in the knowledge network. As large as, you can see, Volvo, GM, Freightliner International, and as small as one- and two-person startups, but mostly in between. The point is that it's a resource base that can be tapped as new technologies and approaches are needed.

Now, not everything is a success. And I think, looking back, I think we all thought that certain fuel types and certain technologies were going to come a little faster than most of us, well, than really turned out. I remember when we put the first hybrid bus on the road, in the nation. It was at an air force base, Vandenberg Air Force Base. About three months later, the battery pack burned. But you learn from that. And these were early efforts back in the mid-90s, where the technology was really starting to [rope out?] But again as Catherine pointed out, there are successes that came out of some of those early efforts in technology and regulation that led to the capabilities that are now here today. In natural gas, many of the alt fuels, in advanced technologies such as hybrid drive lines and other capabilities. And it has led to some interesting things. This is a program that I just threw up as an example of something where tapping a network of capability and finding out what the end user requires can lead to some interesting and very fast movements. This is a program we run with the US Army called the hybrid truck users forum. The point of this is to find out, ok, what fits with commercial users' needs with what the army has already invested in, in terms of drive-line sizes in heavier and medium duty trucks. And how can we leverage off that to move more quickly forward to develop a commercial marketplace. The army likes this because that means cheaper product to

them down the road. Right now there's more than 60 national fleets that are involved in this. So what the effort has done has spread out across the nation among end users—fleets that are interested in this new capability, as they look at, ok, what's going to happen to our traditional or conventional diesel engine by 2010. What's happening with fuel costs? I have to start looking at maybe some new capabilities, especially if there's a business case attached to it. As part of this effort, and this is just one of them, we have a bunch of working groups made up of fleets and different segments or applications. This is one truck that's going to be moving forward, it's a Class 7—up to 33,000 pounds, a fairly large vehicle, in a utility application. And 20 of them, as a pre-production truck will go out onto the road over this next year, leading to the initial commercial production and starting in 2006. Low volumes, still, but the point is, it's starting to move forward in raising those volume levels so you can drive down price. And this was made up of fleets that came together and said, "Let's not specify exactly what we may want down at each of our levels, where we all want something customized. Let's find the most levels of commonality that we can determine, and move forward from that, to really help launch the commercialization."

At the same time, you can pull together—and this is an example of what's been done by these different groups here—to pull together different folks who can coalesce around the idea that we need to be working together to move things forward more quickly. So these are some of the groups that are supporting an effort we're leading on a national level, to develop, if we can do it, up to \$150 million for fuel cell and hydrogen, plus research, over the next six years. The point is, what can we do in the meantime when we need to put other technologies on the road to advance the state of the technology for where we maybe need to go to. But it's real important to have at least the star you're guiding by—what's the direction you're heading toward, and how can you stay stable in that direction. Well, getting back to what I said in the beginning, we don't believe there's any silver bullet. There's no one fuel, or one solution, or one technology. I think the future's going to hold multiple fuels, multiple technologies. But increasingly, we have to look at what are the solution sets that we can go after that we can go after that deal with solving multiple issues. And those three key issues are emissions reductions, which we have had policies on. Energy efficiency, which increasingly, with the cost of fuel, we're going to have to grapple with, and with global warming concerns. And energy security, where is our fuel going to come from and is it sustainable coming from where we receive it? That is a huge issue, I think for the nation, and we can't go after single issue solutions any more. We have to integrate. We have to find ways to address all three if we can. As we move forward and set these long term targets. And these targets really need to go across policy, technology, incentives and regulation. We need to really develop a more unified approach. And often that approach can at least form its creation from the bottom up. And what I think we have here today is a group of people who are starting to make that happen from the bottom up. Those are my overview comments.

We have a great panel here today. Starting out is Allan Bedwell, Deputy Secretary of Regulatory Program, Department of Environmental Protection from the State of Florida. And he's going to be talking about a number of things, including what I hope isn't the Hydrogen Tollway in Florida, but some real innovative efforts that Florida is now doing as a leader in this.

2.2.3 Allan Bedwell, Deputy Secretary, Regulatory Programs & Energy, Florida Department of Environmental Protection

Accompanying PowerPoint presentation can be viewed at http://www.c-u-i.org/uploadFiles/Bedwell_H2%20Florida%20Presentation%20-%20UCI%20-%203.03.05.ppt

Just by way of background, demographically, Florida is very similar to California. We're unofficially the third largest state right now, having surpassed New York in population, with approximately 700 people moving to Florida a day. As a state, we're also very similar to California in terms of demographics of values by our citizens in terms by our citizens in terms of environmental issues and public policy. As a native Californian, it's been interesting working in Florida for the last three years—seeing some of the similarities and some of the differences.

What I'd like to talk to you about this morning is one single focus of Florida is focused on in terms of transportation policy and energy policy. I basically manage the analogue to the California EPA in Florida. I work in a superagency that has basically merged the California EPA and the California Department of Natural Resources into one agency, and I oversee all the regulatory programs, as well as the Governor, July first, gave me the responsibility, back in 2003, of managing energy policy for the state. And on that date, we'd been having a lot of discussions at that point, and on that date when energy policy came over to the Department of Environmental Protection, the Governor specifically said that he wanted Florida's energy policy to be green and clean, and on that date also, we launched the H2 Florida program, which is basically focused on hydrogen in Florida.

The Governor's actively involved in this. In fact, he has been very intellectually engaged in this, and really driving this from a market standpoint, from a business perspective, since he has had a great deal of time in business, and has spent a lot of time thinking about energy issues. Our goal really is to establish Florida for one of the leading centers for the development of hydrogen technology. We have a number of objectives, and I'm just going to highlight a couple. A lot of them are similar to what other states are doing. We're interested in demonstrating new revenue models for companies, specifically, utilities and other companies utilizing hydrogen and alternative energies. As people talk about this value proposition, there's actually a significant opportunity for large and an increase in new market development and diversity of one's markets by using hydrogen energy technology.

We also wanted to keep Florida's air clean. Florida is one of the few handful of attainment states in the United States. During my tenure at DEP we've had the largest reduction of air pollution in Florida's history. And that has been through voluntary incentives and agreements with our utility industry and transportation sectors.

We're also meaning, obviously, to increase our energy independence and security. In Florida, this fall, had a first row seat in what it's like to experience major fuel shortages. During two months of four hurricanes and two tropical storms, I was responsible for ensuring that Florida had adequate fuel supplies for 18 million citizens. That was quite a challenge. And while we were watching these storms come through, managing the emergency situation in Florida, the Governor remarked that this was something that was very similar to what we might see as a result of constraints to fuel as a result of geopolitical upsets that were seen around the country.

The other thing that Florida is really watching very closely is the supply and demand curves in the next couple of decades when China and India increase their cars and begin to create quite a demand for limited petroleum supplies. It's basically going to be a seller's market. And we need to develop alternative fuel supplies before we're paying at the pump.

Our strategy is a six-point strategy, establishing an aggressive portfolio of demonstration projects, being aggressive with financial incentives, establishing uniform standards for fueling infrastructure, focusing that infrastructure initially. Also, putting our money where our mouth is, in terms of creating market pull. And also working with our university systems to establish directed and cooperative R&D programs. Our inner focus on hydrogen in the standard areas—fuel cells, also internal combustion engines—we're going a lot of work in that area, where internal combustion engines are fueled by hydrogen. Also fueling for fuel cells and IC engines. Storage and grid optimization, where you actually utilize the power of hydrogen and the storage capability of hydrogen to actually do peak shaving and to optimize grid operations not only adverse conditions but also during standard operating conditions. This is a very promising area that we're investigating with a couple of our leading utilities, Florida Power and Light, and Progress Energy.

Technical goals for hydrogen are ones that everyone's talking about. These are—this is a partial list of our projects or a map—we've got the red stars represent both stationary and mobile projects. The cluster you see in Orlando is almost a dozen projects focused on mobile applications, where we're focusing our infrastructure and mobile activities. The other stars are both stationary and other types of hydrogen generation projects, like hydrogen utilization projects. The green stars are projects that are currently on the drawing board. And those are ones the state's actually involved with. There's probably an equal number that we're not involved with, that industry is undertaking on its own.

This is just a list of current projects that we've got. The usual suspects involved, Ford Motor Company, ChevronTexaco, BP, a variety of hydrogen technology providers like Hydrogenics, Plug Power. A lot focused on global applications. Phase II, we're looking at more widespread applications. In Florida, we've got a robust and growing relationship with the US military, since we have 21 military bases in Florida. They're looking actively at this technology, not in terms of just full deployment operations, which can protect our troops with reduced heat signature and noise, but they're also looking at domestic fleet applications and domestic operations on military bases.

Phase III, we're looking down the road, and that is that the state will become active in utilizing vehicles as well as expansion of our fueling network to the Tampa area, down the I-4 corridor from Orlando. Hydrogen R&D at universities—we have 106 R&D projects underway right now, at seven universities. Very aggressive and active program, which is continuing to expand. We will soon have all these research and development programs in a searchable database on line, where companies can directly see the work that is going on, identify principle investigators, and also look at opportunities for directed research. We're also very active ourselves, as a state, in pursuing hydrogen technology. I'm in the process of purchasing 12 hydrogen fuel cells for 12 district branch offices throughout the state. We have about 5,000 employees that work in my group, managing regulatory issues in the state, and when the hurricanes came, we lost

our access to databases in our district offices for 72 hours, which is critical time when you're doing emergency response, when you're trying to determine whether the [??] contains gallons of hazardous waste has been breached or not. So there's an immediate and an imperative need for us to ensure that we've got 24 hour backup supply, separate than petroleum or other traditional sources. But one of our challenges in Florida was not only getting the fuel into the state, but then distributing it. We had thousands of emergency generators brought into the state. The problem was that we were having difficulty getting fuel to dispersed to the generators. So traditional emergency backup power supplies just do not work in that type of environment where you might see your breakdown from anywhere from 72 hours to approximately six weeks as it was in some cases.

We are also active with the Florida Hydrogen Business Partnership, which is a group of companies that are actively consulting in the state of Florida, who have actually been working along with us to develop our own hydrogen highway plan, which actually we'll be announcing later this month. But the business partnership is really there to provide us with business-oriented advice. It's an advisory committee to the Governor, and we have really benefited from their advice. We also have the Florida Hydrogen Initiative, Inc., which is a non-profit organization that will be issuing grants later this month for a number of hydrogen projects. That has been sponsored by Congressman Weldon (?) and is very focused in the Orlando metropolitan area as well.

This is what I'd really like to focus on this morning, and again, very quickly to ensure that we have enough time. We've designated hydrogen as a qualified target industry in Florida. Meaning that the companies have access to a variety of tax incentives and a variety of benefits in the state if they increase their presence in Florida. And this is a robust program out. A number of companies have benefited from it in Florida during the last nine months that this qualified target industry tax incentive has been in place. But we're not stopping there, and if I were to characterize Governor Bush with one word, I would say the word "bold" best describes him. Two weeks ago, with the presence and support of Bill Ford, CEO and Chairman of Ford Motor Company, Greg Vissy (?) who is the President of Ford/Chevron Technology Ventures and a number of other executives, we launched the Florida Hydrogen Technologies Act. This is an act that has been introduced in the legislature with growing support within our legislature that will accelerate corporate investment in the state, expand Florida's support dramatically for hydrogen technologies, increase Florida's energy independence, increase our economic security, and improve our ability to protect our air quality. Here are the components: corporate tax and sales tax incentives; national grant program; incentives for utilities to utilize hydrogen and a statewide uniform siting strategy, or actual a statewide uniform siting policy for hydrogen stations.

Corporate income tax credits: We would provide a 75 percent corporate income tax credit for any investment made in hydrogen. No cap on that credit. And it's designed to be in effect for the next four years. And if it goes well, obviously we'd continue it on. The credits would go through December 31, 2011 for those companies that may not have yet reached profitability during that four-year time frame. Sales tax, we're offering 100 percent credit for any type of purchase of hydrogen technology. Again, no cap on exemptions. Also, we're providing a modest \$12.9 million in matching grants, but when you look at that combined with the tax incentives, we're actually I think talking about a very robust and aggressive financial incentive

package for companies both in state and out of state. Finally, we're also providing, because we're a regulated state—our utilities are fully regulated—it's not regulated at all, we're providing full cost recovery for testing demonstration hydrogen technology that is being done in partnership with our Public Service Commission in the State of Florida. We'll actually establish statewide uniform siting standards. What this will be is not a permitting process, but a “deemed approved” standard that will be drawn from the NFPA, ICC, fire safety standards once they're established that will basically give you a full green light for establishing a hydrogen fueling station within Florida without the fire marshals interfering other than to ensure that you are meeting the standards.

In closing, we're very active in hydrogen in Florida. This gives you a good example of the types of things that we've been up to. I've been on the road for the past few weeks in Florida, actually focused purely on hydrogen events. April looks very similar. I will highlight a few things. We're releasing in mid-march our commercialization strategy for hydrogen energy technologies. This has been done in cooperation with the Florida Hydrogen Business Partnership. It won't be a report, it's actually a roadmap for what business and government is going to do in Florida in hydrogen. Finally, on March 24, we're going to have Hydrogen Day in the capital, and that will be an opportunity for legislators to see first hand the hydrogen technology that they are so interested in. If you'd like more information, we've got it, including the text of our act at www.floridahydrogen.org. And I'd like to thank you for your time.

2.2.4 Don Lewis, Fleet Manager, Texas DOT

Sarah and Deborah, we really appreciate you thinking of us again. We were here in December 03 when you allowed us to speak about our program, the real program, the on-the-road program that's in operation daily, day in and day out. I'm impressed with Allen's comments on hydrogen. There's no one more of an advocate of hydrogen than I am. It seems like we have a spam filter in Texas, because all these hydrogen vehicles keep going right across us, either California or Florida, and nothing's getting down into Texas. So I think we'll correct that. I think Florida may have a model program for that, and California, certainly, and I think it's a future not so far off.

Texas DOT, TxDOT, we call us, and we have a motto we spoke about last time, which is to go beyond compliance. It's still our motto. We're still in the program, two years later, and our alternative fuels program to stay in compliance with our federal and state legislation. And Deborah asked us why we met our goals, or what's going to keep us from continuing to meet these goals, and continuing to go beyond compliance. And I think one word would be sustainability. We've moved our people, we've moved our fleet, we've moved our fueling infrastructure to alternative fuels. It looks like a lot of the OEMs might be leaving us now from that area and it's going to be difficult to sustain this momentum. Quickly, TxDOT operates about 17,000 pieces of equipment, from little bitty pieces of weed eaters up to some of these huge pieces of [inaudible] that you've seen on our DOTs. Those bucket trucks look very interesting, those aerial devices that Bill spoke of, so we can see where the future's headed with this. But there's a lot of equipment that has to start every day, and it has to start on something that we can have at the fuel site every morning. And that's not hydrogen right now. It's gasoline, diesel, propane, or natural gas. That's what we're working with. We have about 5,000 propane vehicles in the fleet. A rather large fleet. They operate every day. We have

about 500 natural gas vehicles. Joe, Mr. Darling will come up in a few minutes and speak to you about his fleet of natural gas, and he's a really a big advocate of compressed natural gas. But we've moved that fleet from gasoline that light duty fleet to about six million gallons of alternative fuel a year. So we're not just talking, we're not just buying this equipment. We're actually moving the fuel. We operate 23 hybrid Priuses. We're moving and buying as much hybrid equipment as we can. Ford just drop shipped a little hybrid Escape. It was there when I left. We'll buy 10 of those this year. So we're going to move our fleet. We're going to sustain the momentum the best we can, with our hybrids, which is about all we can buy this year. The Fords, the OEMs, the GMs are leaving this light duty market. There won't be any more of the propane vehicles. The trucks that we used to purchase—I guess we were their largest customer. And we couldn't keep them afloat. One customer can't keep an OEM afloat. It takes all of us. It takes a family, it takes a nation. And there just wasn't enough momentum for Ford and GM and those people to sell a propane or natural gas vehicle and make money at it. So how do we sustain that momentum? People are used to that equipment. They get up every day, that equipment starts and operates just like gasoline or diesel equipment and that momentum is behind us, that push, that training effort has been accomplished over the last decade, so it's aggravating. It's a concern of where we're going to go ahead with this program to keep that momentum there.

A month ago in Texas, TxDOT and I sponsored a workshop much like this for ethanol and biodiesel. The National Ethanol Vehicle Coalition came down; the biodiesel group came down. And so now the buzz words I guess down in Texas are ethanol and biodiesel. I saw some concerns with ethanol this morning with our non-attainment areas in Texas, being ozone non-attainment, we really need to consider these emission impacts that these biofuels bring to us. We need a national standard. So I would advocate that we look at ethanol and biodiesel, bring that product to Texas. Lot of agriculture products in Texas that we could make biodiesel from. We're looking at that.

I've moved my heavy duty fleet, my diesel fleet to ultra-low sulfur diesel. The last time we spoke of that it was preliminary, but now we have thousands of vehicles in Texas running off we call Valero's ultra low sulfur diesel. It's like zero ppm and we're adding a little bit, three or four parts per million sulfur into that fuel. So we do have thousands of vehicles every day running on ultra low sulfur diesel. It's the equivalent of car diesel, it's a high cetane, low aromatic fuel, which gives us about seven percent NO_x reduction. So that's a very beneficial clean diesel. We're running about two million gallons a year now, and running up to about six million when we move our fleet completely over. So out of about 14 million gallons a year, about 60 percent of that today is alternative fuel at TxDOT. We've already met those goals that Ms. Witherspoon is speaking of, 20 to 30 percent of decades to come. So that momentum is already there, but how do we sustain that? That's a real challenge. We do have a little bit of a future where we're working with Daimler Chrysler and Mercedes Benz and this hybrid plug in electric van some of you may be familiar with that product they're pushing right now. I know there are some people on the west coast and the east coast. And we'll be getting one of those, the City of Austin and TxDOT will be getting one of those, so we'll have a true plug-in hybrid van which we'll operate for three years. We're discussing with Ballard for that same sprinter van platform for a fuel cell application, so maybe we'll take that and take a fuel station and put propane in one end and put hydrogen out the other. So we're looking at reforming propane, which we have a lot of in Texas. Sustainability would be the key word I guess where we're

headed with out department. I'm here to answer any questions you might have, with our decade's worth of experience with alternative fuels. Thank you very much.

2.2.5 Alan Jones, Environmental Policy Advisory, Tennessee DOT

Thank you very much, and good morning. It was interesting—I just heard this morning that the price of oil has reached \$53 per barrel, which is a recent high. One of the priorities for Tennessee that's relevant to alternative fuels, is that we have a pretty serious non-attainment problem. Eighteen counties in Tennessee are in non-attainment for the eight our standards. Six counties are non-attainment for PM 2.5. Another priority for us that's relative to alternative fuels, and this is in terms not only of congestion and future transportation planning, but also air quality, and that's the importance of diesel trucks. About 24 percent of the total NOx emissions in Tennessee come from diesel engines. And Federal Highways Administration forecasts that truck freight is going to increase about 100 percent within the next 20-25 years. And especially from the air quality perspective, diesel trucks, all the diesel trucks that are sold before the new EPA emissions standards in 2007, those trucks have incredible life times. Thirty years or more. A million miles on a diesel truck is not uncommon. So a lot of these trucks that are being bought today are going to be on the road for decades to come. One of the things that I am proud of and hope we can do a better job of in the future, is to work together across state government. There are five state agencies in Tennessee that are working together on alternative fuels. Five state agencies, and the Clean City Coalitions, too. We have a couple of Clean City Coalitions, and we're trying to get a third one established. We're working together on alternative fuels. The Department of Agriculture is actually encouraging biofuels *production*. We're focused on biofuels. We're focused on E-85 and biodiesel. The Department of Economic and Community Development, the State Energy Division is in E&CD. They're supporting the Clean Cities Coalitions with DOE grant funds. They're working to establish that third coalition in Memphis. And they've also decided to allocate \$1 M of oil overcharge monies that we had not yet spent to school buses, for their use in converting to biodiesel. The Department of Environment and Conservation is the state air quality agency. And what they're doing is encouraging private companies as well as local governments, as well as state government, to use alternative fuels. The Department of General Services is the agency that purchases vehicles for state government, and we're working with them to purchase more clean vehicles, including hybrids. My agency, the State Department of Transportation, has a significant responsibility in helping to improve air quality, in particular to reduce mobile source emissions. We accept that responsibility, and we're in a position, perhaps, better suited to deal with that challenge than the Department of Environment and Conservation. We're working on a long-range multi-modal transportation plan, and alternative fuels has come up in regional committees across the state, talking about that long range plan. Alternative fuels has been identified again and again as one of the things that State DOT ought to be working on. We're re-bidding our fuel purchase contract for state government including E-85, which is already included. The re-bid will include biodiesel. We're planning a switch to biodiesel for our four TDOT regional offices. That's where the bulk of our diesel engines are located. We have on-site storage of fuels so we'll be able to do B-20 there. The state purchases flex-fuel vehicles to meet EPACT requirements. In the past, we pretty much relied on those flexible fuel vehicles, but for the most part we burned gasoline. We only have one E-85 station publicly accessible in the state. What we're considering now is using CMAQ resources to develop more fuel infrastructure for both E-85 and B-20. The state legislature is considering incentives for the purchase of these

fuels, and that's very controversial. The state comptroller has just filed a report and a lot of the punch lines are on various topics: "Experts disagree."

The states of Georgia, South Carolina, North Carolina and Tennessee have been working together for several years now to improve regional air quality, particularly in the Southern Appalachians. And we've formed, coming out of those meetings, the Southeast Alternative Fuels Task Force. That includes some of those agencies, state DOTs, state departments of environmental quality, state energy offices, etc., trying to work together to increase the availability and use of alternative fuels in the southeast. I'd like to read this because it's carefully crafted language: "A broad-based cooperative network of stakeholders committed to increasing the availability and use of alternative fuels in the southeast, especially throughout those four states. The primary purpose of the task force is to improve air quality and to decrease national reliance on imported petroleum through greater use of alternative fuels. The priority is to establish alternative fuel corridors in the four states along interstate highways, linking major destinations. We bring together concerted efforts of state transportation, energy and environmental agencies, eight Clean City Coalitions and many other stakeholders across the four states. We're focusing our efforts on fleet managers, outreach to them, the opportunities, the advantages, the benefits of using alternative fuels, and also fuel marketers. And we're planning a workshop in Gatlinburg on June 6th and 7th to try to bring all those folks together. Thank you very much.

2.2.6 Harold Garabedian, Assistant Director, Vermont Air Pollution Control

Accompanying PowerPoint presentation can be viewed at
<http://www.c-u-i.org/uploadFiles/March%203%20Harold%20Garabedian.ppt>

I think we've moved from big states to small states. We started here in California, to Florida, to Tennessee, now to Vermont. So we're going to give you more of a small-state perspective. Hopefully I can talk equally fast and equally low. I was asked to give a northeast or New England perspective as well, so I'll touch on that as well. The four points that Sarah and Deborah asked me to address were sort of program description, what's worked and not worked, coordination, and then some of the current and planned activity. I can't get out of Vermont with the tourist shots. This is the typical image of Vermont, but the reality that I deal with is more like this: we've got ozone at the national ambient air quality standard. These are our measured levels and these are the standards through here. For a rural area, we are challenged for ozone. It's regional in nature. So regional cooperation and regional programs are very important to us. We're in the situation where PM 2.5 is very regional in nature, but layered on top of that are local emissions and here in Rutland, we had to issue a health advisory. This regional pollution layered on top of Vermont's local emissions compounded by our meteorology and topography. And then if we look at toxics, which everyone does, the red line here is benzene. The green line is 1,3 butadiene. Benzene is a human carcinogen, 1,3 butadiene is a suspected human carcinogen. High levels. These little black lines down here is the 1 in a million risk level. So we're fighting levels in our area substantially over that one in a million risk guidance. I'm sure you're going to find that level of risk for these contaminants throughout this country wherever there are vehicles. We're challenged, not like this—we certainly don't have three hour delays, but transportation and air pollution is a big issue.

Seventy percent of the inventory is from mobile sources. VMT has been doubling every 15-18 years in Vermont. While we're small, we mirror a lot of what's going on everywhere.

So what have we done? We've adopted the California low emission vehicle (LEV) program, both within Vermont, and see that as a regional strategy. We adopted LEV 1 in Vermont in 2000 and LEV 2 in 2004 applied to the 2007 model year. We're looking at the Hadley Bill in terms of how to integrate that. That's both here in Vermont, and the other what we call "177 states" –Section 177 of the Clean Air Act being the section of the Act that allows you to do this, and that would be Massachusetts, New York, Maine, Rhode Island has a bill, New Jersey has a bill. There's activity throughout the northeast to bring these more stringent standards to the northeast.

In response, looking at some of the issues associated with alternative fuel vehicles, an entity was formed, a public/private partnership called E-Vermont. This was an effort by then-Governor Dean in 1993 to look at it. The auto manufacturers made certain claims about some of the advanced technologies particularly in the northeast. What we set about was a program to look at those issues. The issues aren't unique to Vermont: cold climate, hilly terrain, rural settlement patterns. But I think Vermont is uniquely located to look at them. As we translated that, it sort of comes into vehicle performance, cabin thermal management—keep me warm in the winter with clean windshields, and then how do you use vehicles in rural areas. The industry sort of stated the problem of electric vehicles—and I'll use electric vehicles because I had some slides available. In terms of they worked well in warm weather, here you've got a vehicle that will do 100 miles in warm weather, but will probably only do 18 miles in cold weather. We sort of took this as a challenge back then, and said, ok if this is a technical issue, let's look at it technically. Because we believe there are engineering solutions to all engineering problems. We did cold chamber testing and looked at various things and said ok, if this is the line and we applied these different technologies, this is how they actually how to compare to a conventional car. So we said [inaudible] here we are with proof of concept solutions and moved on. Again we looked at cabin heat and found that these little auxiliary heaters worked really well to keep the windshield clear, to keep the cabin warm, I should say, this the performance of an EV and this is the performance of a conventional car in very cold weather. About zero, all along through here- they're comparable. And they can keep the windshield clear, which is a big issue. So you can have comfort, you can have safety. We're now adapting those auxiliary heaters to school buses to try to reduce idling in cold weather. One of the issues is to pre-heat the cabin to have a warm, safe school bus. Looking at auxiliary heaters to reduce that idling. They're very small, very efficient. So anyway, you put these technologies together, and what we show is that you can actually use EVs –this is all converted Geo Metros done by Selectric Corporation—what we found that with hydride batteries, it's a solid hundred mile car. We could use it throughout the year and in fact, we put 18,000 miles on this vehicle in one year, and 18,000 miles is probably more than the average car travels in the course of a year.

This is sort of what's worked. I present that as what's worked for us is targeted, specific programs and an example is, baseline data, documentation, concept design solutions, integrating with the public, with actual vehicles. This is what we've found to be successful efforts. What we've found not to work that well is sort of broad, stakeholder processes. That just has not

worked for us—a lot of talk, but not much progress, not much action. There's a vision of an I-95 route corridor in the northeast. It was a great plan, but it hasn't come to fruition.

How do we coordinate with others? In Vermont, up until this past June, it was just informal technical level staff work. In June we actually established a formal Memorandum of Agreement with our transportation folks and established a transportation/air quality working group to address these issues under that authority. Regionally we have a lot of groups, one called Nescom, that looks at air quality issues throughout New England, plus the states of New York and New Jersey. It's very effective. The New England Governors' Association. This group has just come out with a Climate Action Plan that's regional and bi-national, so we're cooperating with the eastern Canadian provinces in terms of reducing CO₂ emissions throughout the region. We have CONEG which is the Council of Northeast Governors. They're actually the ones that created the idea of this green I-95 corridor in the early 90s. And to their credit, they had a vision back then and while I don't think it has rolled out the way they thought, pieces of it are actually coming together. The Ozone Transport Commission is actually established through the Clean Air Act and takes the 13 states from Virginia to Maine and puts them at the table and says, "How are you going to deal with regional ozone?" And there are a bunch of other organizations that coordinate.

In terms of the existing infrastructure, it's fairly diverse in terms of New England. The state is wrong because it changes all the time, but the message I would give is that it's sort of different in different states, but there is some overlap in terms of what everybody's doing. The reason you see so much natural gas down here is that's actually where the natural gas pipeline is. A little bit of gas comes down from Canada through here. There's no gas in Maine, very little in New Hampshire. That sort of dictates what we have to work with. There's no E-85 throughout New England that I could find. LP is kind of universally available. It's a very well understood fuel in rural areas. Electricity—Massachusetts jumped on that very early and had some very large demonstration programs. Still likes it, I guess. We obviously believe in electricity. We have a very clean grid in Vermont. Vermont purchased-electricity is probably approaching 40 percent renewable energy. So that's one of the reasons we like it. Its NO_x emissions are probably have those of the Level II standards. Biodiesel is taking on. It's cult-like in nature. It's everywhere. People have really taken this spiritually, I think, in terms of biodiesel. I think it's because people feel it's an individual thing. People feel that on an individual level, they're making a difference. We have a lot of concern about the NO_x disbenefits. Our policy on biodiesel is to keep the blend rates down unless people are willing to invest in additives and tailpipe treatment. We see that as a way of compromise.

In terms of planned projects, more CNG. Apparently they're going to get some gas up into Portland, Maine. There may be numbers of others in terms of private side. University of New Hampshire is doing some shuttle buses and Rhode Island's Providence Airport is going natural gas. In Vermont, we're doing a fast-fill station in Burlington, a CNG station. Then we're also bringing on some shuttle buses at the University of Vermont. And then we're doing an electric station-car project. Probably we're the last people who still think there's a role for battery electric vehicles. And then we're doing our hydrogen project. I guess we're defining the other end of the east coast. It sounds like Florida's going to get some points out on Key West, and we're going to have a northern Vermont project, and it's a wind-to-wheels project, where you actually have a wind turbine and have proton electrolyzer, Air Products dispenser and refueling

something in the transportation area. I think that we do expect some interesting issues coming out about fuel cell vehicles in cold climates. A lot of people thought about the performance of them; we're actually asking questions about water management in terms of where's the water going to go.

2.2.7 Matt Miyasato, Technology Demonstration Manager, South Coast Air Quality Management District

Accompanying PowerPoint presentation (in pdf format) can be viewed at <http://www.c-u-i.org/uploadFiles/SCAQMDMiyasato2005.pdf>

I'll try to go through these as quickly as possible. It's good to have our executive officer from the ARB give background on California activities, and what I'd like to do is give specific snap shot of what we're doing at the AQMD, which is the Southern California perspective. And from those of you who are from out of state, or outside the District, welcome to South Coast. We're one of the largest districts in California, made up of Los Angeles, Orange, Riverside, San Bernardino counties. 16 million residents who are our stakeholders. It seems like everyone wants to have their own car, so we have an issue with vehicle miles traveled, high population of people and vehicles, two of the largest ports in the world—Los Angeles and Long Beach. And so we're faced with density issues and vehicle issues, but also we have some unique atmospheric conditions which have conspired to produce smog in copious amounts. We are battling trying to reach the federal standard by 2010. We're in compliance with the four species you see there, but the two criteria pollutants that we're concerned about are ozone and PM. In recent times, it seemed like we were having good years in air quality, but if you look at the average over three years, the last two bars—2002/2003, you're actually seeing a slight increase in the days exceeding the ozone standard, so that's a concern.

This is a favorite slide for many of our board members, and we like to show it because it shows the risk associated with the particulate emissions from diesel. ARB had designated particulate from diesel as a carcinogen. We did a study back in the late 80s and we're following up with a study this year called the Multiple Air Toxics Exposure Study, MATES II, which showed the risk associated with diesel and particulate in our basin. This is excluding diesel sources, and if you include diesel sources, the risk goes up dramatically. You can see that it also essentially outlines the freeway system. The point of putting this slide up is, it's a health issue. And if you look at the distribution of NOG, which is a precursor to smog, you can see that trucks and buses, these heavy duty vehicles contribute the most part for criteria pollutants, so it's PM and NO_x that we're concerned about. And so, we need to concentrate on mobile source reduction strategies for Southern California. And to put a bigger perspective, if you look at in terms of health effects, the ARB conducted a study recently though USC that shows that there's potentially irreversible damage that can occur to children's lung tissue due to criteria pollutant emissions. It's a health effect, we can talk about greenhouse gases—it's a global effect. And then of course, energy security, it's an economic effect. The forces that are driving us in California, and specifically in the South Coast, we have the California Clean Air Act that is a very aggressive policy. And also, Catherine mentioned AB 2766 and 1493 for greenhouse gases that we're trying to displace. So those are the driving forces.

So how does the South Coast implement those things? Catherine alluded to it, Bill talked about it. We see it as a three prong strategy, or a three-legged stool, I've heard it mentioned before. Where we have to have some regulatory muscle, we have our jurisdiction is really on stationary sources, we have a small amount of leverage we can apply to fleets, but we do apply that. So we have fleet rules, that's a regulatory effort. We have incentive programs, which is the Carl Moyer program. And then Bill mentioned, I work in Advanced Technology, where we're trying to fund technologies for future commercialization. So we feel that we'd have all three of those aspects to successfully deploy alternative fuels.

There are quite a few slides, that are really here for you to look at in detail later, because I'd like to get to the question part. But this describes our fleet rules, the number of vehicles that we've been able to displace and put alternative fuels on the road. We're famous for our fleet rules. We went to the Supreme Court. The bottom line is that we're now working very closely with ARB to try to incorporate all fleet rules within their jurisdiction. I think that's great news, and we're hopefully going to go to their July board Meeting.

The second part of that pronged attack is incentives. You've got to have funding availability for people who do the right thing, if they're not impacted by your regulatory actions. So the Carl Moyer program was established through the state. It helps displace, repower or provide alternative fuel technologies for people that want to do the right thing. But there are strict criteria which they have to adhere to and there's a cost-effectiveness that's associated with that. The typical types of equipment that are under this program you can see here from the dirtiest to the cleanest. Marine vessels, locomotives, etc. This gives you an idea of the sheer magnitude of the tons reduced and also the funding that's available. And this is what the AQMD expects to garner in 2005 for our administration of the program--\$12 million, \$11 million, large amounts, \$30 million toward this program and then annually after that. The state was proactive enough to secure this funding on an annual basis with no sunset date. And we expect to see about \$56 million thereafter. And then there's some other applications. The Moyer program that worked previously [inaudible] and mostly looked at PM and hydrocarbon emissions reductions. And also light duty.

And now to the technology advancement programs. So you've got regulatory muscle, you've got incentive funding to help people do the right thing. But then you also have to have, which is something that is critical, you have to have the OEMs and the technology providers involved. And the funding, we support this through our Technology Advancement Program to help accelerate commercialization of these technologies, get them all on the road faster. And we call it RDD&D. Most of you have heard of RD&D, well this is Research, Development, Demonstration and Deployment. Deployment is key: you have to get these vehicles out there. And what we typically—we have a small amount of funding, about \$10-15 million per year, so we try to pick project where we can level the partners. Apply it in different arenas, from near term to long term, so we look at after-treatment, mostly diesel, you can look at the list, I don't have to read it to you. And of course, we're also looking down the road a fuel cells and hydrogen technologies. The next few slides are for you to take home and read at your leisure. With natural gas engine advancements—we're very interested in gas and liquid (?) technologies which is a diesel-like fuel made from, for example, stranded natural gas on-site (?). And of course we have a fairly strong program in hydrogen technologies—hydrogen ICEs and we're

working very closely with the state, on the Governor's efforts with the hydrogen highway. And with that I think we'll proceed to questions.

Bill Van Amberg: What I'd like to do is open it up to questions. There are two microphones. Let me open up with one question. What would it take to accelerate from your perspective, the transition to alt fuels. You've talked about some of the things you've been doing to keep it going, you've talked about some of the barriers. If we could just go down the table, what's it going to take to accelerate or move faster than what you're doing now?

Allan Bedwell: From Florida's perspective, it's incentives.

Don Lewis: I would say, availability. You can't buy something that's not available.

Alan Jones: I think we have to get the cost down, through various means.

Harold Garabedian: If you were to take the price of fuel in 1980 and roll it forward to today, it would be over \$3.00 per gallon. I would say if you want to change behavior, you need to increase the price of gasoline, so that alternatives are attractive.

Matt Miyasato: I agree with all the panelists. Again, there are three components—some regulatory effort, some incentive funding and clearly, OEM availability. Getting long-term commitment from the OEMs and state policy-makers is key.

Bill Van Amberg: Just to build on that, and then I know Caltrans has a question. One of the things you see is that when you when you get involved in this for a while is that it takes a lot longer for change to happen than most people think. And it's not two year incentive programs, and then everybody wondering at two years, well, gee, why isn't there anything there? I know, for instance, that it has taken in San Francisco probably 10 years to finally get CNG incentives for taxi-cabs and other things and now there's no product for everything they finally built incentives for. It really does take a long term commitment that people stick to and some clear directions. Catherine, would you

A really quick comment and question for Allen Bedwell (from Catherine Witherspoon) I think it's going to have to be national, because the engine manufacturers, some of them, have told us that even if California adopts a fuel diversity policy, they will sue us in the same way that they sued the South Coast (AQMD) on the natural gas rule, because we're not allowed by mandates in their view to deny any of the market to clean diesel vehicles. So it's going to have to be a national policy change. I'm curious—the combination of direct grants and the tax credit package that you describe, which is very impressive—what do you think the total amount of that will be in four years time, to the Florida treasury.

Allen Bedwell: It's hard to say at this point. In the middle of March we're going to release a return on investment analysis of what the incentives and grants may offer Florida and our economists are telling us that it's anybody's guess, because there's really no way to benchmark this. There's nothing else comparable to it. Our own revenue-estimating committee, which is what we do to estimate whether we have enough money to pay the bills, or whether we'll have extra money, every year, estimates that it will be about a total of \$20 million, but I think that

number could be quite low from the response we're seeing right now from industry to this package. It's real hard to predict.

Bill Van Amberg: What other incentives are being brought to bear. In Texas, Don, I'm interested, what are you guys doing on the incentive side. There's a huge TERP program I know right here, we call it Moyer On Steroids.

Don Lewis: The legislation did pass our Texas Emission Reduction Plan, TERP is the acronym, and it's based on Carl Moyer. And the monies are similar. Millions of dollars for the next several years for engine replacement or various mechanisms to clean up the heavy duty diesel fleet. And it's been quite successful. It's a new program, just a couple of years old, and it's totally based on Carl Moyer. So we're mimicking the successes of California, and basically applicable to non-attainment areas in Dallas, Houston, Fort Worth and the big major metropolitan areas that we have. A very successful program.

2.3 Industry Roundtable: issues, Opportunities, Realities

2.3.1 Daniel Emmett, Founding Board Member and Executive Director, Energy Independence Now

My name is Daniel Emmett, and I'm the Executive Director of Energy Independence Now, and I've been a member of the Executive Order Team, which is the team that's been working on the implementation of the Executive Order related to the Hydrogen Highway in California, for the last nine months with a lot of other people in this room who have also been involved. I'm going to be moderating today's panel.

This session is called Industry Roundtable, looking at issues, opportunities and realities, and we have folks here from various current real-world demonstration projects. This is where the rubber meets the road, so to speak, where the vehicles and infrastructure and how it all fits together. This is the exciting meat of what we're all working on, and this is the real lessons can be learned, and where we can see the path we're on, and what the appropriate path should be, and so we can see where we need to readjust. Where the opportunities are, where the barriers are. So I'm really excited to hear from this esteemed group of panelists.

2.3.2 Bill Reinert, National Manager, Advanced Technologies, Toyota:

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/March%203%20bill%20Reinert.ppt>

[TRANSCRIPTION OMITTED. PLEASE REFER TO POWERPOINTS AT ABOVE WEB ADDRESS.]

2.3.3 Harry Sigworth, Consulting Engineer, ChevronTexaco:

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/March%203%20Harry%20Sigworth.ppt>

So some of the things I'd like to talk about today is the future fuel availability and some of the options for alternative fuels, including greenhouse gas emissions and criteria pollutants and things like that. Also talk about some of the elements needed to be in place for change to occur and a couple thoughts on ways to choose the best options for the future, looking at all the different fuel options that are out there. Just talking about the amount of oil that's available in the world, just oil, natural gas. If you look at the produced oil, there is something on the order of over a trillion barrels that's been produced so far. The produced reserves according to the USGS are on the order of another trillion barrels. Undiscovered estimates are half a trillion barrels. And there are some other potential options for making fuel, including enhanced oil recovery, and of course we do that now in our [inaudible] projects in the Bakersfield, for example. There's extra heavy oil and [inaudible] like the Athabaska tar sands, and there's shell oil, which the United States is kind of the Saudi Arabia in shell oil reserves, which is fairly extensive, but difficult to extract. Just looking at proved reserves, you have enough oil for a few dozen years, but if you include these others, there's a lot more. But the issue is development costs, product costs, getting the oil out and environmental impacts. And as time goes on, it won't be so much an issue of running out of reserves, but it's more an issue of related costs. So at some point, the cost of getting the oil may be higher than some of the alternatives. So as a result, ChevronTexaco is looking at the full range of alternatives.

The situation with natural gas is roughly the same, although if you included hydrates, this would go over this wall here. And of course, there's lots of ways to make oil from a lot of these alternatives, including as to liquids from natural gas, which we're doing. And of course, making oil from coal and other things like that.

Now taking a look at the switch, and what would enable the switch to alternative fuels, we and the other oil companies, energy companies, will basically provide whatever fuels the customers demand and are willing to pay for. However, from past experience and other alternative fuel programs that we've seen, typically customers require several things. Equal or improved driving performance, safety, reliability, comfort. Equal or better fuel and other operating costs and vehicle utility. And improved economy and environmental quality if it's not too expensive.

One way to look at what's happened in the environmental area, particularly criteria pollutants and looking how the alternatives stack up with gasoline and diesel in the criteria pollutant area, I show here a plot of exhaust emissions, this is ozone precursors, organic VOCs and oxides of nitrogen. And if you were to start with an uncontrolled car, you'd be way up on the roof here somewhere. And this point six represents about 95 percent control from an uncontrolled vehicle. And if you get down to the California SULEV standards, you're down at 99.8 or 99.9 percent control from an uncontrolled vehicle. And this is a fuel economy on this axis, and this is basically mid-size car example. You could look at any SUVs or any other general type. And if you look at hybrid gasoline internal combustion engines and diesel internal combustion engines with conventional drive trains, as time goes on, emissions are going down, we expect this obviously to occur in the future, and the fuel economy is going up. I show a few examples here of actual cars you can go out and buy now. Here's the Nissan Sentra CA, which is a PZEV vehicle. Here's a Toyota Prius. Here's a CNG Honda Civic GX.

What about looking a little bit more at the hybrids? If you look at the range of hybrids, the mild hybrids might be over here, the future hybrids might get a lot more fuel economy with

future development. And what about fuel cell vehicles? The hydrogen internal combustion engine is here. As Catherine mentioned earlier, this area down here is getting fairly crowded with vehicles that are PZEV that are essentially near zero emission vehicles. Already you can buy over two dozen partial ZEV emission vehicles from about a dozen manufacturers. Many more will be available in the future.

I won't spend too much time on this slide, it's in your handouts. But basically this is pounds of CO₂ per hundred miles. And this is a lot of different types of vehicles. In general, there's a fair amount that can be done with alternative fuels. For example with a conventional vehicle, a diesel will reduce the greenhouse gases perhaps 20-30 percent. CNG could reduce it even more than that. Hydrogen ICEs can provide some reduction, but if the hydrogen comes from natural gas, it's difficult to get a big reduction there. If you just go to a hybrid with better fuel economy, you can substantially reduce the greenhouse gases.

As a company, we are committed to investing in promising and innovative new technology, and supporting economic and environmentally sound programs and basically, increasing our own energy efficiency and reducing greenhouse gas emissions. For example, our refineries have reduced energy use by about 10 or 15 percent in the last 10 or 12 years. So I appreciate the chance to talk with you and look forward to your questions.

2.3.4 Bryan Flansburg, Director, Transportation Services, UC Boulder:

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/March%203%20Bryan%20Flansburg.ppt>

One thing about being vertically challenged is that I don't even have to slump for this mic. (laughter) The University of Colorado has always been in the forefront of technologies and alternative fuels and we've strived to set examples for our peer institutions, so when we were approached to do a biodiesel project, we were enthused and excited about it. Our biodiesel project actually started because of a student on campus that approached the University saying that he was in engineering and he was developing a biodiesel processor as a part of his project. The campus has a closed campus for about four blocks and in any given hour, 35 buses move through that four-block area. Of those buses, half of them are University of Colorado buses. So when he approached us, he told us his project was to develop a processor which you see up here. As this processor was built in my garage, I noticed it looking more and more like a still, and I was really wondering what the students were producing. And at the time, University of Colorado had a reputation had a reputation for the number one party town, so it made me a little more nervous. We're hoping someone else would like to take on that number one spot. He made this processor in our garage, we helped him to get all his supplies for it, and then we put a pilot project together. He also collected all the grease from our campus facilities, so all of the kitchens on campus is where he collected the grease for the pilot program. The pilot program was one bus that we put on 100 percent biodiesel that was totally produced by Andrew Asmud [sp?] and his crew, it was a six-month pilot. We had actually taken the bus out prior to the project starting and did a dyno test on it, and an emissions test. I don't have the results of the dyno test. I can tell you that the emissions test, the particulates started out 39 percent and they dropped to 11 percent when we started using biodiesel on our buses. The biggest way that we were able to keep our project going was, with the help of Andrew, again, if you're on a university campus, or most people here are in state government, you understand

that by administration going to the campus students and saying 'we want to initiate a referendum for student fees to increase by 50 cents, they're going to look at administration and just think this is just another way for administration to get into their pockets. But in this case, the students were actually the ones that initiated the referendum. Andrew and his crew started a company called CU Biodiesel. It's a non-profit organization that works with the university. Him and his crew went out and initiated the referendum. They were able to get the referendum passed with the highest count of passing ever at the University of Colorado, and that was for 50 cents, per semester, per student. There's 30,000 students at the University of Colorado, so that's \$30,000 per year we have to offset the costs of our biodiesel program. That \$30,000 isn't just for the offset of the program, they're also in the process of developing a new processor that could actually produce a lot more biodiesel than they did with their little processor. And we have moved away from the processed biodiesel. We're actually buying our biodiesel bulk now.

Partnerships were very important to us. Barkus (sp?) is a bulk fueling station that we partnered with. We don't have fueling on our campus. We got together with the City of Boulder, Ecocycle, University of Colorado, CU Biodiesel and Boulder Biodiesel. We all got together with Barkus (sp) to talk out and see if they would be willing to put up one of their pumps, one of their tanks, to stock the biodiesel for the university. We contacted Blue Sun Biodiesel. That's the company that actually produces our biodiesel, and Blue Sun was able to come in and work with us. Partnerships are so important to us, again, because of the fact that as we saw things coming, we knew that we may have problems with gelling in the wintertime, as some people have heard about. So as we saw that coming, Barkus was very good. They took all of our Biodiesel at different percentage rates and put it in the freezer to see what they could do with it, and then they started adding additives, so we didn't have any problems with gelling in the first winter. We actually ran 100 percent biodiesel on three of our buses until right around December, the first of December. That's when we did start having gelling problems with 100 percent biodiesel, so we moved them back to 20 percent and didn't have any problems.

We also had issues with microorganisms. During our first year, we didn't have any problems with this. When I left my office yesterday, we were putting our last dose of biocide into our buses to kill off the microorganisms that were growing. We had the same problem 10 years ago in our diesel buses. So the problem exists in both diesel and biodiesel, but the problem is actually worse in biodiesel because the microorganisms like to feed off the oil product, and there's more water in biodiesel typically than there is in diesel and that's how they breed, is off the oxygen in the water. So partnership again, Blue Sun Biodiesel, they came in, they worked with us to shock-treatment all of our buses and they're testing all of our fuels to make sure we don't have any of it left.

This is just some quick statistics done by the National Renewable Energy Lab that's outside of Golden, Colorado. The laboratory right now is working with RTD which is our rural transit district in Colorado. They're working with them, they have one route in the city of Boulder, which has ten buses. Five of those are run on regular diesel, and five are run on biodiesel. Each month those buses are coming in to (enrail?) to be tested, and those results should be ready at the end of this fiscal year, near the end of June.

So at the University, we've started out with a one-bus pilot program, and in August of 04 is when we went live with all of our buses. We have 17 buses currently on biodiesel, and then we have three buses that are natural gas, so our transit fleet is entirely alternative fueled. All of the rest of the vehicles on the campus as of this September went live with biodiesel, so all our trash trucks, recycle trucks, anything that is a diesel vehicle, as well as some of our lawn mowers and things like that, are now on biodiesel. So the campus is 100 percent biodiesel. Thanks.

2.3.5 Joe Darling, Director, Equipment Management Division, NYSDOT

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/luploadFiles/March%203%20Joe%20Darling.ppt>

Thanks to Sarah and Deborah for inviting me out for this session. I was here for the original session back in December 03, and I thought that was productive. And for those of you who have heard me talk about the New York experience, I have to clarify one thing. Yes, we are very dedicated to the CNG program, but we are fuel neutral. I take a lot of heat about not being fuel neutral. So we are fuel neutral. Fuel neutrality is choosing the most cost effective and viable solution to fit our operational needs.

One of the things I want to get across is that there is no single solution. We've heard a lot of different things about the end of the world oil production as we know it, the different environmental reasons for doing what we're doing. Glad to see the Honda Civic GX is still the cleanest vehicles, because we run about 500 of them. We're also running almost 200 pickup trucks and vans on dedicated CNG. Our light duty fleet is about a third of our total fleet right now. In 2003 I did a financial analysis of the two different platforms, natural gas and gasoline vehicles. In 2003 we saved an estimated \$410,000 plus in operations with our dedicated CNG vehicles. Our CNG Hondas run at an operating cost of 3.5 cents per mile. Comparable gasoline engines run at about eight cents per mile. Our pickup trucks and vans, Chevys and Fords, primarily, with a few Chryslers before they got out of the ballgame. On gasoline they run about 14.6 cents per mile, and on CNG they run 6.9 cents per mile. That's total operating costs, that includes fuel and maintenance. We've seen a lot of benefits with the dedicated CNG fleet as we extend the oil change intervals. The maintenance is greatly reduced. The biggest problem we have with that is the CNG content sometimes has some moisture in it which can cause injector problems. But other than that, it's been a very successful program. It's been so successful that we are starting to look at our heavy duty fleet. Governor Pataki has been very instrumental and forceful. He's provided us with the financing to do what we need to do, and he's made it clear that he wants us to do whatever we can, not only on the light duty fleet, but on the heavy duty fleet. We're operating 13 large dump trucks in snowplow operations in New York State right now, on what we call "dual-fuel." It has the capacity to displace 80 percent of the diesel fuel use in these snowplow operations, which is an environmental benefit and a fuel benefit. One example that I was telling someone about earlier, I got a report about one of our trucks on Long Island about three weeks ago ran 65 miles during a snowstorm. That's not very far, but on Long Island you don't go very far because you're stuck in traffic all the time. Even in snowplow situations, you're stuck in traffic. But they ran 65 miles, and I told them before you go out, top off the CNG, top off the diesel fuel, and when you come back in, top off both fuels again. Well they went out, topped it off like they were supposed to, and when they came back they topped off the CNG, they said it took 4.5 gallons of CNG. They didn't top off the diesel

fuel. So I don't know what the diesel fuel was, but their rationale for not topping off the diesel fuel was the tank was still full. I told them they should have topped it off to bring it up so we could measure how much fuel had been used. Estimating even on a worse case scenario, at 50-50 mix, they would have used 9-10 gallons, tops, to go 65 miles. So that's better than seven miles to the gallon, and in these type of operations we're lucky to get five miles to the gallon on straight diesel fuel. So we are seeing benefits. The fuel is cheaper, we know it's cleaner. We've had some studies done on the emissions benefits. I can't share those statistics with you because I've got some problems with some of the data that was produced. I think that some of the data was flawed, and they were contributing too much of the benefit to our oxidation catalyst and not enough to the CNG. But the bottom line is that we're reducing emissions significantly with this technology and the operational benefits and the cost benefits are there. We do have to have a varied supply. There is no single solution. We need to relieve our dependence and improve air quality. The fuels that can help us achieve energy independence and are practical in the short and the long term—this has been one of our covenants in New York—let's not do something today and have to change our whole fleet five years from now. That doesn't work. You have to have something that's there for the short term and the long term. We see CNG as being there for the short term and the long term. There are some caveats there, but generally we think CNG is even the transition to the hydrogen highway, if the hydrogen highway comes about.

The cost effectiveness of each solution, if subsidies are equalized—I think that's important. A lot of times you'll hear about the cost-effectiveness of one fuel or another, and some states will subsidize one fuel more than another. In the Midwest, the corn-belt, you'll see subsidies for biodiesel and ethanol. In other places, you might see subsidies for natural gas or propane. Those things need to be equalized if you're going to compare the cost of fuels.

This slide is a little bit old, it says 700 CNG vehicles. It's up to about 900 now, a third of our light duty fleet, and we are converting our heavy duty fleet. Infrastructure is key. One of the things that we got tasked with when we got into this is that you've got to have something that will work for the whole fleet. We have 20,000 light duty vehicles in the state not only in the DOT. So the biggest obstacle we had to overcome was the cost factor. People said that you cannot build CNG infrastructure for less than half a million dollars a station, if you want a fast fill station. We built 30 fast-fill, low-volume CNG stations at 100 gallon per day capacity, and each one of those stations cost us about \$100,000 a piece. We did it with Fuelmaker technology, which is a low volume technology. But we proved that we could go in and build a station that was modular in fashion so that as the fleet grew and the demand grew, we could increase the capacity by simply coming in with another compressor, taking the Fuelmaker out and putting in a larger volume compressor, or just increasing the fuel storage—all ways to increase the capacity to support the fleet. We've done that successfully, most of our stations have been changed out in either compression capability or in storage. So many of the original 30 stations have been replaced with higher stations where we're producing 600 to 900 gallons of CNG a day at these stations. Last year we produced, distributed almost half a million gallons from our sites alone, and we bought probably another 200,000 gallons of CNG from the private suppliers, the utilities of New York State, and Clean Energy.

Also, LNG we see as a very important part of the infrastructure plan. We have a problem in New York State, our legislature created a moratorium about 30 years ago. They were ahead of

the Not In My Back Yard syndrome, and we're trying to get that overturned so we can have LNG. Because we see that as the logical way of getting to a total fuel infrastructure plan. What we'd like to do is, we have 210 fuel sites for gasoline and diesel fuel. We'd like to be able to truck LNG to each one of those sites, vaporize it on site and pump it into our vehicles, into the light duty vehicles. Our heavy duty vehicles, we'd like to go with the LNG option and at some point if there is a long range plan, we'd like to see LNG in light duty vehicles as well, because that takes care of your range limitations. And LNG is renewable from landfills and wastewater treatment plants. This country has a drastic surplus of waste, and all that waste could be turned into energy. Methane—natural gas is simply methane, and these sources of methane are excellent sources of LNG. And then LNG can be transferred, stored and dispersed without the need for pipelines. LNG can be dispensed directly into our heavy duty vehicles and vaporized into CNG so we see this as a total solution for us. If we can't solve the problems associated with CNG and LNG, hydrogen doesn't stand a chance. You're talking about the same type of limitations. Natural gas technology is the forerunner for hydrogen gas technology, only the problems are going to be dramatically increased when you start talking about 5,000-10,000 psi cylinders, the reliability of these systems, the reliability of the vehicles, the safety of the stations. There's a whole myriad of problems, and if you can't solve the problems with CNG and LNG, you're not going to be successful with hydrogen.

Biofuels, yes, we're using biofuels in some places, but we see that as only a portion of the dependence. We'd like to see a national standard for biodiesel, instead of every state having their own standard—5 percent, 20 percent, 100 percent--we'd like to see a national standard, whatever that is, so that Joe Trucker knows what he's going to get from one state to another, and the emissions benefits will be the same and the operating characteristics will be the same. We also need a national standard for the mix percentage in the quality of the base stock. A lot of people are saying let's use yellow grease, but there's a lot of problems with those sources when you start producing biodiesel. So we'd like to see a national standard.

Heating oil, in the northeast, is an excellent application for biodiesel. There is no pollutants from heating plants, supposedly, I haven't tested that, but from what I'm hearing, there is no pollution from heating plants, and we see that as an opportunity, especially in the northeast where we consume a lot of heating oil annually as an excellent source of biodiesel. Hydrogen fuel, you've heard about hydrogen. We don't know if we're going to get there or not, but if we do, we think LNG and CNG is the most cost-effective base to get there. And we need national safety standards for the vehicles and fuel stations. State DOTs, Federal GSAs, state procurement agencies are the logical leaders to accomplish the final goal, and we need to work together. We need to influence the vehicle manufacturers to produce the right vehicles. If they don't have enough sales, they're not going to stay in the business as we have seen from Ford and General Motors. We can influence their decisions if we have a network and a consistent demand for the vehicles. And we must do a better job of educating the public on the benefits of alternative fuels. Many people, well, we're doing it for the environment, you're doing it for this or that, but there are cost savings if we make the right choice.

This is a picture of the hydrogen highway in New York. You'll see no stations there, but that is about to change. We're having a hydrogen vision meeting next week which I'm part of, and you're going to see hydrogen in New York, there's no doubt about it. And actually there are a couple of stations, one in Western New York and one in the Albany area. But essentially there

is no hydrogen network for fueling. But this was also the picture of the New York State infrastructure for CNG. The blue stars that you see up there were the utility stars when we first started. That was what was available outside the New York metropolitan area. Next you see the little red fuel pumps being put up. These were the first 30 stations that we built, in a modular fashion, most of them, and these were Fuelmakers. These green stars are the stations that we've upgraded to higher capacity. And these purple stars are the ones that we have created a public fuel infrastructure with clean energy. We've opened up stations that we've built to the public so that they can start buying gas from clean energy.

2.3.6 Mitch Pratt, Vice President, Public Affairs & Business Development, Clean Energy

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/Mitch%20Pratt.ppt>

The way that I chose to take my eight minutes or so was to look at it from your perspective. Is this transition a reality? We've already heard some of that and I'll quickly add a couple of points and move right along. What are my vehicle choices, how do I get a station, what are some keys to success as I look forward to a natural gas option and to a hydrogen future and how can Clean Energy or other fuel providers help?

Charts like this just show that we've moved from whale oil and wood in moving transportation to oil and we're ultimately on a pathway long term to hydrogen as the economics of that make more sense. You've heard about the increasing dynamics in the Middle East, and I'll just boil this down another way. Today our production is about 83 million barrels of oil a day. We have about 83 million barrels of refining capacity today. Our supply reserves are not being replaced as we've seen in the earlier presentation. That's leading to a global economic competition for oil. Here in the US, we've been pretty gluttonous because we've gone unchecked. Good for us, hoorah. But that dynamic is changing. The reality is that you've just had China do a deal with Canada, one of our regular supply sources, to take some of their oil, to build a pipeline from Edmonton to the coast and ship off oil to China. Likewise in Venezuela, we hear some of those dynamics because we didn't really like that president so there's dynamics to side with China there and sell some of those supplies, a large chunk of our supplies for Texas refining come from Venezuela. Those right now are somewhat fungible globally, so as we press on the bubble in one spot, we'll get oil from another spot. But the reality is that that whole dynamic is changing and we aren't replacing our reserves as fast as we need to. And the challenge for oil price and scarcity of supply is going to continue to see oil prices come up. The Saudi minister the other week said, "Start to live with \$50 a barrel. Get used to it." And we'll see that price continue to rise up as we have more global challenges, and if, as earlier mentioned, we have unrest in the Middle East, well hang on. I hope your SUV is parked.

As you look at this, this is a nice little slide, and another look at global energy demand. This charts vehicles per capita over history, and you see the US all the way up in the top right hand corner, and on the very left lower side is China, and Asia. Well that dynamic is changing. Their population of vehicles is growing rapidly, let alone their whole economics of their manufacturing sector is driving up oil demand over there. I've been approached by them the end of last year to look at building 300 LNG stations, because they realize there is much more diversity of LNG

natural gas sources globally than diesel, and the oil is going to be challenged, to keep up pace with their growth. They also recognize that, gee goods movement is the backbone of our economy, and if that goes down the tank, if the cost of moving goods just goes skyrocketing, what's going to happen to the economy? Well we need to pose that question here, too, because that's a challenge. And if that's not enough of a challenge on oil or energy, here's what's happening on our emissions standards. Some of you operate heavy duty diesel engines. You've seen that change over the last ten years. It used to be, maybe 15 years ago, a really easy engine to operate. It's gotten increasingly complex. It's going to continue to get increasingly complex. The challenges from pre-2004 to 2004 standard engines, we saw a price increase in the cost of those engines, we saw operating complexity increase. Some of you are operating traps. There are some challenges with traps. All of that's going to get better. But don't consider diesel to be business as usual. You're going to need to invest in training and changing that way and as we drive down to the very lower left hand corner, that's the goal, that's where everybody's supposed to be at in 2010. Natural gas engines by Cummins and John Deere and now, as I understand, talking to Caterpillar, will be at the 2010 emissions standards in 2007. Caterpillar is coming back into the marketplace. So, in 2007, we'll have natural gas emissions that meet the 2010 standard. Your operating technology, your life cycle costs, the improvement in greenhouse gas will all be there in the heavy duty engines. So let's talk about product.

Fuel cells, you'll hear more from Steve about that. Hydrogen internal combustion engines or blended fuel options—those are coming. Fuel and infrastructure is going to be a challenge on that. If you want to be a leader, on the bleeding edge a bit, then there are demonstration projects that need to be performed, that will be performed, to roll this in. We're working on a blended fuel project up in Vancouver right now. But NGV products are here today, so we'll quickly look at them. For refuse, every manufacturer of chassis is offering a Cummins Westport engine. This is not intended to be comprehensive. It doesn't have Mack on here. OEM products, that's the Honda Civic there. That's the GM truck down below. In fact, if you're still looking for a Ford F150, a dealer up in LA has a dedicated natural gas F150 from last year's production. You've got street sweepers available from Elgin and Timco (sp?)

Small volume manufacturers—these guys have to go through a number of hurdles and requirements and certifications to be listed as a small volume manufacturer. Well, the folks that put together the kits for the heavy duty bi-fuel vehicles that Joe was operating on his dump trucks—that's BAF technologies, they're making the Ford Crown Victoria and the E450, the shuttle down on the lower right side. And then you've got the kits for the GM vans or the Chevy vans. And then, this is a new vehicle, just introduced last week at the heavy duty truck conference. Freightliner M2 truck. It's got the John Deere engine in it, that's the picture of it down in the middle, and of course it's got many applications.

So if you want to get a natural gas station. Most fuel providers, if I've got to come in and build a station for you, a fully competitive, diesel-like, gasoline-like fueling station with the same kind of flow rate, same kind of vehicle after vehicle capability, it's going to require a rather large investment. And depending on what other kinds of onerous things you put on, such as bonding requirements and other state issues that we've got to work through, the costs can be \$750,000 to \$1 M. There are lower cost options, but in the full scale site, you're looking at—if you're using my capital—I need an ongoing commitment of about 300,000 gallons a year. Not easy to

get to right away, but trash trucks are a good anchor. And we need that load to make that investment. But sustained growth and commitment is an important facet that you need to consider, that we need to have, in establishing a partnership. And Joe Darling, New York State, boy it's been just great to have them, because they do have the sustained, ongoing commitment, the requirement to buy more vehicles, and working with Joe is a breath of fresh air for me.

There are other options—as we've done with Joe—you can help co-develop the site. You can do civil work, that helps reduce the cost, that can help speed up the permitting process. We have some leverage, we have some refurbished equipment. We can leverage those as installations. And you can utilize the public network in some areas. LA, this is the network of stations that we currently operate in the greater LA area. We've got networks in other locations around the country, and I'd be happy to talk to you about that. If you want to be successful, though, you've got to be serious about it. These vehicles have been demonstrated and these vehicles work. So if you're going to screw around with one or two vehicles, get ready for the ram, because if you got a bad fleet guy in there, you know what? It's not going to work, unless they're on board. If you don't want it to work, guess what? It won't work. So don't waste anybody's time, and don't waste anybody you're trying to entice to get in on it, if you're just going to screw around with it. Because the vehicles do work, the engines work. Are there obstacles? Have there been big obstacles? The early engines of ten years ago are nothing like today. And the engine technology and the improvement just continues to get better. So it can be done, but top-down leadership. Your commitment to making it work. Your commitment to looking for good vehicles, making sure that Honda Civic other products is listed on your state's procurements, or what ever other hurdles you've got to go through is important as well. So make sure that you're really committed to it. Facility modifications can be as minimal or as complicated as you want them. Stations can be built. Joe just mentioned how he did it very successfully. There are some tradeoffs with a little slower filling. Fuel cost is critical. Employee training is absolutely essential. There are a lot of great training programs to make this a good experience and remember that every person that you train in your facility, every mechanic that you get on board, every management person you have on board, is that much closer to making hydrogen a reality. Our societal experience has to spread here as a way to be able to ever transition to hydrogen. And as we look at this, you look at the desire to move to hydrogen, natural gas has similar inputs on the components—natural gas, water, electricity, the equipment pieces are the same. Customer training, fueling requirements are the same, overcoming high pressure gas, integrating experience with your fire departments and other regional permitting agencies. All very familiar. So as we move to a CH₄, or H₈₀, to H₁₀₀, the full hydrogen molecule, then that transition can take place very clearly with natural gas. We're headquartered in Seal Beach, we operate over 160 stations, we provide complete turnkey services. We'll design it, build it, operate it. We can provide financing, with your commitment. And we also have the ability to establish fixed, stable, fuel price contracts for you. One-year, two-year or longer terms. Thank you.

2.3.7 Steve Ellis, Manager, Alternative Fuel Vehicles, American Honda

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/UCI%20UI-Ellis.ppt>

Thank you for having us here today. I think everyone's seen a good mix of foundational philosophies for why this is important and a mix of some of the products, so I think the role I'll

play today, other than trying to rush you to lunch, is to bridge that gap a little bit. I told someone the other day I was pushing CNG along for years and then, I think it's fair to say now I'm kind of straddling it and truly driving it, and now maybe it's fair to say that I'm pulling it along because my transition to hydrogen fuel cell certainly clearly puts into perspective the importance of this transition. So that's the role I'll play today, transitioning from the first group over to the next. We're continuing to invest in America and I think this is important to point out, because we hear so much talk about our nation's economy and things like that, so there's certainly a role between the vehicles and what we do in this country with manufacturing. Yet the need for cleaner and more sustainable transportation, that will be good for America's economy, too. We have this long history of working hard on environmental issues longer than most people know, and not touting it as much as we should. But I think this is an example, here as it says, this requires the involvement of everyone: industry, government, third parties. We have to work together for these societal benefits, and it's more than just the five-star crash testing that you often see on the news or hear about on the ads, but even compatibility with other vehicles, occupant protection, and even pedestrian safety is built into our cars today. And here's an example, transitioning to the alternative fuel side of it, this is actually a New York State DOT vehicle that was involved in an accident, and I think this exemplifies this safety program at that vehicle side, but even how it was built and as we transition to alternatives, the driver of this car, touts the added structure of the back of the car with the CNG cylinder as helping protect the occupant in walking away from this crash. And we have been working hard with CNG solutions for years and I think that many of you do know the GX has continued on this pathway every year, getting greater acceptance, understanding of what its purpose is in life, so to speak. And again, it has fallen to the top of the list as the ACEEE ranked their vehicles each year, the greenest vehicles or what we often hear about on the news are the meanest vehicles. Well here's the rankings, and the GX at the top, in addition to other vehicles, obviously, like the Prius, the Civic Hybrid and other great vehicles, even the traditional Civic HX. So Honda holds a few rankings there pretty high.

This is the best case example of CNG today, as a station in America, just like Mitch said. What we're dealing with today is a different animal than what it was ten years ago. Those were all proprietary cars, for those of you who've heard this about the station, I'll be very brief. But here's a station in Garden Grove, California, off the SR-22 freeway. It's an AM/PM mini-mart. You pull up, put your credit card in the dispenser, no different than you would with gasoline. Then, if you've never used the station before, or used the credit card at the clean energy station, it actually trains you with an on-dispenser video. It takes just a couple of moments to do that. It starts filling your car, you go inside, you buy your soft drink, use the restroom, buy two dogs for a buck, you come back outside and here's your receipt waiting for you, and you drive away. All in three to five minutes. So this has become very normalized, just like what the public would expect from their gasoline fueling experience. But that was yesterday in some respects in that CNG vehicles were only filled at public station, but this is the new day, the introduction of Phil for home refueling. And today we add that new option, and we just trained our dealers for our California launch of this just last week. It's going to be challenging. It won't be easy. And it will be a limited test program for about a year, but we have to get our feet wet going down this pathway. So it move the GX from fleet to retail. This is critical. We've heard people say how we have to get this out to the public. Get it from behind the fence and into their garage and on the street. We think this will go a long way to doing that. This is our development concept for fuel cell vehicles. You can see the hurdles for fuel cells are

environmental adaptability, range, performance, efficiency, cost to manufacture, and this chicken and egg syndrome, where we need more R&D on hydrogen stations. Cost has to come down before investment decisions will be made that can truly let us hit the target. But we've made some good advances here with the new 2005 Honda stack fuel cell car with manufacturability, with the parts content, with the stamped steel plates instead of machine carbon. The power is up, the range is up, but the big one here is the freezing weather startups. So that's why we took this to New York and leased it up there. So you can see we're already crossing some of these hurdles, but it's at the earliest stage of success. We did get the cars out to the customers' hands, such as in the City of Los Angeles, Dee Allen, Manager of Environmental Affairs operates this type of vehicle on a daily basis, along with four others in the City of LA. And the South Coast AQMD is leasing a couple. I heard someone once say, "You know, after all, there's no lines waiting at hydrogen stations today with hydrogen fuel cell cars." Well, here's proof that it's already started.

So we did a fuel cell car to the State of New York. Our president with Governor Pataki, because we needed a place to not just say that in the lab we had the subfreezing temperature startup capability, but to literally hand the keys to the customer and say, "Here's your car. It's a good day when you folks are freezing your butt off." It was a cold day there, but not much snow on the ground. But we did take it up there as the first freezing temperature market and a partial deployment of a fuel cell car. This is actually us driving the car for the vehicle's delivery. See the sign—Albany/Troy/Schenectady. And we had to bring a hydrogen fuel solution. In this case, we relied on our partner, Air Products, for mobile fueling support. That's working extremely well. And we had to train the customer on that actual fueling operation. That was important. But again, these things are not beyond us. And the actual delivery of the vehicle on site, with the Office of General Services, Jerry King, Joe's partner in crime.

We then took a vehicle very recently to the city of Las Vegas. They say that what happens in Vegas stays in Vegas. We insisted that we have to have the cars back someday. But Mayor Goodman did mention that this is an important day because this is the first deployment of hydrogen fuel cell cars at an extremely high-temperature desert climate. And as he said, it is known to get above 120 degrees on a few days in Las Vegas. But we won't succeed if we keep [inaudible] fleet, and that's why I showed the GX transition with Phil to the consumer. What day will it be? How long will it take before we can bring these to the market from our dealer network which is the way people do buy cars. Also, as the stations proliferate, it will be important to unleash these customers from their central operations and move them out into the market more freely. This is the example of LAX being opened up for use.

So I'm going to end here on this slide, which is what we call the Hierarchy of Honda Energy Choices. And we've struggled at the company to say how do we tout one product without denigrating the other? So we use kind this good, better, best and ultimate scenario. And I'll be very brief in walking through it. Clean gasoline, as we heard from ChevronTexaco, we have SULEV level gasoline vehicles today. The emissions are essentially not part of the smog equation. So these are really good. Better is gasoline hybrids because what you get is the benefits of SULEV level emissions with decreased use of the resource—petroleum. And that provides some benefit to the customer like reduced fuel cost and of course there are environmental drivers. But notice how we split it down the middle. And to the left, here, these two require no new infrastructure innovations. The drivers in the hybrid vehicle today

don't do anything different. They actually drive farther on a tank of fuel, but they're still fueling with gasoline. It's the bigger challenges to the right, but notice the benefits to society go up with each technology. We are calling this best because it's here today. That's your gas vehicles, with, again the same level of emissions, near zero, ULEV vehicles actually operating much lower, certified to the same standard, but now we're talking about the benefits of a domestic fuel and it completely displaces petroleum. I saw earlier a presentation with the fuel efficiency chart, showing the Civic GX there, but once I asked EPA, "What is the gasoline fuel economy of a dedicated Natural Gas vehicle?" Of course there were blank stares for about 30 seconds. But the point is this is fuel economy of a non-petroleum fuel. But here's where the link lies to the hydrogen future. In what we call the ultimate. It's some place we're trying to achieve, but it's not really here yet today, certainly not for the masses. Home refueling for CNG will pay great dividends as a potential for home fueling for hydrogen fuel cell vehicles generating that hydrogen right at the house. So this is that pathway to hydrogen that we refer to. Here still today, our success with that is already paying dividends with codes and standards and that early effort of getting the public to understand this purpose. And this is our home energy station creating electricity, heat and hydrogen from fueling your vehicle at home. But if we cannot succeed with this, this will be an ultimate challenge that will be even more daunting. So keep in mind we also developed this one phrase for these drivers. So hybrid vehicle drivers today are part of the solution, and certainly in a large volume. We'll see millions of these on the road, and these to the tune of 100s of thousands, and here a thousand or so as it is today, and hopefully increased. But right here, this is at the 100s of vehicles today. So these folks here, the CNG drivers, are what we call the apprentices of fuel cell hybrids in the future. They're accustomed to the storage of high pressure gas, they're accustomed to a limited infrastructure which, as Joe properly shows, that's the difference even between CNG and hydrogen today. But what they've invested in CNG is a perfect model and pathway to where hydrogen and that infrastructure needs to go tomorrow. So we think this is an important step. That's why we put a stake in this and call it the best today that everyone has to play and if they continue moving up this scale, they will be playing to a greater degree. Thank you very much and we look forward to your good questions.

2.3.8 Jamie Levin, Director of Marketing & Communications, AC Transit, Oakland, CA

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/March%203%20Jamie%20Levin.ppt>

I have to comment that Bill's presentation gave a very strong, quantitative, convincing argument about the onslaught. And I'm compelled to share with you, briefly, my experience as a commuter. I live in Berkeley. I work in downtown Oakland. In 20 minutes, I take a bus and a BART train to get to and from work. Today, I stayed with my friend in LA. I traveled 44 miles, and it took me two hours and 15 minutes to get here. And while it's really great what we're doing with alternative fuels—they're absolutely necessary—we've got to recognize the real problem here, which is vehicle miles traveled. And we really need to address that, beyond the technology.

So with that, let me talk about what AC Transit is doing with its program. We're a transit service agency in the East Bay of the San Francisco Bay Area. We carry about 64 million passengers annually. We serve Oakland and Berkeley. And we have initiated over the last five

years a very extensive hydrogen fuel cell program that is \$20 million and counting. It includes these four buses, one of which will be going to Sunline Transit in Palm Springs. A prototype bus that we've been testing for the last year, and up to 10 Hyundai fuel cell cars that we will be getting in the next year, over the next several years as part of the DOE technology program. We're also in partnership with ChevronTexaco to build a hydrogen station that uses natural gas, reforming natural gas to make hydrogen. A very practical and affordable solution we believe will help launch our hydrogen program in the very early stages of commercialization. That station will produce 150 kilograms of fuel a day. We've had in operation now for over two years, an electrolysis program that produces about 24 kilograms of fuel. We have a major evaluation project, that we've worked on together with Enrail and the Department of Energy to evaluate the success and the problems with our demonstration. And we also have a major education effort that involves curriculum development for middle and high-school students as well as developing a learning center so that the experience of the demonstration is far greater than the importance and understanding of what the technology brings.

So why does a transit agency that really is a public agency that loses money, why are we involved in a very high-tech R&D program? It's a very good program, since only about 20 percent of our costs are covered by farebox revenue. We were very successful through an aggressive effort to raise this money from 10 different revenue sources. Mostly public agencies, but also leveraging that money with private contributions and working a real public/private partnerships.

The key to why we're doing this is, number one: health. Improving the health of the communities we serve. Our buses cover a single intersection many times a minute with all of our trunk lines and services through the most densely populated communities that are impacted by air emission problems—people who have lung problems, seniors and young people. Secondly, there's a quality of life issue, which relates to the problems of noise. Berkeley, which is a transit first city, is suing us—not the City, but two neighborhoods are suing us because of the noise problem. Fuel cells offer significant improvement over those kinds of impacts. And then we have a self-interest in terms of life-cycle costs. We see electric-driven or electric-powered being significantly less costly to maintain than internal combustion engines. And the value proposition for us is that we offer a heavy duty application where the technology companies can test this technology and expand and accelerate their development efforts. We see the application in urban transit systems as the first stage of commercialization for hydrogen and fuel cell technology. And largely because we have a centralized staff, a professional staff, our fueling is centralized, our maintenance work is centralized as well.

With respect to lessons learned from this project, I would say that it takes a lot of money and a lot of persistence. We've raised \$20 million and we've done that three times over, dealing with the delays of pulling the project together and having to go back and seek approval from everyone from the state legislature to the California Transportation Commission to keep our funds and to move forward. Additionally, our ability to collaborate with partners is absolutely critical, and developing a comprehensive program that evaluates this technology carefully. The prototype vehicle in the middle picture of that bus that we've operated this last year—we've put over 8,000 miles of service on that vehicle. We've realized 7.6 miles per gallon equivalent compared to 3.8 miles per gallon equivalent for a standard 30 foot diesel bus. So we have a lot of promise with respect to the new technology that will launch with these 40 foot buses.

So what does the future bring? We have to bridge the gap between this future technology. We're doing that with the development program with gasoline hybrid buses. We look at hybrids as a key transition strategy, looking at hydrogen ICEs as part of that design. And I think we really have to look at ways to sustain the financial effort that we're putting into this, and also the mandates. CARB has been very helpful and very much a leader in helping us realize the need to improve our own emissions. And so DEQs in other states can really play a leadership role in advancing some of those mandates. But on the other side of this, it takes funding and money to bridge the gap between the standard technology of diesel and this advanced technology, particularly in public service applications, where our riders want to see improved technology. But if the bus that is expected to deliver them to their workplace is either not there or it's 20-30 minutes late, they don't care whether it's diesel technology or zero-emission fuel cell technology.

2.3.9 David McCarthy, Commercial Manager, Fuel Cell Energy Solutions, Air Products and Chemicals, Incorporated

Accompanying PowerPoint presentation can be viewed at <http://www.c-u-i.org/uploadFiles/Dave%20McCarthy.ppt>

Air Products is an industrial gas company, a leading producer of hydrogen for industry and we're getting into fueling stations, as well. My presentation is just around the fueling stations today and in the past couple of years, and what's coming in the future. I'll give you some detail around the hydrogen fueling station and projects that you can expect to see over the next couple of years.

First, Air Products—again, a chemical and industrial gas company, about \$8 billion. We supply about 50 percent of the industrial hydrogen market. We also are a leader in hydrogen fueling stations. We've got over 30 demonstration projects in operation today, around the world. Also developing the future technologies—reformers, hydrogen storage solutions, trying to work on the technologies that we've heard throughout the morning that need to be addressed. We concentrate on safety and safety education and training and are a member of the NHA.

This slide shows the different modes of getting hydrogen to a fueling station site. I'll start on the right hand side—that's a little picture of a compressor. High-pressure gas storage and the dispenser, very similar to a natural gas fueling station as Mitchell represented. The cars and buses are at higher pressure today, about 5,000 psi, so you need to go a little higher pressure. Really the difference with hydrogen is the supply mode. There's a great diversity of options for supplying the hydrogen. And that's where we get on the left hand side. First, hydrogen pipelines, just like natural gas being piped into the site. Now hydrogen pipelines are very limited. There are large pipelines for industry in the Gulf Coast. There's one here in Los Angeles, some in Chicago, but again, very limited. The typical mode for distributing hydrogen to industry is to deliver it to the site. You can deliver liquid hydrogen and store it on site as a liquid, or deliver it in a gas truck and store it on site as a gas. The next two modes are to produce the hydrogen on site. You can do it through natural gas reformation, similar to what Jamie just mentioned that he'll be doing in his new project with Chevron. The last one is electrolysis, which AC Transit did with their first project in Richmond. They took water and electricity to make the hydrogen. Those are the five most typical modes of bringing hydrogen

to a fueling station site. And then really, the fueling stations can take any of those modes of hydrogen, once you've produced the high-purity hydrogen, it can go into the fueling station.

Let me talk about some examples of what Air Products has done in the past, and then we'll talk about where we're going. When it started out, probably just three-four years ago, University of California had some demonstration programs with Toyota. The equipment we were using were really industrial delivering cylinders. They had little valve skids up in UC Davis. Here in Irvine, we had a test skid with a two trailer to fill their one or two Toyotas. We had some pretty big demonstration programs at Ford, in Dearborn, and in the City of Las Vegas for the Department of Energy. But again, all kind of demonstrations, a lot of hands-on with engineers, a lot of steel—we've taken that learning and taken it into products. You'll start to see now more user-friendly products.

The next slide shows something that looks a little more like a typical station. We've got small products up in the upper left hand corner. Everything's in one little box, the compressor, the dispensing system. That's what fills the Toyotas up in UC Davis. Over on the right hand side, is just a larger system, the hydrogen dispenser stands alone by itself. UC Irvine will be getting this for their upgraded station. Bottom left hand corner is mobile fueling. It's a product that is really self-contained. You don't need any utilities. Solar panels on the roof, all of that. It's for very easy installation. We've grown with Honda with this product. It's been nice for the Honda customers. This is the first one at LADWP in downtown LA.

Also some high-technology demonstration projects to get the next phase of technology. We have two of them for reformation. We've had one reformer running in Las Vegas for there years now. Now refueling the Hondas, as Steve mentioned. Penn State, with the USDOE will be getting the next one. In Washington, DC, we work with Shell. There we've had underground liquid hydrogen storage. That's the first time that's been done. That's at a retail site, with 10,000 psi fueling and also liquid hydrogen fueling for the General Motors cars. Also, large scale bus fueling. Another fuel cell bus demonstration program is with VTA, Valley Transit Authority in San Jose. They have three fuel cell buses with Ballard fuel cells. Their grand opening was held last week, and the buses are up and running.

A couple examples of projects. Retail fueling. This is Air Products technology that went into a Shell stations and a BP station in Singapore and Washington, DC. You see they put it right into the gasoline site. The Shell station shows the hydrogen dispenser, and the rest of the row is standard gasoline dispensing. You'll start to see this now in California as well, with Chevron and BP and Shell are also planning similar programs in California.

One of the other things we need to do is follow the OEMs. And we're doing this with all the operators. The last couple of months, Honda wanted to do their cold weather testing in Albany, so we've had to build a fueling station in cold weather, and have a lot of our own [mournings?] as well—solar panels don't work too well with a foot of snow on top of them. Various things like that.

We've also followed them to Las Vegas. Dan Hyde in the picture there, flew down to LA to drive his fuel cell vehicle to Las Vegas. We followed them with our mobile fueling station, filled them in Victorville and Bakers so they could make it on the route.

Last couple of slides just examples of how this is growing, and California is a perfect example. If you look at where we were just two years ago, we have our five hydrogen plants in the state and a handful of fueling stations for the Honda and Toyota customers, one for BMW. A pipeline system in LA. Our plan was to tie all that together, and that was while the DOE validation program came out, so that was the proposal that we put in to the DOE. This project will be with Honda, Toyota, Nissan, BMW, Conoco-Phillips. The proposal is for about 80 vehicles in the next five years, up to about 20 fueling stations. The picture there is the one we're building now in Torrance, on our hydrogen pipeline, within the vicinity of Toyota, Honda and Nissan so they can all refuel.

Last slide—by the end of 2005, we should have close to 20 fueling stations. The first 10 are running now. Five of them there are for the South Coast Air Quality Management District, for their program. And a couple of other ones here in the LA area. That's it.

2.3.10 Dan Emmett, Energy Independence Now

A lot of you are aware of the Hydrogen Highway initiative that the Governor initiated last April in his Executive Order. Largely because a lot of you have been directly involved in developing the blueprint plan, which is the plan that will lay out the pathway for rolling out a hydrogen highway and infrastructure in the state, along with vehicles, over the next 15 years. So this plan is essentially complete. It's being delivered to the Governor as we speak. It's going through final tweakings for the public and the legislature and will be announced officially and before the end this month and in advance of the NHA conference this month in DC. So just to quickly sum up some of the key recommendations or elements that are in this plan, without getting too specific about numbers and costs. I can't quite talk about that yet. But essentially, the Hydrogen Highway network is an initiative to promote the use of hydrogen as a means of diversifying sources of transportation energy while ensuring environmental and economic benefits.

One of the main points is that it will be implemented in phases. Three phases have been identified. Phase I is between now and 2010, and that's what the Blueprint Plan focuses on. The total of all three phases looks at a path to 250 hydrogen stations in the state, and 20,000 hydrogen vehicles. Phase I by the end of 2010, the numbers are 2,000 hydrogen vehicles including both fuel cells and hydrogen ICEs, and about 1,500 hydrogen stations.

I was separately asked to say something about the DOE program, but I'll just simply say that the hydrogen highway effort works in tandem with and conjunction with the other initiatives such as the Department of Energy's initiatives in the state and in the country. And if you include the South Coast Air Quality Management District's leadership and their programs, along with DOE and the Hydrogen Highway efforts, there are already 39 stations either existing or in the works for California right now. So this would mean an additional 11 to 61 stations in the state by the end of the decade.

Another key element of the Blueprint is that thorough biennial reviews need to be undertaken, periodically reassessing the technological maturity and commercial readiness for vehicles and other hydrogen fuel products. The results of the biennial reviews are going to be critical to

evaluate progress on implementation of a Blueprint Plan and to inform the path forward to subsequent phases of implementation. The results of these reviews will also help identify and define the time frames of phases II and III. The topic teams involved in the process felt you couldn't make those kinds of statements at this stage of the game. One step at a time—that's the phased approach.

There are, in terms of specific recommendations, rolling out major hydrogen stations should be located in major urban areas near the fleets that are expected to use the first vehicles and then there should be stations in major urban areas in a station buildup philosophy. There are recommendations in the Blueprint Plan for incentives, including incentives for infrastructure and for vehicles, modeled largely on the basis of what others have done before, including SCAQMD and DOE, public/private partnerships matching public dollars with private dollars. Also the vehicle incentives will be more nominal, but will indicate a sustained, long term commitment to this pathway.

And then on the implementation side, you heard from Allan Bedwell, what they're doing in Florida. We've taken the lead from them and have been talking with them about their efforts there and have very similar recommendations contained in this plan with regard to codes and standards and permitting. There are specifics that are in the plan that will help streamline that process and standardize it, and consolidate the authority having jurisdiction to the state fire marshal.

Another key part of the Blueprint Plan is to ensure environmental goals of the Hydrogen Highway. Specific goals in the plan are 30 percent reduction in greenhouse gas emissions associated with the Hydrogen Highway network. As well as the goal that the Hydrogen Highway network should utilize 20 percent new renewables in how the hydrogen is produced.

And finally, I'll just say that this has been an effort of more than 250 stakeholders from a wide, wide array of all of the above stakeholders. It's been a very collaborative process. It hasn't been a consensus process, but the result is a tremendous amount of work and cooperation, and this has created a real strong movement to move forward in pursuit of this unified goal and this vision for a diversified, sustainable transportation economy in the state. I guess that was more than two minutes. In transitioning to Sarah, I'll just say that on my way down here sitting in traffic, I was having visions of a smog-free traffic jam. So that didn't get me too excited—I'd still be sitting in a traffic jam! I think you're going to talk about congestion.

2.3.11 Sarah Catz, Director, UC Irvine Center for Urban Infrastructure

I think Bill Reinert did such a nice job of interlinking congestion with what we're working on, I'm just going to add that the Center for Urban Infrastructure was created to advance constructive solutions for the connection of land use, transportation, energy, environment and other infrastructure issues, as well as finding great financial solutions to create a stable financing system. We look forward to working with you on all these issues. Steve Ellis from Honda has to leave—so if anyone has a question for Steve, please ask now, and then we'll adjourn to lunch.

Ranji George: My question for Steve is that you have shown that you're on the cutting edge of new technology, why did Honda join the other automakers on the lawsuit?

Steve Ellis, Honda: I was warned to be careful and to expect these types of questions. I will simply say that no matter what our great efforts are, it's daunting. The goals are daunting. It's not easy. There are questions of fairness. Those that have worked the hardest, certainly eking the last bit out is more challenging to them. And I'll leave it at that.

Darryl Clark, Sierra Club: Since you've had experience with both vehicles, could you compare the equivalent miles per gallon of the CNG Civic vs. taking that natural gas and reforming it to hydrogen and fueling the fuel cell.

Steve Ellis: That's a good question, and I'll have to defer to my engineers for the best answer. But on the other hand, I've been one that's defended the production of hydrogen from natural gas, because I think it's an indicator that this is an industry in its infancy. And striving for perfection right out of the chute is like asking a baby leaving the hospital to change its own diaper. It's just not going to happen. And we have to go gradually into this, and accept hydrogen no matter what the source. And of course, always strive for the ultimate goal. As far as the GX and relevant energy models, Ben Knight, Vice President of R&D has worked extensively using the Greek model for coming up with those answers, and I would encourage you to contact him for that. The home energy station is a great example. It's operating on pipeline gas, but has significant efficiency benefits that come from the fact that you're using this single fuel source—the natural gas—to create the hydrogen, extract the heat, make the electricity, and of course the excess hydrogen then is compressed on the site, using the power of its own unit, so you have none of the line losses, and you have an efficiency model and CO₂ reduction that most people don't even consider when they think of hydrogen derived from natural gas. So don't get locked into a concept. Think far beyond that before you assume one single model regarding CO₂.

2.4 Connecting the DOTs (and the DEQs, MPOs, AQMDs)

This section presents the afternoon workshop, which included brief presentations and discussions focused on four topics:

- Fuel & Technology
- Transportation Infrastructure Finance
- Regulatory & Institutional Issues
- Plugging in the Public: Serving Customers & Educating a Nation

Sarah Catz, CUI: When we did this last time, we actually had a two-day conference, but when we sent out the surveys, the overwhelming response was that they just wanted a one-day conference. They also requested that it be in the middle of the week, so we tried to do what the majority wanted. So there were certain accommodations that we tried to make. So if you're thinking, why did you compile so much information in one day, that's the main reason. In any event this next section is where we really need everybody's input, your successes, failures, etc.

I mentioned Jeff Morales this morning. He's the former Caltrans Director, and he left about a year ago. And when Jeff was at Caltrans he was a leader in so many fields, but he was a

particular leader in the alternative fuels field. Maybe one of the reasons Jeff was such a good leader is that he had a huge policy background. He worked for Senator Lautenberg. He worked for former US Secretary of Transportation Pena, and a variety of other places and for other people. He's now with Parsons Brinckerhoff or PB Consult, and he's doing all kinds of fabulous things. Hopefully we'll keep him involved in this area.

Jeff Morales, Parsons Brinckerhoff: I guess I used to be a visionary and now I'm a mercenary. This session we're going to build on this morning's discussion, and really kind of take it to the—ok, what do we do with all of this? How do we make things happen? And how do we translate what's happening in the private sector and in some isolated places in the public sector, and turn it into more of an action plan, and figure out at what agencies and what levels things need to happen. We've got some folks here who are going to help kick off the discussion. We're going to follow roughly follow the green sheets in your packets. We do want this to be interactive.

We do have some experts still in the audience. The first topic we're going to talk about is fuel and technology. What are the problems we're facing in this area? What are the solutions that we've started to see, with an eye toward bringing this up to scale, deploying these fuels and technologies. Resources that are available to solve the problems, and resources we need to solve the problems. And some ideas at least to help start out in terms of a national, coordinated approach to doing this. We heard a lot of discussion about that this morning, particularly with Joe Darling talking about the need for national standards. So how do we start moving forward on that front.

So we're going to start with the fuel and technology area, and what I'd like to do is ask our folks up here to help frame the discussion and then open it up for discussion more broadly.

Harry Sigworth, ChevronTexaco: What I'd like to do is just cover some observations from our company's perspective, and particularly from my perspective on looking at fuels and technologies for alternative fuels. I think that one of the key things we run across many times is people looking at alternative fuels vs. gasoline and diesel and technologies available now. We see a lot of analysis that compares some future technology like a hydrogen fuel cell vehicle maybe 20 or 30 years out at the stage it would be at then to the five year old gasoline vehicle, and it tends to be kind of an apple and oranges comparison. And I think one thing that's very very helpful in looking at alternative fuels is comparing everything on a common basis. In other words, if you're going to compare a future technology ten or twenty years out, also compare a gasoline or diesel vehicle ten or twenty years out. Maybe it's a hybrid, maybe it gets a lot better fuel economy than the typical car on the road today. So I think that's one of the key problems. There needs to be a very balanced comparison of the different vehicles and fuels out there.

The solutions that we've identified—we have tried to participate and have spoken in a number of forums in trying to provide our perspective and also participate in a wells-to-wheels analysis. We have participated, for example, in one with General Motors, looking at criteria pollutants as well as greenhouse gas emissions on a wells-to-wheel basis. And that study should be coming out pretty soon. Although a preliminary version was presented at a fuel cell conference about a year ago. And one other thing that I think is important to recognize, and is something that I

mentioned in my talk this morning, is that sometimes things that really look good, but maybe aren't too well defined or maybe have a lot of hurdles to overcome, some of these hurdles might be a little more difficult to overcome than people think. And something else may become better. So as a result, it's a good idea to let the different technologies and fuels compete for the market place as they develop and see what really tends to rise to the top. So those are just a couple of general observations from what I've seen in this area, and as I mentioned earlier this morning, certainly, alternative fuels—they have a lot of promise. The issue is, if the public is going to buy them and what will it take for the public to buy them. Because if they're not bought by the public and used by the public, then their benefits aren't going to be realized.

Jeff Morales: One question I'd like to throw out. We heard some great things about what some states are doing, in terms of these—but there is a question, what is the right role, and what can a DOT or public agency do in terms of driving—is it really the right place to try to drive the conversion to new technologies. I was very struck, I'll say, by something Jamie Levin said, about the cost of the fuel cell buses that they're using, being roughly 10 times the cost of a traditional bus. When I was in Chicago at the CTA, we were running fuel cell buses, and this was seven years ago, and it was about the same price differential then, and there was a real question in terms of whether the market, in the public sector, is big enough, in fact, to really drive change among the manufacturers. Or whether it's going to have to be the private automobile and that technology leading to advances in the public sector. I don't know if anyone has any comment in terms of that issue—what is the role of the public sector as we look at this issue in terms of driving technology and fuel use.

Jamie Levin, AC Transit: I'd like to respond to that. You're quite right that there has been a shift in the cost, but there is a significant improvement in costs in terms of reliability and durability and of course we'll be able to see what that is over the next couple of years. But there are significant advances there. I think the technology is also on the verge, as it pulls out of pre-commercial stage into mass production, those costs will go down. So maybe in the next round my \$2 million bus will be a half million dollar bus. But we will not be able to move forward in what we're doing if the state—in fact, Jeff deserves credit for this because this forward thinking, the state of California recognized they needed to step up to the plate and provide the funding—yes it's only three or four buses, it's not a lot, but it's critical to the evolution of the technology. And we have a very significant partnership with the technology players, ChevronTexaco, United Technologies. So they're not just vendors where we're going out and buying their product. We're actually a team working together, to tie in the user as well as the technology players. And that's why I think it's really important that the states can really be the instigators of this new technology and the incubators and we need to play a role in that area.

Woody Clark, Milken Institute: I think that's one of the critical questions to what Jamie just said. One of the issues is procurement of the vehicles, where the state starts off and says it's going to have a plan and lets the manufacturers know that over a period of time there's going to be x number of vehicles per year that are going to be required. And those of us who are involved in manufacturing know a bit about it. There are manufacturing cycles for whether they're cars, buses, or trucks. Taking those cycles, we know pretty much what's going to happen. And Jamie is I'm sure aware of the fact that his bus now is probably going to be good

on the road for another 9, 10, maybe 11 years on the road, but after that we're going to have some other vehicles that will move into the transition. The second thing is that Caltrans in particular, has two hundred, three hundred, 250 or so different locations throughout the state, many of which could be converted to hydrogen stations along the highways. They're very strategically oriented. And because they see the value in this, there could be that kind of activity. And the final thing is, and I think this is something Governor Schwarzenegger has been on top of and following, is this whole issue about we, in the state, again get a formula from the federal government of money that is allocated to California. We should be able to get some of those resources to bring them into the state and be very aggressive toward that. And that kind of thing is going to be able to help us put something there other than public policy or lots of smoke and mirrors. We've got to roll up our sleeves and do something about this.

Unidentified Male: Joe—maybe you can say—you're out there using other vehicles. Are you seeing any progress in terms of production cycle, volume, pricing, coming into play making it easier for you and others to proceed along this path?

Joe Darling, NYSDOT: [answer inaudible]

Leor Alpern, Cliff Gladstein & Associates:

Just to pick up on the topics that Joe was just mentioning, and to answer your question. The answer is that Caltrans and other DOTs absolutely can play a critical role when it comes to natural gas vehicles. Because as Catherine said this morning, we have a bit of an issue with the manufacturers. And what they need to see is demand. And consistent demand, as was mentioned earlier by Woody, year after year when a DOT says that these are the types of vehicles that they're going to be purchasing. So when it comes to natural gas, specifically, speaking on behalf of Gladstein & Associates (?) and the Interstate Clean Transportation Corridor Project, for the last ten years we have been helping together as a public/private partnership a network of liquefied natural gas, liquefied to compressed natural gas infrastructure and fleet deployment here in California. And the infrastructure exists, it is substantial, it is expanding. We're doing this together with the South Coast AQMD and helping them with their fleet rules. In addition to that, there's also going to be economic incentives. It was mentioned earlier today the Saudis are pretty much saying "get comfortable with \$50 a barrel." And next year it might be \$60 a barrel and the sky's the limit. So also with emission compliance, with regulations for 2007 and beyond. Yet another reason why it might be easier and cheaper to go with alternative fuels and possibly again natural gas. There's also the topic of in-state LNG deployment both from off-pipeline sources or liquefaction projects such as are going on in the Central Valley together with PG&E. Again, worth consideration. Caltrans can link together with local DOTs to use this infrastructure, and finally, hydrogen is a key topic of today's discussion, and natural gas is the natural bridge to hydrogen. We're involved in a project with DOE and ENRO (?) again through the ICTC to examine the possibility of blending LNG and hydrogen as we've seen demonstrated through the hythane demonstration over at Sunline Transit, and also with Collier Technologies over at UC Davis. So again, a lot of opportunities there, and Caltrans can play an important role.

Harold Garabedian, Vermont Agency of Natural Resources: There are three roles for state agencies. And one is I think a leadership. And leadership can take a lot of different forms in various states. Our first nickel-metal hydride battery pack cost us \$60,000. Our next one

cost \$30,000. And our next one cost \$15,000. And now, today, nickel-metal hydrides are pretty standard products. So I think people have to go out there and demonstrate these technologies. And I think the second role is education/outreach of the public. To educate the public is very hard thing to do, and there's a lot of mixed messages out there. And I think state agencies are in a position to put credible information out there on the issues. And then the third one is sort of regulatory public policy incentives. I think that in the end we'll really need regulations if we want things to happen. I'm sort of back in the command and control world a bit. I understand the role of incentives and all that stuff, but in the end I think that if we're looking to level playing fields, I think regulation is the only tool we'll have in the future.

Mia Waters, Washington State DOT I echo the other sentiments that state DOTs and other agencies do play a role. In that role there are certainly a lot of challenges. Currently, within Washington State, although we're not sure who our new governor is these days, our former governor mandated that the state go with 20 percent biodiesel blend for the state fleets. Yet we have the challenge that currently with engine manufacturers, we are not able to get to the warranties that we need to maintain that type of fuel within the systems. And so in order to move toward this mandate, which we're going for in a regulatory way, and trying to drive the system, we also need the system to catch up and work with us, so that if we're taking that step, that we don't end up losing all the warranties for our fleet equipment out there as well. I think it's a combination with industry and with government as a coordinated effort to support each other. In the diesel realm, if it looks like diesel, smells like diesel—it is diesel. Some of that interchangeability should also be a factor of interest. And related to that, amongst our various topics of conversation, this goes as well with codes and standards. Because if you are going to have a specific type of fuel, do you have fuels of the same ilk that will go across the board that you can use from one state to another, from one engine type to another, and still maintain all your systems and warranties.

Bruce Agnew, Cascadia Center, Seattle WA I guess the question is, California is engaged in this hydrogen highway initiative. Up north, our neighbor, British Columbia is set to build six alternative fuel stations with a mix of natural gas and hydrogen and biodiesel around a lower (main line?) in British Columbia in advance of the 2010 Olympic Games. And that's part of their policy to go to a sustainable fuel for their economy by 2025 for all sectors. It seems to me that the west coast, if you throw in Alaska, where getting fuel products to remote areas via barges is a logistical nightmare. But the west coast, and particularly the I-5 corridor could be a great case study for the development and deployment of these infrastructure stations or malls for alternative fuels. If you could get Washington and Oregon which are already engaged in this with the purchase of their fleets and such. But the role of the federal government as a catalyst for this would be appropriate in that we have completed our interstate highway system, and there are some folks who wonder whether we ought to skip TEA-21 and just give the money back to the states. That's an active debate, particularly with all the congressional earmarks—3,000 of them in the House bill that we just marked up. But it seems like the interstate highway system could be the backbone for deployment of these stations. And I'm not sure in California, but in Washington and Oregon, we have great rest stop areas, and there's some talk about privatization of those rest stops because we can't afford to maintain them any more. But every 60 miles or so along Interstate 5 or Interstate 90 or I-84, there's a rest stop that usually has an area for cars and campers and trucks. Why not try to convince the federal government to sponsor the development of that, where there's a public right of way that could be privately

developed with private funds, to get people used to the convenience of stopping at least along the interstates crisscrossing America as a way to start getting into the infrastructure deployment area, so that it's easy to get to a station and you know where they're going to be.

Jeff Morales: If you look at the transportation economy, certainly, it really has grown up around, as we all know, petroleum, the use of gas. One question I'd throw out is, is there agreement that we're talking about a wholesale transition to another form. One of the issues is that even within this group, we hear some splintering, in terms of do we go to hydrogen? Do we go to natural gas? Is one a pathway to another or are they separate paths? And out of this group, I think there's a pretty strong feeling, in fact action moving toward new fuels. A contradiction in a way being that, at the national level, we've heard some discussion about that, there's—I think it's fair to say—resistance to moving away from petroleum based economy. How do we reconcile those two differences? Since this is a country, after all, and at some point there has to be a national policy, and I don't know if there might be lessons—Heather—in your area? Local vs. national standards and points of view.

Heather Rosenberg, CTG Energetics: [inaudible]

Jeff Morales: Can the industry support different directions? If New York really goes wholesale into natural gas, for instance, and California decides it just wants to leap frog to hydrogen? Is that a viable scenario to have different directions, or at least different paces of direction, if not entirely different directions? Is that a supportable scenario, or does there in fact need to be a consensus on more at the front end, as a country where we're going?

Bill Van Amberg, CALSTART: Two thoughts. One is, I don't think we can afford not to have multiple pathways. Even as you look at alternative fuels that are there, we're going to have some challenges whether it's with supply directly or because of recovery time and investment periods or costs, with petroleum providing all of the energy that we're going to be needing in the transportation sector. So we're probably going to have to have, at least the way we view it, multiple pathways. Some of those may be regionally based. You may find propane has been really strong in Texas. There's no reason necessarily for them to stop on that. You may have ethanol be stronger in the Midwest. You may have other pockets of biodiesel being the replacement fuel. What I think we're seeing is that we're probably going to have a portfolio of different fuels that are going to be out there, and probably technologies, depending on—some people call it sneakerization—but really where you'll have different technologies used in different niches or different cycles. Transit is an interesting example of where alt fuels have taken off. Twenty-five percent of new transit bus purchases are alt fuels already. But if you really want to get volumes up, which is tougher with a niche approach or with a portfolio approach. But one thing I think DOTs could do, and state agencies in general, is look at how they can create partnerships across multiple states and use their own market power. One of the things we've looked at just, for instance, in hybrids, is how you can pull together to define specifications and parameters and then go out to industry and say, "We as a group will buy a lot of these if you can build it." And I think there could be a similar approach taken by DOTs to cooperatively, in different areas where you could find enough commonality, go forward, and say, "ok—we'll buy volumes of this alt fuel vehicle if you'll build it. And this is the amount of total market power or pull that we represent." I'm not sure the public sector has ever pushed their capability of market power as much as they could.

Harry Sigworth: I'd like to agree with some of these thoughts. I think that first of all, it's clear that we're going to need to rely upon a lot of different fuels in the future. Everything we can basically get, that's economic and the customers will buy. And I think that another key point is that conservation is going to be important here, too. It's not just switching to alternative fuels or having alternative fuels make up part of the mix. It's also conservation, and we've seen some quite impressive improvements in fuel economy being offered by some of the manufacturers. So I think that those are a couple of points that I agree with.

Catherine Rips, California Hydrogen Business Council: I have a lot of different thoughts about things that have been talked about. I started out in the propane industry in Texas, spent nine years there. Moved to California, it was sort of the land of electric vehicles and the zero emission mandate. I do live in the South Coast Air Quality Management District, and so I worked for Sunline Transit Agency, that was an all natural gas test fleet, and we were also the first place in the country to start generating hydrogen on site and using it in vehicles. So I have several different perspectives on all this, and I really appreciated all of Jamie's comments about the lead that public transit can take and needs to take, and I think state DOTs need to follow along with, to catalyze the market, and to be the early adopters, and to work out the problems in the technology. Sunline is an example. It converted its fleet overnight from diesel to natural gas. There was no natural gas infrastructure in the Coachella Valley. And within a couple of years, six stations were built that basically put all the other fleet operators within 10 minutes of a natural gas station. So we were then able to work with the Clean Cities Coalition of the Department of Energy, with local customers, to convert over the waste haulers, to convert over postal vehicles, taxicabs, police cars and you can see this domino effect of going from no zero-emission vehicles in a community to over a thousand, and it was because public transit started it. By having transit be an early adopter and build stations that are open to the public, and then working with some of the other fleet operators, you can make a huge impact. And I just want to echo what Bill was just saying. I have this great frustration that I've had for years, about the lack of a national energy policy, and I've seen them start and stop and start and stop. You know, I can really appreciate the dilemma the car manufacturers have, not knowing where the technology is going to be mandated next, and with the energy providers, who don't want to build infrastructure that's stranded, but I come from the school of "do what you can where you can every time you can." So, if propane works in one market, then you have a fleet operating on propane and it's that many gallons you've displaced. If you've got a hydrogen project, great. We advocated hydrogen very heavily at Sunline, and I still do, but that's the same kind of subject, because you're not going to be able to get all your hydrogen from the same source. So, I mean, in some places, reforming works. In some places electrolysis works. Our example is, you're not going to put a windmill in Manhattan to generate renewable power. You have to do what you can where you can, but if the states will take up the gauntlet, in lack of a federal policy, which I see them doing all around the country, and pool their power, we could have it happen now.

Jeff Morales: Actually, the reconstructed World Trade Tower does have a windmill, or will have.

Daryl Clark, Sierra Club Angeles Transportation Chair: Two disparate comments. One is we talked about what would make people interested in moving to other fuels, and I can

just imagine the next time the gas lines start going around the block again—and all of us who remember that from the 1970s, to be able to either plug in or fuel my car at home would suddenly become a great quality of life thing. Not to have to wait in that line at the gas station. And personally, whether it's an electric vehicle, a hybrid, or a natural gas vehicle I can fuel at home—and I think I'm not just speaking for myself—I think that would be great for my quality of life to have such a vehicle. And I think that most of us agree that it's inevitable, whether it's political instability, terrorist acts, or just that oil supply starts to drop below demand, we're going to see that sort of impact nearer rather than later.

Second comment, and this seems to be a question that's in the air—I alluded to it in my question to the gentleman from Honda. On the one hand, we're talking about natural gas, then we're talking about hydrogen, and the question is what is the source of that hydrogen. Generally it seems the source is natural gas, so therefore, what is the lifecycle efficiency—are we better off just directly using that natural gas vs. both infrastructure costs and conversion losses, converting it to hydrogen and using it as hydrogen. Why not just use it as natural gas? And if we do, there's a great article in *Scientific American* last May, suggesting that the overall system efficiency would be greater if we use our renewable sources of electricity to feed the grid, rather than use those to hydrolyze water to create hydrogen. So that second one may get more of a comment than the first.

Jeff Morales: Anyone want to respond?

Harry Sigworth: I have a comment on your second question, which is a good one. I think that the hope is that future fuel cell vehicles will have high enough added fuel economy to offset the extra costs, the extra inefficiencies of making the hydrogen. I'm not sure we're quite there yet. If you looked at my chart on the actual fuel economies there now. But I think that's one of the things that needs to be demonstrated and further development needs to occur.

Tim Lipman, UC Berkeley. I have a quick comment, Jeff on that last question, which I thought was very good. On the question of using the renewable energy to displace grid power vs. make hydrogen for vehicles, that's a pretty well-taken point. And what you have to think about is what's the marginal power plant that you're displacing with that renewable power. If you're displacing a coal-fired plant, then that's almost incontrovertible, I would argue. Because the greenhouse gas emission benefit is probably about double from displacing coal power what you'd get by displacing gasoline in the vehicle fleet. In California, of course, we have some coal plants, but they're all out of the state. So you have to think about what are we really assessing where—are we talking about California or somewhere else? But of course a lot of our power in California is natural gas, relatively clean natural gas. And if you're displacing natural gas power, it's much closer—it's probably still a little bit better to displace a natural gas powerplant than to make hydrogen, but we may be much closer to a wash. And then there's another point, when you talk about windpower and intermittent renewables, there may be time of the day, or year—mostly day, for example at night, when that resource—you know, you probably don't want to mess with those base load powerplants that are operating there, because that affects their emissions and their efficiency and so forth. So there may be times when you have off-peak renewables and you'd be better off making hydrogen. But that's a very interesting question.

Matt Miyasato, SCAQMD: One thing that you might be willing to accept, in spite of efficiency losses if you compare using natural gas directly vs. using hydrogen in a vehicle, because with hydrogen fuel cell, it's a true zero emission at the tailpipe power source. Compared to natural gas, which is not zero, an improperly maintained natural gas vehicle can be a gross polluter. So there are no guarantees. But with hydrogen, it's still a zero emissions vehicle.

Joe Darling: I want to comment on one of the questions that Bill asked about regional partnerships. Back in 2001, we started the Northeast Association of State Transportation Officials Alternate Fuels Task Force. And it was very aggressive early on, because there were compliance issue at that time, and there was a lot of interest. Some of the states decided to utilize the biodiesel credits to meet their light duty vehicle obligations and the partnership became fragmented. It wasn't over that issue in itself, but it goes back to the point that I was trying to make earlier on this—we need national leadership on this, because each state has a governor, and each governor is in a term for maybe four years, maybe eight years, and as the turnover in governors goes, so does the policy go. So it's hard for the State DOT or the state agency to develop a consistency policy sometimes even with the same governor in place, because the advisors, or whatever, lobby groups influence their decisions. Just a comment on the regional thing. It should work. It could work—that was the concept behind the NASTO concept, is we wanted to develop an interstate network through the northeast. NASTO includes 13 states from Maine to Delaware. And if we could have gotten every state on the same page with building biodiesel fuel facilities, but then there was no standard for the biodiesel in those 13 states, or nationally. You need a consistent biodiesel standard. Is it 5 percent, 10 percent, 20 percent? Whatever it's going to be, it has to be operational through that whole district. Conditions in Maine are much different than they are in Delaware, so you have to look at that, you have to consider all those things. But I still think that if we don't get national leadership—and the hydrogen concept is there—I'm not knocking the hydrogen concept. The problem with the hydrogen concept is it's just like hybrid vehicles—it's deterring from what can be done. Hybrid vehicles are very nice. But they're all running on gasoline and diesel fuel. You could supplement them with CNG or an alternate fuel and make them a true alternate fuel vehicle, but there's no policy in place to do that. And the manufacturers are going with what they know best, and what's easiest for them to produce. So I think we need a national strategy. I think that's the only way we're going to overcome. And short of that, I think it has to come from industry itself. From people who are involved, people who know what it can do, and who want to make a difference and will work together to make a difference.

Jeff Morales: I'll echo some of that and maybe modify it a little bit. I think clearly a national strategy addresses a lot of the problems here. Because if you have a national strategy you also get funding and other things that start to flow from it. We had a very similar situation where we started a fleet greening program at Caltrans, covering everything from sedans, where we were buying Priuses and even some electric vehicles up to our heaviest vehicles and we had very strong support from the Governor at the time to do that, but it was a discretionary program that was self-initiated. And we saw exactly that type of situation, where as the budget got tighter, and then subsequently the changes in the administration, that program pretty much is on life support at this point, because it wasn't codified. So one action item that we ought to look at in addition to seeking national policy is that any of these localized initiatives, local being either a transit agency or at a state level, there needs to be an effort to codify it, to put it into

formal state policy, or even better, law, to give it some longevity and it just doesn't just end up being a series of random, very well intentioned pilot programs. Unfortunately, I think that's the situation we may well find a lot of what we're all talking about here, is things never moving beyond that pilot stage unless we institutionalize the efforts.

Unidentified Questioner: [inaudible]

Woody Clark: There is in fact a national energy policy. There was a commission that issued its report in mid-December, a bi-partisan commission. There is leadership, if you will, on the policy level coming out of Washington. But then I have some problems with that, when a particular leader refers to nuclear energy as renewable. It's not political, it's just—I wonder. And what I'm saying here is that Bill's comment, which was that this tends to be regional. We here on the West Coast, as my colleagues from Washington State pointed out, as our colleague from Boulder, from Denver refer to Colorado, and in each part of the United States, we have different kinds of, if you will, assets, and different kinds of strengths. We have a lot of geothermal in this state, untapped and useful to be able to look at in terms of hydrogen—they're doing it in Iceland. I think we have to look among ourselves within this country, but also look abroad. Jeremy Rifkin, who wrote the Hydrogen Economy, just came out with a new book, called the European Dream. And in that, he talks about looking across the pond. But I would argue that, given some of the conversations we had today with colleagues from Honda and Toyota, we also look to Asia for some leadership and some direction. And that's where we should look for national policy in this country. We don't own it. We need to bring in we need to collaborate with people who have been doing this, have gotten some great experience at it, and on the ground have created standards and protocols that we can actually partner with and learn a lot from. I think we need to move off the model of telling everybody that we know better, and sort of absorb, understand and listen to where people are really interacting and doing some of these things and really kind of tweaking the tires, and helping us and we could collaborate together on this.

Jamie Levin: I want to reflect back on I guess Allan Bedwell's presentation about what the state of Florida is doing. In this case it's specific to hydrogen. But whether that's hydrogen or CNG or whatever the alternative fuel program, it's refreshing to see that there is at the top level a real committed effort. In California we're doing that with the hydrogen highway network. But I have to share an experience that we've gone through. I mentioned earlier that a good part of our funding came from the state of California, most all of it. We just went through a one-year process to get the Board of Equalization to exempt us from sales tax for research vehicles. And I can't even begin to tell you the arguments we had to make to save a considerable amount of money. After struggling for a year, money is now going into education which is critical to making the demonstration programs of value. I think one thing that the states can do, aside from the need to have a national energy policy, is really take the mantle and create an effective, fully integrated program that endorses movements in these areas of transportation and alternative fuels. And I'll say one thing in defense of hydrogen, with respect to the Sierra Club gentleman's comment. And that is, the one possible opportunity here is that hydrogen provides diversity of feedstock, and there a lots of individual arguments whether its going to be coal, nuclear fuel, or carbon- based fuel or renewables. But the fact is that hydrogen is an energy carrier, and it can utilize a whole range of feedstocks. And if we look at the history of carbon-based fuel production or utilization in the world, I don't think there was

the kind of scrutiny that we're giving hydrogen or alternative fuels when we crude oil was discovered. And it's a good thing that we are starting now, because we do have an endpoint here, at least with respect to the peak of reserves in which costs and pricing, even though there may be carbon-based fuels available, the costs are going to be prohibitive. So if we can start, really under a microscope, evaluate the value of hydrogen as a carrier. And we need to do it through the demonstration projects that are more than just demonstration for technology's sake, but for educational value as well.

Norman Dong, Caltrans Project Manager for Environmental Justice: Air quality is a big issue in our program because it affects so many low-income and minority communities, particularly in the goods movement area and trains. But in listening to the discussions today brings back some memories. Because a lot of us in Caltrans used to work in what we called the TDM program—remember the old rideshare program. Years ago some of you at South Coast Air Quality Management District remember Regulation XV. All the employers had to have vanpools. In those days, people were experimenting with alternate fuels then, too. This was 1990. I remember, I rode in an electric vanpool that 3,000 pounds of storage batteries strapped to the underside of it. And it had a range of about 120 miles, it could go 55 miles per hour, and to defrost the windows, we had to light a little diesel burner under the window so we could defrost the front windows. That's how far it is. But I hope in another 10 years we're not having the same conversation. What happened was that in the rideshare days, the carpool and TDM days, they had demonstrations too, of alternate fuels. We had compressed natural gas. We had methanol. Remember methanol? That stuff was so corrosive that your entire fuel system had to be made out of stainless steel because it would eat right through the rubber hose. We had ethanol, too. And it was clean air driving it then, not so much energy independence. The thing that happened in all that experience is that some of those things just fell apart. The wheels came off because there were isolated efforts of trying to get to energy independence and clean air. I think that what we need to do is remember that in all this discussion, we shouldn't be fragmented. States should collaborate and network, so we can say we can all buy some buses—maybe 50 or 100 of them. Here's the basic specifications, it has to be ADA compliant, and maybe we should talk about how we can use our transportation funding so that we can break some of that off to do R&D in this, to buy more vehicles for demonstration, and use some of these funds for public education as well, because I think the DOTs have some obligation to work with the public to get them moving toward thinking of alternate fuels rather than being wedded to gasoline stations. These are kinds of things that can happen. What I'm fearful of is that the discussions that we're having here will be like what we had back in 1990 when we had the old carpool program, where we had all these little spot demonstration projects, that fragmented, that never went anywhere because they were fragmented. If we continue to fragment, it means we're muddling toward energy independence, and you have to guess and hope that this rate at which we muddle will be at least equal to the rate of energy consumption in the world. Because if you're behind the curve on this, we're not going to solve the problem.

Jeff Morales: Excellent points. We'll have to come up with the muddle equation, and figure out what that rate is. Let's move on to our second topic which is financing. And it's a critical one to this whole discussion, because every vehicle, regardless of what it's fueled by, regardless of what it's running on, uses the infrastructure. For those of us who either are or have been responsible for building and/or maintaining the infrastructure, money is the game. How we

finance the infrastructure system is critical to this as we look to alternative fuels. And we've got an interesting effort going on up to the north, in Oregon, which James Whitty is going to tell us about.

James Whitty, Oregon DOT: I'm James Whitty and I'm Manager of the Office of Innovative Partnerships and Alternative Funding. Blame me for the name of the office. Two programs, running them both at once, put them in an office together. Oregon is 86 percent dependent on the gas tax. We're not the worst—I heard yesterday that South Carolina is 92 percent dependent. A lot of states in that boat. We tried four times in the 1990s to raise the gas tax. Lost every time, including one on a public vote nine to one loss. Gave it up. Not doing it now. Not even considering. What did we do with our infrastructure that needed modernization? We bonded our way to our modernization dollars, to do some necessary modernization as well as fix our cracked bridge problems. We don't have any modernization dollars in the future.

Our economist tells us that with the market penetration of fuel efficient vehicles—not necessarily looking at alternative fuel, I'll tell you why in a moment, but we expect the gas tax to drop off permanently. Kind of rolling down a steep hill, is the way he describes it, beginning the latter part of the next decade. So, the present looks bleak, the future looks bleaker. Other than that, everything looks great.

So there are two programs we're running out of my office. One is the public/private partnerships program, some other states have done that, I want to describe our version of it. We recognize that the departments of transportation across the nation are not entrepreneurial. They can't handle the risk like private sector can, thus, their imagination is stifled. They won't go to certain places to seek resolution of problems. So we passed Senate Bill 772 in Oregon, that gave us freedom from essentially 100% of the state's contracting law. Essentially there's a couple provisions left. We have freedom to contract with the private sector to bring them into projects at the earliest state and develop projects and then find new revenue sources within those. I'll briefly describe how this process will work. We're going to test it out beginning April 8. We have a draft RFP out on the street right now for industry comment, it went out yesterday. We're asking for the private firms to come in and define the projects as well as to contribute to the environmental process. Primarily to develop a funding and financing plan for projects that have virtually no state dollars in them. They'll look at new tolling capacity. We don't toll in Oregon. That's going to be an interesting one for the public to swallow. We toll bridges across the Columbia, but not within the state. They'll be looking at the extraction of land value that will be benefited by the transportation infrastructure. They'll be looking for the contribution of businesses that will benefit from the transportation infrastructure. You've heard of shadow tolls, perhaps. That's a way to contract with the private firms or whoever would benefit to measure the increase in business as a result of the infrastructure and then they're contractually obligated to remit that to the project. Private firms will be looking at local taxing districts. This is a combined cost. The DOT puts up part, the private firm puts up part for this early work. The innovation is that once the deliverables are made and we are satisfied, the private firm earns the right, without competition, to go forward into negotiations. The competition occurs at the very front end, not at the midpoint when in negotiations to deliver the project once the deliverables are met. That's the innovation. You might say, how are we going to get this past Federal Highways. There's a

special program called Special Experimental Project (SEP) 15, that's brand new, it came out in October. We are an applicant, we have preliminary approval and expect to get final approval this month and go forward in April. That's one program.

The other one—we get a lot of reactions to this one. You may have seen some of it in the media. The Road User Fee Pilot Project. Before I want to talk about something that all states ought to do, and I didn't realize you didn't have this. Oregon has a use fuels tax, we call it. Any fuel that can be burned, that has a BTU, is taxed at a rate that's similar to what the gas tax rate is in Oregon. Duh! That's obvious. Even so, vehicles are going to become more efficient. It wasn't addressed, I understand, earlier today. But if the weight and other issues are going to make them more fuel efficient, there's always going to be a market incentive for improvements in fuel efficiency. The first one is obvious, the petroleum supply is going to hit a peak, if it hasn't already, we don't know. And then we'll start to see price hikes that will be dramatic. So what do you do about that? The fundamental question that needs to be answered, I've framed it two different ways. 1. Should policy-makers disconnect fuel consumption from road funding. 2. Should policy-makers connect road use with road funding? We are proposing a mileage charge, a per mile charge, as a replacement for the gas tax. I'm going to describe it to you and a lot of people react to this description because they make assumptions that just aren't true, including three major California newspapers. We'll get into that in Q&A maybe.

So you have a per mile charge to replace the gas tax. There's a differentiation of boundaries, which means you could have different rates in states, counties, cities or within a city. The switch is an electronic pulse down to the vehicle. The electronic pulse could be done a number of ways. One is an overhead gantry. We could build them at the borders. That's expensive. Or you could use a GPS receiver to do that. It works the same. I'll leave that reaction for the questions and answers. Then you go to the service stations where you have the mileage data transmitted into the point of sale system at the fueling stations. That data enters the point of sale system, the mileage is applied and the gas tax is deducted, because the aim here is to replace the gas tax, not to add on to it. Although a state could do that if they could get it passed. In this case, we're trying to do a stop loss for lost revenues in the future. There's no change in motorist behavior required. They drive up and they get this many gallons, and they get a bill and they pay it. That is a critical component here. We would apply it only to equipped vehicles, and only to new vehicles. The technology should not be retrofitted, it's outrageously expensive, and there's an inordinate number of reasons why you don't want to retrofit. It has the ability to create a peak period pricing possibility, a congestion pricing---probably easier and more properly designed for the regions and cities for which it would be applied than some of the older methods which are very cumbersome. We're doing a pilot on this. We ran the technology successfully with television cameras running last may, and it worked. We're doing a pilot starting we hope November. We're having a little trouble with the major oil companies cooperating with the use of their point of sale system. But we anticipate that we'll be able to start it in roughly a year, on 280 volunteers to prove it can be done. Our offer to the nation is to prove that this is practical. It's affordable, administratively doable, and the technology works. Whether they accept that or not, that's for somebody else to figure out. But we have to figure out how to solve these problems before we get there, or shortly after, and this is our offer.

The home fueling issue is a big issue. The difficulty there is that you have to send a monthly bill home, and monthly bills sometimes don't get paid. There has to be a hammer. If you don't pay at the fuel station, you don't get the fuel. If you don't pay the monthly bill, there's no hammer. I believe we're a few years out from having to worry about that. My suggestion is you move forward even though you don't know everything. You do what you do know. And later on, solutions will be revealed. As we developed this concept, there were an unbelievable number of problems. We kept moving forward and solutions revealed themselves. This has got to be the mantra for this group: Just keep moving forward.

Unidentified Questioner: [inaudible]

James Whitty: The point is to have some kind of electronic switch so that you can change the computer to put miles in one place or another, in state or out of state. In state has a fee rate applied to it; out of state does not. So that can be done a number of ways. I mentioned the overhead gantry possibility. There's no use of GPS in that. People watch spy shows on television and they think they know what GPS is—hey, there's a homing beacon and they can follow people under ground. GPS receivers simply receive signals that are already being sent through satellites. There does not have to be additional transfer of information. There doesn't have to be a transmission from the GPS device. If you go out into the store right now—right now—and buy a personal navigator and it'll follow you around. You can buy a wristwatch so that you can go out in the woods and know where you are. Nobody can track you with either one of those, because there's no transmission. That's the element we were proposing to use. You can add a transmission element. People have rented cars and they have noticed that the rental car company knows where you are. You can add a transmission element to a GPS receiver. Rental car companies do it with cellular. But if you don't do that, there's no ability to track.

Paul Sorensen, UCLA I have heard subsequent to our conversation that took place last fall that, though on the technical front things are moving ahead generally smoothly, one problem that you might face was whether vehicle manufacturers essentially with the on-board equipment you'd need to institute this type of electronic tolling if other states weren't doing something similar. And as a follow-on, there's been a similar type of project at University of Iowa led by David Forkenbrock, and I know that many state DOTs contributed to that, including Oregon. So I wondered how those two projects were dovetailing over time, if there was something like that happening.

James Whitty: First, the auto manufacturer question. That was an early worry. But worry seems to be waning. The reason is that we just learned—I guess it was on Ground Hog Day that General Motors said they're going to put On Star which is a GPS receiver as standard equipment in its 2007 models. Now it has that transmission capability, but I presume that GM won't require anybody to have that part of it switched on. But if the technology is going to be in the car, we've spoken to the auto manufacturers who believe that ten years out there's a good chance that all new cars will have that capability in them. There's other elements of the technology that will also be in the cars. We may not have the mandate, except for the ability to outline a state and have zones. That part of it—you have to have computing power for that in the cars. I think we're going to get there without having a state mandate, which is delightful. We're not going to get one of these things implemented within the next ten years anyway.

You've got to get it past the legislature, retrofit all the service stations. There's big problems, and it's going to take a while.

On the other front, yes we were involved with the Iowa study, some of the technology development there was something we drew upon. We went a little bit farther. We wanted to make this thing practical so that it actually could be implemented. So we've taken it to the next step. The Iowa study is stopped now, they've completed their work.

Unidentified Male: [barely audible—question about different tax possibilities]

James Whitty: I think it's about as tolerable as the gas tax. There are going to be a lot of changes in the marketplace. It may be that we have to experience some suffering before people realize that we have to protect our roads. I can't predict that. All that I want from our program is to have a national debate on it. To get it into the minds and consciousness of the people and at some point they might find it acceptable.

Marlon Boarnet: I'm a professor in the Planning, Policy and Design and Economics departments here at UC Irvine and I chair the Planning, Policy and Design Department. James Whitty's talk really warms my heart. I want to make two initial observations which I think are linked. I have the sense that part of what we're trying to do in thinking about alternative fuels is to predict possible futures in a world of substantial uncertainty. What types of fuels may be preferred? Is there a need for standardization, and if so, around what? When will technologies be ripe? James Whitty hit on something that we know, essentially with certainty: there is a transportation finance crisis. The only question is will it hit us in full bloom next year, five years from now, six years from now. But there is a real crisis out there, so I find this very reassuring. We have an element of the future that we can firmly grasp. We have a real transportation finance problem.

The second thing I'd like to point out is that one of the speakers this morning wondered whether or not, in some possible future, we might sit in traffic jams comprised of clean vehicles. And I would argue that that's quite possible. If you think about the trendline data, the national ambient air quality standard pollutant data, if you were to track over the last three decades suggests that, at least as measured by those criteria, the air is getting cleaner in essentially every urban area in the US. The most recent data I saw, which was a tad out of date, suggests that there's maybe half a dozen metropolitan areas that had some measurable worsening. But on the whole, we're cleaning the air. It's still a serious problem. And I don't mean to minimize the need for improvement at all—but we're cleaning the air. On the traffic congestion side, and our traffic congestion data are in many ways of lower quality—but the message is very clear—that no matter how you measure traffic congestion—travel times, especially commute times are getting longer everywhere. So if you run these trendlines forward, it does look like at some future point if all goes well, so to speak, if we continue to clean the air, we will be sitting in rather long traffic jams in clean fuel vehicles. Which brings me back to the question of infrastructure and finance, and I just want to discuss three things very briefly. One is some background; two is what does alternative fuels mean for this; and three is what do we do?

Background: this isn't an alternative fuels issue. There is what people I've spoken to call the long twilight of the gasoline tax. Going back now for three decades we can see that the

gasoline tax has essentially become de-linked from vehicle miles traveled, because automobiles became more fuel efficient, because gasoline prices dropped in real terms. There have been some trends recently that haven't made that de-linking as severe as it may have been, say, ten years ago. But still, as a way of raising funds that are somehow linked to how much infrastructure you need, the gasoline tax has been working less and less well for three decades and there's no sign that that's going to turn around.

Secondly, infrastructure costs are increasing substantially. Even if the gasoline worked well, in some sense it's not at all clear that it would raise enough money. It's becoming very very infrastructure where we need it. The number I like to throw out there is \$100 million a mile, but I fear I might be a little bit behind the times. But that's what's ballpark for what these new highways tend to run you.

Thirdly, our infrastructure needs are becoming localized. They have been, again, for three decades. We don't really have any more uniform ground transportation needs across the country. What we have are some urban areas, California in particular, where the need for new infrastructure is immense, and try as you might to think about how to manage demand, you still have to think about bringing new infrastructure on line. We have other places where population have been loosely stagnant and the issue is maintenance, maybe meeting some changing patterns of driving behavior. And so the gasoline tax regime, which was for the most part national, doesn't work well in a world where our needs vary a lot locally.

What do alternative fuels mean for this? First of all, if the movement toward alternative fuels accelerates in anyway, it will exacerbate the delinking of gasoline tax from vehicle miles of travel. Secondly, alternative fuels raise the prospect of some amount of new additional infrastructure we would need. In other words, there's a problem on both sides of the coin. It can make the revenue raising side of the puzzle more difficult; it can create additional costs.

So what do we do? Let me suggest four possible things, and I actually argue that all of these have to be a piece of the puzzle—that it cannot be an either/or. This is the menu—use them all. Increase tax revenue, however you may do it. In some sense there's a need for more public money in most cases, especially in grey urban areas. Secondly, demand management, however you might do it. Pricing is probably the most powerful tool we have. Other tools I think are somewhat limited. There is, in particular a great deal of promise that has not been fully tapped if you use pricing to reduce the peak load, and the peak hour capacity that you need, and make infrastructure less expensive. Thirdly, borrow more. We built the interstate highway system—the largest infrastructure public works project in human history with cash. Paid cash for it, right up front. No borrowing, essentially. This is an incredible thing if you think about it in terms of today's society. And what I would argue is that that is somewhat outdated. We do need to think about, in a world of very constrained budgets, using debt finance to accelerate forward what we can do, with a caution. The reason we built the interstate highway system with cash is because in the pre-World War II, the period between World War I and World War II, many states that had been using debt finance to build their highway system found that that debt burden was very crippling to the states. So you can go too far on the other side of the coin. But having said that, I think that is “pay for your roads in cash up front” system is essentially at the end of what we can work with. Fourth point: figure out and become more astute at using private sector money. I think private sector money,

public/private partnerships will be a piece of the puzzle. I think we need to think of private sector money as what I call “close the gap” money. Joe Dimento and I, several years ago, studied toll roads in Orange County, which is an interesting model because we have both the State Route 91 toll road, which is a private sector toll road, similar I believe, in some ways to what James Whitty was talking about, although it sounds like they’re going to innovate somewhat beyond that. And also some public sector toll roads. And one brief plus, in Access Magazine, which is put out by the University of California Transportation Center, the last issue, we have a brief summary of the private sector experience. I believe that the State Route 91, which was wholly private financed, is probably the exception. That there are unlikely to be opportunities for private funders to find it to be profitable to put up all the money for these projects. So we need to think about close-the-gap money, and that is immensely complicated, and will face transportation agencies with, I think, a need for a culture change. The complexity of these public/private agreements should not be underestimated. I even argue that in some sense you need not so much try to anticipate all things that may occur, but rather build things up front what will happen when the anticipated does occur. Because, given the complexity and the changing nature of demand patterns, public opinion, and the fact that these are typically 30-35 year agreements, I think the unexpected will occur. And I think you need the institutional structure to manage that. And what that means is that somewhere in these DOTs we begin to shift from being infrastructure-building agencies to being regulatory agencies that essentially think about how they interact with private components. What are the institutional structures? What are the incentives? How do you shield yourself against industry capture? But those are the four things, and I suggest we start doing them all.

Unidentified Female: I just wanted to point out that with regard to the 91 Express Lanes here in Orange County, they are now publicly owned. OCTA owns them. And the reason for that was we were stymied from making improvements along not just the immediately adjacent public lanes, but along the entire freeway corridor from LA County to Riverside County. If any of you are local and have tried to drive in the morning, it’s pretty much a parking lot. So in order to continue making private toll roads a win for both the private sector and a win for the public, you would need to be very careful how you structure those agreements so you’re not continuing to use the infrastructure that we have. The toll lanes in the San Diego area right now are the model for the Reason Foundation’s HOT Lanes, and those actually seem to be much better received by the public, in terms of congestion pricing and we in Orange County have taken some of that in regards to how we set our policy for when tolls increase on our toll road. They go up after so much congestion has occurred over time. People are paying up to \$7 or \$8 one way for the privilege of using the toll lanes. But we’re now also able to make improvements in the corridor which are easing the congestion in the regular lanes as well.

Unidentified Male: I can’t agree more that there’s absolutely no question there has to be more private sector investment in infrastructure, but it does raise an interesting question, and the 91 lanes certainly are an example. The public sector does things for policy reasons that the private sector would never do things for business reasons, and vice versa. So it’s a very tricky balance in terms of who’s calling the shots at the end of the day, and how you strike the balance between bringing in the private dollars or protecting the public policy goals.

Marlon Boarnet: I started my research career as a quantitative researcher, and my qualitative research friends talk about narratives—stories we tell ourselves. I’m getting old and soft and I

want to talk about a narrative. I think that the narrative we tell ourselves about the State Route 91 does not serve us well, and I don't think it's really correct. And the narrative is mostly what you describe. This idea that there is a public purpose that was being impeded by the State Route 91. I guess I would say first of all, I don't think that's the case. The evidence we have suggests that at the time State Route 91 opened up, and State Route 91 was toll lanes in the median of a highway that was free lanes—travel times in the free lanes dropped substantially. Estimates that I'm aware of were 20 minutes one way, sometimes larger. Now then the roads began to congest. But the evidence suggests that people on the free lanes also benefited. And I think it's just a fact that provision of that infrastructure was accelerated by several years due to the provision of private funds.

[inaudible comment]

Marlon Boarnet: The non-compete clause is a second point. There's a mile and a half corridor around the median of State Route 91. And the contract specified that the state could not build any project in that mile and a half corridor for the life of the franchise, which was I recall was either 30 or 35 years. That was received conventional wisdom about how to do these projects in 1989, when the contract was being written. In retrospect, you can tell this creates a very difficult tension between the public interest, which will eventually want the infrastructure sooner, and the private interests, which will want some assurance that they will be completely [inaudible]. But at the time, that was the perceived wisdom, and it wasn't at all secret. I was always kind of appalled at the LA Times reporting on tolls in the late 1990s that inevitably had this tone like they uncovered some plot. This was absurd, because you could pick up the contract document which was publicly available. But of course the way these things get reported [///]. I think the better way to do view that is that this is a prime example of how the apparent tension between public and private interests can't be well anticipated. You had at the time some of the brightest minds in the country on this problem. They talked about it, they thought about it in a forum that was probably as public as you could reasonably get, given that the exigencies of these contracts are not going to be debated on the evening news. But there are just things we can't anticipate. And when we do these again, what are the institutional structures? What are [inaudible] of agreement? What are the starting points, whereby if a conflict divides us, [inaudible] even. I don't mean this in any way to criticize anyone. The project was a successful learning experience that we had.

Jeff Morales: Let's do what I think Woody's probably going to do, which is to connect back to the alternative fuels discussion a little bit more, and frame it a little in terms of gas taxes at both federal and state and even local levels, where they exist are, I think without exception, flat amounts of taxes, not percentages taxes. As we look at alternative fuels and just fuel efficiency, the less fuel bought, the less tax generated, price having no value in this context in terms of tax generated. In fact, it has the inverse, because the higher the gas price goes, the harder it is to even entertain a discussion of a gas tax increase. So the whole push toward efficiency and alternative fuels has a very immediate effect and we're seeing the beginning of the crisis from a financing perspective of how we do pay for infrastructure, both maintaining what we've got and building what we need.

Woody Clark: My name is Woody Clark, and I'm with the Milken Institute as a Senior Fellow and deal specifically with finance issues. In fact, I refer to myself as a qualitative economist. But

I think in the context of Jeff's charge to the group just now, talking about finance, I want to bring up several points that I've been actually waiting all day to mention, but let me bring them up now. First of all, I think what we have to recognize is that what we are doing here today is talking about a significant paradigm change. We're in the process of going through something that within a period of time, we're going to see fundamental changes in the way in which we all—and our children's children as well as our children themselves go about getting places and conducting their lives. I mention that because some of the panels have already touched on it. Jeff and I actually worked together in state government, for those of you who aren't from California. But nevertheless, what some of us did in state government is actually implement some of what the panelists said, and I refer to it in a book I just came out with, called *Agile Energy Systems as Civic Markets*. That is to say, there no longer is this great divide between the public sector and private sector. We're in a new world of actually collaborating between partnerships that have to go into the future and achieve some of the things that we're talking about. The gentleman from Oregon mentioned taxes and I would add one thing that Jeff just touched on, which is the concept of tax shifting. If in fact you have a tax, and it has basically run its course, you take the tax and don't tax the public more. But you say, look, how can you help those resources that are already there accomplish and promote and fund some of the activities that we're talking about with private partnerships and private sector collaboration. I mention that because what hasn't been talked about today and strikes me is that this whole conference is about infrastructure. We've been basically talking about vehicles and highways. Well let's look beyond our borders and parts of Asia, they use ferry boats, high speed ferry boats for transportation. Why don't we think about that in the United States as a possibility of getting trucks, even trains, but certainly cars from point A to point B, and get people off the roads? What happened to mass transit? I'm new to Los Angeles, and I have to tell you I'm not just shocked by sitting in the traffic and having to be on my cell phone 24/7. I'm just shocked that there's no mass transit literally in this community, in this area. We should be talking about those things and not just building more highways and more lanes and commuter this and commuter that. We've got to look at the future in terms of saving generally, and looking at the savings in terms of air quality and savings in terms of time and money and resources, and if we don't do it now, because we're in this paradigm shift, our children—and us, those of us who are younger in this room, we're all going to be paying for this one way or another. And I think it's not just in terms of security as Bill Reinert mentioned earlier in terms of foreign wars in other parts of the world, but here here in our own country. And the final thing I wanted to mention is that, it seems to me, that if we're talking about infrastructure, why not talk about infrastructure in terms of how transportation—we have been talking about energy—but what about water and waste and other parts of infrastructure that need to be looked at together. We've talked about hybrid vehicles—Priuses—why don't we talk about hybrid infrastructure? As long as we keep looking at these things in isolation, we're going to again increase the cost of it. And we've got to look at where they're in tandem with each other, where we can have a mass transit system with a highway or with other types of modes of transportation. And I offer that as a challenge—I think that's part of the paradigm shift that we're experiencing and all of us have got to look at that, including with the alternative fuel and how that fits in with this scenario.

Heather Rosenberg, CTG Energetics: I want to raise a related point. We're talking about infrastructure here, and we need just to maybe step back. We're talking about infrastructure, we're talking about sustainability in a lot of ways. How do we move beyond thinking about just

fuels or types of cars and really take an integrated approach? That's one place where I think the green building community and green building movement has a huge amount to offer in terms of a case study for what's happening here. And the biggest piece that I think applies is using an integrated design approach, and see what happens when you bring people into the room. We've talked about communication across states, so that everyone can get on the page, but also across agencies and across expertise. If you think about streets and stormwater together, or water transportation and other types of things, and there are synergies that we are seeing and there are real cost benefits to that. There are of course huge challenges. The example that comes to mind first, is if you want to combine alternative stormwater infiltration with transportation and street design and you do a bios wale and change the curbs then you have the fire department involved and emergency vehicles getting through and you have to basically redesign the entire system so you have to bring all of those people to the table in order to understand everybody's concerns. And that process is very tricky, but we are seeing that working in a lot of ways in the building and development communities, and I think those are lessons that can be looked at here.

Joan Solenberger: I'm in learning mode. Just a couple of reactions and comments, and several of the remarks resonated here in this section where we are today in California with transportation. I wish I would have heard Marlon's talk about seven months ago—I would have saved myself about seven months' work on something called Go California. The announcement that the administration made this last week was three pieces of legislation that legislators were introducing to do public/private partnerships, HOT lanes, to do design build and design sequencing. And so we'll see how those go, and the kinds of questions that are being brought up here about alternative energy and the institutional structures and the financing of all of this—we do need to do some pilot things out there to get things rolling, and I think there are some really good examples of that. But we also need that larger framework, for example, that legislation that was just proposed, much of it is not allowed under federal law. So you need federal law changes to implement things, or special permission on a case-by-case basis. So we certainly need, in California—I was talking to my colleague from Nevada, Don, who said they have a \$3 billion transportation problem in the next 10 years, and I smiled, and said, "I wish ours were that small. Ours is only about \$160 billion problem over the next 10 years. So when it comes to paying for that, our traditional gas tax that we've been relying on—California has been buying less and less, and the last time we had a gas tax increase was the 1989 Blueprint legislation, and that was designed to last 10 years, and that ended five years ago. So we've been five years without another solution to our problem. Where things will be colliding, or dovetailing on the positive side, is that the exploration into these alternative fuels will kind of force the policy decision on the user's tax. The one that we've been using hasn't been buying as much. What do we do as an alternative? Because there's one thing that's very very much a reality and that is, for California's transportation system, with the fact that it supports and in good amount, the national economy with the goods movement that flows through here, the deterioration of the system has gotten us to the point where the lack of money we have right now—what was costing a dollar to do preventive maintenance to do a few years ago has gone up to six dollars to do rehabilitation. And now we're graduating to the \$20 fix with major reconstruction. Because the use of the system is so heavy with the VMT and what it's carrying, that we can't sustain it any more. So I think the marriage of these two things have to be brought together, just as was discussed regarding other infrastructure—you have to be thinking about those things together, because one isn't going to come out without the other. We do

definitely need the public/private partnerships. Figuring out how to leverage private resources is something that I don't think the public sector is very adept at this point. And maybe we won't use State Route 91 as our best example in the state, but maybe State Route 125 will be. We'll see when we get there. As examples of success stories, and then you bring into that the fact that we need a multi-modal transportation system. I was reading Susan's comments from last time about the diversity of the system. We've got to be able to spread and do many things at once for us to survive. We're still getting a half a million people per year born in California. We're not like Florida, where they're all just moving there. They're being born here. So we're really facing some challenges. So this turnover, the air quality, the quality of life, I think will provide opportunities for us. But we have a ways to go, and we need all those solutions, but we don't have the answers right now. Someone says the solutions going to come to you—I think the stars aligning, it's getting bad enough. We're going to have to do something.

Frank Hotchkiss: The mention about thinking also about alternative forms of transportation in addition to alternative fuels and how those interact I think is really important. Then the mention of alternative ways of building—like green building, and how that impacts demand, how that impacts the financing of fuel may influence that as well. I just want to add one more thing to it. I think what we're getting here is really good—it's a great conference. People's life patterns may change radically, and our urban forms may change radically. And the two combine so people adjust their life patterns in ways and what we're talking about in the financing could impact that. Especially user fees and congestion pricing and so could result in people shifting around as Peter Gordon talks about—self-equilibration. And we may not see this continually expanding demand for vehicle miles traveled.

Mia Waters, Washington DOT: In relation to the funding mechanisms, and how we look at this paradigm shift, because it is happening. And it's whether it's a toe in a pool, or jumping in head first. And Washington is looking at Oregon with very interested eyes. We are also looking at the same challenges with the gas tax. And I think fundamentally, as this paradigm shifts, we need to look at who's using the systems and who's benefiting from the systems. Because it's not always the same people. For instance, if we use commerce as an example, who's using the system might be a truck or a car or somebody going out to get groceries. Who's benefiting might be the store they're going to, and the owner. And so putting those systems together or just thinking about them in terms of who pays may be fruitful, and I've heard a lot of good ideas about that. In terms of how we go about it in Washington State, we're looking at Oregon and how other states are trying to confront this eminent paradigm change. And given that, within Washington, it's a fairly big state and we don't have full agreement on where to go, nor do we have the same types of ideas that congestion is a problem. On the east side of the state, we have long sections of miles where you'd be lucky if you saw a car go by every half an hour or so. And then we have very congested centralized areas. So we're looking more towards those that toe-in-the-pool on a localized basis, and how can we do localized or regional improvement districts? How can we look at vehicle taxes, other integration of funding sources as we acknowledge the gas tax is not covering our main infrastructure and that we're getting further and further behind. But on the who's benefiting and who's using the systems, within those congested areas, where they're willing to be a little bit more creative, to say, well, will those local properties that are actually benefiting be willing to pay a little bit more. In the user sense, we have some proposals that are kind of being bantered out within the newspapers and our legislature about could you apply, not necessarily a

VMT tax or the number of miles you drive, but a weight tax. So if you're going to buy a really light car, you'll pay a certain amount. But if you starting to get heavier and heavier as you start to get into the heavy duty vehicles, that you end up paying more and more and it is accomplished in a very similar way. And then using the licensing structure as the hammer to have people actually pay for that so I think there are a lot of different ways of going about it and we're all sort of experimenting, and what it's really going to come down to is the public and us and our willingness to pay. And that public willingness to pay is very dependent on who's sitting in traffic at the time. And perhaps that solution starts at that local level but then grows out.

Unidentified Male: Two quick comments in response to something Frank and Heather and a few others have made, in terms of how we build and what we build and all that. There's no question that transportation in many cases—and it's certainly the case in California—that it's the symptom, not the illness. There are some new studies out showing that the single fastest growing segment of the commuting population, and it's still a small percentage but it's the fastest growing are supercommuters. People who are commuting more than an hour and a half each way. It's the fastest growing segment of the commuting population, which suggests big problem, but isn't a transportation problem, per se.

And also, looking at a multi-modal approach, which is another critical element, it's also important the same financing issues we're talking about transit, nationally, is funded at least in part by the gas tax as well. So it's not just a matter of highway construction and how we maintain funds for that. It's our whole national transportation is based around the gas tax. So this is a very central question, whether you're talking highways, transit or anything else.

Dennis Taylor, Nevada DOT: I head up the Program Development Division, which is primarily responsible for the transportation funding and programming for every project in the state of Nevada. Before I continue, I'd like to qualify some of my remarks may or may not reflect the views of Nevada DOT.

Jeff Morales: What happens in Irvine stays in Irvine.

Dennis Taylor: Let me share with you a couple of situations we have in Nevada, and also address some of the comments that Marlon made on his four areas for success. This year alone we have over \$500 million worth of transportation projects on the books and underway. Next year it will be \$700 million. With that in regard, is anyone familiar here with the Prip (?) report that was just recently published? Prip is an independent agency, and I believe they're from Oregon or somewhere. But what they do is pick DOTs or sectors or elements of state and federal government often times and they grade them. Our report was just recently released where we were graded a B on highway smoothness even though Federal Highways say we are number one in the nation. A B- on bridge maintenance, even though Federal Highways say we're number two in the nation. On and on and on. C for congestion, D- for financing. We have a real problem in the state of Nevada. As one of the fastest growing states in the nation, I think Arizona has slightly edged us this past month or so. We cannot put enough asphalt down on our highways to keep up with congestion. We cannot do it. So what have we done? We are currently, our legislative session, there is a bill draft request—not initiated by us, by the way—for two cents per year per gallon increase on fuel over the next five years for a

total of ten cents. Demand management. In the state of Nevada, I don't think anyone in this room would have the guts, if you were a citizen of the state of Nevada, to mention to the public as a government entity that you were going to propose a toll road or a whole brand new tax. Particularly in a state that doesn't even have a state income tax. Borrowing. The majority of project that are being financed today are bonded projects. We were forced to do that simply because 1) we do not generate enough money from the fuel tax to give us a large large surplus in our general fund; 2) we do not have a multi-year reauthorization, yet a sample of the latest statistics show in the Las Vegas Valley alone we have approximately 100 new cars a day entering our major arterials and 5,000 people a month moving to the Valley. We recognized the need and we had to get the super projects on the books, in the design and out to bid. Private/public partnerships. Obviously with our growth, does anyone who's been to Las Vegas recently remember the wonderful sign that says Welcome to Fabulous Las Vegas on the strip—that's where Las Vegas used to end. Now it continues going southward. So obviously, that is primarily due to the development in that area. But almost every freeway or arterial or roadway improvement that we make, we have businesses moving right next door and of course they want access. So much so that what we start requiring of all private developers is a letter of commitment or surety bond to ensure that we're going to get our money. Transit. I've heard mass transit and I have heard mass transit and I have heard mass transit. Every project we do, we work collaboratively with all four of our major metropolitan organizations. Lake Tahoe, Reno, Carson City and Las Vegas. We studied every method of mass transit possible that could possibly be applied. We worked with the RTC. RTC just recently, I forgot what their initial fleet of MAX vehicles, but it's a fixed guideway vehicle that is fully articulated, but it actually looks more like a train than a wheeled vehicle and it actually has platform stations for the passengers. So anyway, we've looked at monorail—don't laugh, please, it's up and running again. We've looked at light rail. The fact of the matter is, and this has already been brought up earlier today, until human perception and behavior is changed, you can provide all the mass transit you want, but no one's going to use it. That's why we refer to the MAX bus as a vehicle, it helps change public perception. One thing I failed to mention—has it dawned on you that Nevada is one of the few states that you can only fly to three of our cities in the state of Nevada. You can fly Las Vegas to Reno, Reno to Elko twice a week, and if you're lucky you get to go to Ely for the fourth one. So primarily, there's three. We have 5,000 miles of roadway. We have great distances of vast desert. There's only one way you can get from point A to point B until which time we have a dedicated, safe, reliable and efficient mass transportation system—high speed system, if you will, and that's called driving. We are also a bridge state, but we are not recognized as a bridge state. Do you realize Interstate 80, Interstate 15 and US 95 are the heaviest traveled freight cargo corridors in the nation? They go right through the middle of our state, both north and south, and east and west. Yet we're not recognized as a bridge state.

And now back to mass transit and that's the point I'm trying to get at and this where I qualify. I heard earlier that 13 million cars are introduced in the nation each and every year. How many of the existing vehicles already on the road are retired? We are addressing alternative fuel, we're addressing tax structure, but we're not, I don't think, adequately addressing the real route of the problem. We can't build enough highways to accommodate all of the vehicles being produced each and every year in this country. We simply can't do it. And today, as a citizen, that chart was showing to me the number of cars that are likely to be on the road by the year 2040-2050 frightened me to death. And it should frighten each and every one of us, because it's not going to get better until we as a nation, as a community, fully address the real

root of the problem. We have to change human behavior. And we have to figure out how to build a better, efficient transportation system. With that, thank you.

Sheri Alston, Federal Highway Administration I live in the “other Washington” and I just wanted to mention that there are a couple things that relate to transportation financing. First of all, I believe that many of you know that there is a Transportation Research Board study right now that’s looking at the long term viability of the gas tax and what it will be doing is looking at the viability of several options. They will be considering things like alternative fuels and the impacts on funding for the future. Also, within some of the legislation that was introduced last year as far as Congress went, there was a provision for a national commission on the study of transportation financing. So we’ll have to see whether that’s reintroduced and whether it survives the conference process. And a couple of other things. I know the lady from California was talking about public/private partnerships and flexibility. Well, one of the things that FHWA has been doing has been taking a long look at the area of public/private partnerships. In December there was a report that looked at what was going on as far as public/private partnerships throughout the United States and some of the impacts and just basically giving some information. There is a website at www.fhwa.dot.gov and you can look up public/private partnerships on that website. And we have been working with Oregon on the SEP 15 process which would give states some additional flexibility. I just wanted to add that national perspective along with the other elements that have been mentioned on the state level.

Paul Sorensen: I agree with a lot of the comments on congestion pricing and I think that most of the evidence says that in terms of affecting driver behavior, it’s working as expected. And I think going forward, the real challenge is how do you extend it past just selling excess capacity in the HOV lanes to taking it to models similar to what they have in London or Singapore where they’re doing it over much wider areas. And I think probably one of the most difficult challenges that it faces is finding interest groups who have political influence who would actually support that kind of thing. And along those lines, since we may very well be trying to think outside of the box, I wanted to mention an idea by Professor Don Shoup who’s at UCLA and a couple other of my colleagues there who’ve been writing about the idea of giving cities some claim to the revenue that would be raised from congestion tolls on the highways that cut through their areas, in that they bear a lot of the air pollution costs, they also lose the ability to collect taxes on that land. So if we’re trying to think creatively about how to get past some of the likely resistance, we may very well need to think about which different stakeholders can we reward to get them on board with these kinds of ideas.

Tim Lipman: Moving on to the next session, which is regulatory and institutional issues. I’m a research engineer with UC Berkeley, but my Ph.D. is in environmental policy analysis. So I’ve done quite a bit of studying over the years of regulatory design and so forth, and know a little bit about it. What I thought I’d do instead of tell you what I think, is to play the role of provocateur and throw out some questions to stimulate some Q&A to follow. Some of these have already come up during the day, but maybe I’ll phrase them a little bit differently.

First of all, with our current regulatory structure, are the existing regulations addressing the right problems? We’ve been talking about problems with VMT. And I know that San Francisco is considering London-type strategies to reduce traffic into the downtown areas. Second, what is the appropriate role for transportation regulation, given the rapid technological change that

we're seeing in the transportation sector? Third, how do we develop flexible regulations that stimulate regulation, but still yield tangible results? How can we have flexibility without losing the assurance that we're going to get what we're after and hopefully not end up in protracted legal battles that end up in stalemate? Fourth, how do we manage and share technology risks between the public and private sector in the context of forcing regulation? Fifth, like my wise friend Harry said, down the table earlier, we should try to enable winners but not pick them. How do we do that? How do we provide an environment where innovation and competition can be stimulated without actually picking the winners? And related to that, in the area of hydrogen, are we at least verging on picking a winner? Or is the idea of hydrogen so broad and encompassing such a wide set of technologies that we're not really doing that? And then on the institutional/structural level, how do we foster collaboration between state agencies to meet the goals of some of these regulations and policies? Is that important to success? I know that coordinating efforts even within one agency can be very challenging, so how do we coordinate efforts of multiple agencies? I think that may be important. It also may be important to eliminate or reduce the possibility of unintended consequences of environmental regulation, where in one example, we promote DMTE and then end up with ground water pollution problem. Next, is it important to harmonize policies between states with regard to fuels and vehicles? We talked a little bit about this at the outset. And then, last, some of us believe there are important linkages between transportation energy solutions and stationary power, energy and environmental solutions. And yet our regulatory structure tends to differentiate between those and there isn't a lot of connectivity there. Is that important and how might we develop some more integrated policies. So those are some questions I had, and I have the answers, but that would take too much time and you'd have to buy me a beer first. (laughter) So let's throw it open to questions. The idea here is to talk about problems you see with current regulations and possible solutions to those problems.

Joan Solenberger: These views may not necessarily reflect the views of the California Department of Transportation. But I know that we, in the South Coast, we have to buy some compressed natural gas vehicles to meet the regs here. Those may very well be the only ones that Caltrans buys, and we have to own and operate them because that's the regulation because it was specified what the technology was. So my personal thought is that statewide, we have air quality problems in various areas across the state and we have a huge fleet of Caltrans vehicles. And so one of the ways that really ought to be given some serious thought is to think about what are the outcomes in a regulatory nature or incentive nature, what are the outcomes that we're trying to achieve. We've talked a lot today about multiple objectives, from air quality to self-reliance, all of those things. We need to look at the multiple objectives, look at the outcomes we're trying to achieve and design whatever we're going to do around that. In California, I don't know if we would have made the headway we've made without CARB having some serious regulations on a California basis that have driven some national policy, but what gets scary sometimes is that on the trucking side, we know that trucks travel interstate, and we know they like to fuel outside the borders because they don't like our reformulated fuels and they cost more. So whatever we're thinking of, we need to think of globally enough on the outcomes that we drive decisions that can stay up with technology, that are flexible, and that if places have things like fleets, in Santa Barbara, they had at least three or four technologies they were operating because of the strengths of each of the kinds of technologies for the purposes. They found that to be cost effective. So I think that within fleets, where you wholly own your world, as far as you're maintaining it, fueling it, I think many things can be explored as long as

the outcome can support that. That we drive things based on public policy from an outcome standpoint. So that's a very global statement, but I think that would work very well in this arena, especially when you're talking about multiple things impacting each other, even in the area of alternative energy.

Jamie Levin: I am going to address several of your questions—I'll let you figure out which ones. But basically, I think there's a presumption here that technology is going to solve the problem, or in fact that we've defined the problem well enough to know what technology can do. I'm a big advocate of technology, and I think I've presented that with respect to what we're doing as a transit agency in the fuel cell and hydrogen arenas. But what occurs to me, and I say this as a transit user—I've been a transit user since I was a little kid. Grew up in Portland, Oregon, I'm an advocate of using transit. But what is the reality of that? The gentleman from Nevada spoke about the difficulties of getting people onto mass transit. And they are very real problems. If you look at the journey to work numbers over the last four decades, you will see a double diamond slope for drive alone vehicle miles traveled. And you will look at the transit market share and it's down for the US. It's down to less than five percent figure for total transportation trips. And in the last decade, it's dropped by 0.5 percent while drive alones have gone up by 2.5 percent. Well, am I telling you that you all need to go out and start riding public transit? That's wishful thinking and pie in the sky. There are three factors that will drive people to use public transit, and this will get to the point I want to make. One, that I think is the most elastic, is that it's got to be convenient. Your time is valued and you're not going to take a public bus or a rail car if it isn't convenient. Secondly, it has to be reliable service. And third, less elastic, is actually pricing. The difficulty with this, in planning this future that we want, is that we're all focused, I think, on mobility. We have excellent mobility. I was able to rent a car and drive to LA, but it took me a long time to do that. What we don't have is accessibility. The lady who spoke earlier about interdisciplinary approaches to addressing these problems—that's really critical here. Because transportation reacts to land use, it reacts to what people's needs are. And if you can walk to the book store, the movie theatre or the restaurant, or you can take a bus conveniently, that's going to drive more ridership on public transit and less usage of cars. It isn't go to do away with use of your car. I guess the point I'm trying to make is that it is clearly an interdisciplinary challenge. And if all the DOT representatives here go back to talk to your fellow DOT colleagues, but are not talking the policy makers with respect to land use and development, those issues—then we're not going to make any progress. And lastly, I'll make a pitch for what AC Transit is trying to do locally, and you can see this on our website. We recently published a document on how to make communities more accessible to public transit. So that when new divisions, subdivisions and new developments are built within our service area, instead of making the pedestrian walk a quarter of a mile around to get to the bus stop, that there's accessible routes for pedestrians to easily reach public transit.

Lynn Long, UC Irvine: Tim, could you repeat question number four?

Tim Lipman: How do we manage and share technology risks or technological risks between public and private sector groups in the context of technology-forcing regulation.

Lynn Long: I will go with "e, none of the above." (laughter) I had the opportunity about two years ago to organize a session at TRB sponsored by the History Committee. The topic of the session was technological choice in the early part of last century, and I titled the session

“Technological Determinism or Social Choice.” Let me briefly explain those. The theory of technological determinism argues that once you introduce a technology to society it sort of takes on a life of its own, and we will inevitably be forced to adopt it and be sort of pawns in the process. And I used as my example, PowerPoint, which has literally changed the way we communicate at professional meetings. The opposite, the idea of choosing, of social choice, is no, that’s not true. We as individuals are faced with an array of technologies and we’re the ones that choose. And you can introduce any technology you want, but unless that technology is congruent with your needs and your desires, you simply are not going to adopt that technology. We talked a little about TDM and carpooling, which by most objective measures, was a well-intended policy that failed. Well, if you look at the psychological and social difficulties in organizing carpools, you’re looking at a mammoth social undertaking. No amount of incentives or disincentives is going to change a very, very fundamental behavior. So I’d like to extrapolate that behavior to the case of alt fuels. We’ve talked about a range of alternatives. They each have their advantages and disadvantages. But it’s ultimately going to be the consumer that will decide. And the role of the manufacturer is simply to make sure that they can understand, predict and respond to the choice of the commuter. The role of the government, at least in my mind, is to understand what it is that makes people choose what they do, and provide the infrastructure and incentives to allow this to take place.

Tim Lipman: I would agree with your comments pretty much completely on the vehicle side. I think on the fuel side, it’s a little bit trickier because the public isn’t necessarily going to know exactly where the hydrogen is coming from or where the fuels are coming from. They get a better handle on the vehicle, than they do on the fuel, which is a little more behind the scenes. And so one of the things I worry about, for example, we’ve talked about this hydrogen transition and natural gas being a key transitional stepping stone to that. I think there’s a lot of validity there, but there’s a risk there in technological lock-in. Once we get pretty far down that path, it’s very hard to deviate from it. There will be a lot of positive feedbacks to trap us in that end state. And I think that’s the kind of thing that with policy we have to very cognizant of. So we have a very clear sense of where we’re trying to go, so if we’re not making the right kind of progress, we can be attentive to that. So I really agree with your comments, but on the fuel side, I feel it may be a little bit more nuanced.

Woody Clark: In California, I’m not sure if some people are here from these groups. But we have had the California Fuel Cell Partnership. And when I was in state government, we formed a stationary fuel cell collaborative in the same way, bringing the public sector together with the private sector. And to be very concrete about it, one thing that we also did, which was very productive, was recognizing that wind and solar were intermittent resources, we put together a public/private group to figure out how we look at this and how we make these financially viable. Because you can imagine, if you’re in the wind industry or the solar industry, where’s the contract, where’s the money, are you actually going to develop and take that risk? We were able to come with setting tariffs with the California Independent System Operators, that was adopted two or three years ago, and then went to FERC and is now a national tariff. I mention this because, again, it seems to me that the action, if you will, is at the local/regional level. Those of you from northern California—I come to a carpool lane down in southern California, and I can’t go in and out of it, because it’s got a double yellow line. I also find out that in northern California, there are certain hours of the day I can drive in the lane and certain hours you can’t. Down here, it’s forbidden. You get a ticket. So there are these differences even

within our state. And my point is that there are number of things that we're doing within this state, and Oregon, Wisconsin and Nevada, and I would certainly disagree with my colleague in that the public has to become aware before they decide to get on a train. Put a train to the airport and they'll be on it. The point is, we're often doing these things in collaboration with industry here, now at the regional level. It then goes to the national or state level and beyond. The reason I say that, is because the question asked earlier by Steve from Honda, about what is the issue regarding the lawsuit from the auto industry against the California Air Resources Board and our regulations here in the state, when these groups have all been working with state government in this collaborative partnership for so long—why all of a sudden this action? It's because fundamentally the issue comes down to—and I will throw this out to the audience for discussion, I think it fits into Tim's challenge—it fundamentally has to do with states' rights. Think about it for a minute. Those of us who did a few things in the sixties and caused some hoopla around the seventies. It had a different definition then. But think of what it means now. If we have, in California, a renewable portfolio standard the Governor now has even expedited and moved up even quicker, at let's say 20 percent in the year 2013 and we go to other states, and they say we can't do that ever—we can do maybe 20 percent in the year 2025. What you find at the national level, we in California will have to be forced to have a lower renewable portfolio standard. So what you have is an issue between what's going on locally and regionally here and what will go on nationally. And if we look at the benchmark of those standards and lower that because of federal policy, I think we're at a disadvantage. I think it's much more important that we're able to push that envelope, push those technologies, because that's what's driving the market. That's what's bringing the car companies to California. It's no accident that Toyota and Honda have 5,000 and 8,000 people, respectively, in Torrance. It's because of the policies in this state for the last 10-12 years. And I've warned that it didn't happen because Honda and Toyota all of a sudden got, if you will, the idea of being environmentally friendly. It had to do with regulatory policy in the state of California and continues to do that for other car companies to come to California.

Steve Mazor, Auto Club of Southern California: I think we've talked the least about the public. But ultimately, if the public doesn't accept these technologies and systems we're talking are bound to fail. The battery electric vehicle fiasco from a number of years ago is a perfect example of that. But whether that was the public's fault or not is another question. I'll get back to the basics just a little bit,

Certainly the dependence on oil and the ability of foreign governments to manipulate conditions within the United States are one of the keys and eventually you're throwing out outside government intervention because the price of oil is going to go up, it's going to be too expensive to extract, so we're going to have to have some alternative. Again, we have to think about the environment. Gasoline powered vehicles and diesel powered vehicles are getting better, but we're getting more. So we can see trends of emissions going down, but as there's growth, eventually they'll go back up unless we can find other solutions. So the alternatives need to be moved out to the public. And there's a lot of concerns with that. The public buys cars, buys vehicles for a lot of reasons, and the fact that they are low-emitting cars, or even the fact, even with today's gas prices, that they get good fuel economy, are not the prime movers behind people purchasing cars. They purchase cars—on surveys that the Auto Club does—it's always about safety. It has been about safety since the 1970s. But they still might go buy a red sports car—but they'll say it's about safety. And styling, and the ability to fit the kinds of

lifestyles into the car. At just about any price of gas, those things come first. So you cannot compromise the performance of the vehicle. People want the car to do what they want it to do. And no matter what alternative you use, you have to meet that standard.

But, on equal performance levels, if you have a car that gets better fuel economy, if you have a car that is lower emitting and they know it—because in many cases, the public is not aware that a car may be lower emitting, they will be willing to spend a small amount of extra, maybe deal with a small amount of inconvenience in terms of refueling. You may not have to have a hydrogen fueling station on every corner, but within a few minutes. People aren't going to drive all around town and face the nervousness that they might run out of gas before I get to this station that's 20 miles away, and is it going to be open? So the supply of fuel and the location need to be convenient and they need to have confidence that it will get better and will continue. I'll give you an example. We're doing some testing on the old methanol program. And there was a car we were testing, and we had a little booklet that showed where all the methanol stations were. We went to the closest station, to our downtown headquarters in downtown LA, and it got burned down in the riots. It wasn't there. It was a vacant lot. Now what? If you do that kind of thing to the public, you erode their confidence immediately and any new technology is pretty well bound to fail. And one other thing that we haven't talked about is safety and the perception of safety from the viewpoint of using an alternative energy source. My personal background goes back to hydrogen fuel cars from the 1970s. I always hear, when I say I'm working on hydrogen cars, "Isn't that dangerous?" Whether it is or not, and there's pluses and minuses of hydrogen fuel cars, I would tell people, "Do you ever watch one of those Arnold Schwarzenegger's Terminator movies? And those big orange explosions with the black smoke? What do you think they use to make those explosions? That's gasoline. We've accepted the risk of this bomb under our car, but if you use the word hydrogen, they think of the Hindenberg and the hydrogen bomb and we have to get past these perceptions. People have to understand that even with the hybrid vehicles with higher voltage batteries, we constantly get questions, "Will we get electrocuted?" So those things need to be dealt with. It takes education. And people who respond in an emergency also need to be educated to know how to deal with the vehicles that are coming out.

Susan Shaheen, UC Berkeley: I want to thank Sarah, Scott and Deborah for inviting me back to speak at this conference. Deborah gave me an assignment. She asked me to think about the problems and solutions related to "plugging in the public: serving customers and educating a nation." In response to Deborah's question, I have broken my response into three areas. **Consumer issues**, related to fleets and customers, which should include heavy-duty and light-duty vehicles. The second issue is **public education**. The third is **training our workforce**.

I think it is critical to **understand the needs and concerns of the customer**, such as cost, convenience, safety and hassle. We also need to think about training individuals on how to drive these vehicles, as well as how to fuel them. It is very important to manage customer expectations, particularly among early adopters, because sometimes these systems do not work perfectly, and that can have an effect on how the technology is perceived. I've been fortunate in my research to have a chance to work with many early adopters, who are actually quite forgiving when things don't go perfectly and have had many suggestions on how to improve new

technologies/services. But in part, I think their flexibility is a result of working hard to manage their expectations of the new technologies and services they are using.

Developing an integrated systems approach—we've heard a lot about that today—is critical to helping the consumer have a better experience. This would include one of the things that we heard Bill Reinert speak about this morning—integrating vehicles, infrastructure and the overall traffic management system. For instance, information technology might be used to help individuals locate fueling stations for hydrogen vehicles. Also, what types of incentives might we employ to create and to support demand for new technology as it emerges? This might include tax incentives for buying gasoline electric hybrids, use of high occupancy vehicle lanes, or Honda's home fueling tool, called Phil. These are few examples of what we might think about as we look at consumer issues.

In terms of **public education**: How does the public view alternative fuels? I think we should start with children, community groups, decision makers and politicians when we look at the issue of public education. We should also manage their expectations about what various fuel paths can lead to, as well as the characteristics of the vehicles themselves. In addition, we should think about the best approaches to educating the public on key issues and addressing their concerns, such as safety, cost and convenience.

Finally, with respect to **workforce training**—mechanics and practitioners—it is important to note that training takes a long time, so this is something we should start thinking about early on. It is critical to distinguish between public education and workforce training. These are two different tracks. The timing of training has to be connected with the deployment of the technologies—making sure that we have the resources in the right places. At present, many of the existing alternative fuels educational programs are geographically clustered. Thus, we have a challenge in making sure that training needs are met at the right time and in the right locations.

To close, I think the solutions that I am posing—consumer understanding, public education, and workforce training—rely upon:

- 1) Strong public-private partnerships—coordination among public agencies and the private sector;
- 2) Making sure that we have synergies in the right places versus redundancies (or that when we do have redundancies, we want them);
- 3) Experimentation and research, which are critical to understanding customers and educating the nation; and
- 4) Developing incentives that make alternative fuels and vehicles more attractive to consumers overall.

Norman Dong: I work in environmental justice, as I said before. And we're talking about plugging in the public. I haven't heard us define what the public is. And in the course of defining what the public is, we have to look at the changing face of California, and probably the rest of the nation. We're finding tremendous linguistic and cultural diversity in what we call the

public. And you're talking about really basic things, of getting them to come to public hearings on public transportation and land use issues, which affect everything that we do. We're talking about urban sprawl, changing life styles, driving lighter cars, cleaner cars, greener cars. All these things deal with lifestyle issues and cultural issues. And for many immigrants, for example, who are aspiring to be part of the American dream. Owning a big car and a big house is still part of their dream. And if you look at the changing inflow of cultural diversity. There's a group in San Francisco called the New California Media that I've worked with on environmental justice, and they did a study and they found that in the ethnic groups in California, something like 80 percent of them get their news from ethnic media. And 65 percent of them use it regularly, because they trust it. They trust the way it's worded and they trust the way it's formed. So if we talk about connecting with the public, we can't just treat it as a generic public. We have to look at different groups, different languages. And one of the things we're telling our project managers in Caltrans, is that we're going to have to have bilingual hearings, bilingual assistance. We're going to have to have use of ethnic media to reach the public. So there are a lot of cultural issues involved. And if that's not resonating with you, you might talk to a public health nurse or a doctor in a managed care health plan that works with Medical. They'll tell you it's a real challenge even to get people to take medications to save their life because they don't understand what you're saying. So it's a real issue. So we need to account for the changing face of the public. Here in LA, you've got public schools with kids who come from families who speak over 100 different languages. That is just profound. What do you do with bilingual ed? What do you do if you're a health care provider? What do you do for voter registration? And what do you do if you're a transportation planner trying to get people to come to your hearings to talk about land use and transportation. These real challenges, but at the same time I tell people they are opportunities because we get to meet the people we call the public and we get to work with them.

Joe Darling: I want to go all the way back to the financing thing and work my way through a couple of comments. On the finance thing, it sort of reminds me of the discussion of privatization of social security. There's a pitfall there when you start talking about privatizing transportation and revenue sources for transportation. The transportation system was built for public benefit. It's an essential part of economic development, not only in the states, but nationally. I think that, regardless of what kind of tax you call it, whether you call it a fuel tax or a use tax, it's still a tax and there's still going to be opposition if it's not approached in the right way and not managed in the right way.

I think the regulations tie into what the last two speakers talked about—public outreach. In the alt fuel program that we've had in New York, whenever I go out to the public and talk to local municipalities, public groups, they say, this program makes sense to be a government sense. It's too logical. And the reason that we've tried to design it the way we did, is to be 1) cost effective. We tried to make sure we managed our money properly because people were watching what we were doing. And I think it has to be cost effective, and it has to be of taxpayer value. So if you're creating regulations, it has to fit into that scheme. And the public outreach has to be designed for taxpayer value and fiscal accountability.

Jeff Morales: Let me thank the panel for their presentations and the audience for its participation.

Sarah Catz: I want to thank everyone. This was a tough session—not only was it long, but it’s kind of the meat of the whole coordination. So I really appreciate everyone’s participation. There are several of you who were here last time, and I think the continuity is really important. If you remember the last one, we had some representatives from Hawaii DOT. They couldn’t make it today, but they wanted to me to make sure that everyone knew if there’s going to be a third one of these, they want to host it. So next one in Hawaii. (laughter, applause) Please stick around for the reception and meet our new Caltrans Director, Will Kempton. Also Kevin, please raise your hand. He’s the owner of Electric Cyclery and has these electric bicycles if anybody wants to raise them. Dick has a biodiesel VW Bug outside, and will give anyone a ride. I’m not sure if the fuel cell vehicle is still outside. We’ll send you a draft of the white paper for your input. I want to thank those of you, especially, who came from out of state. And again, I want to thank Scott Samuelsen, Deborah Redman, Jeff Morales. If it wasn’t for Jeff Morales’ leadership, we wouldn’t be having this second meeting.

3 Synthesis of Workshop Findings

Selected General Findings:

Alt Fuel Drivers:

- Criteria pollutants
- Greenhouse gas/global warming
- Other environmental indicators
- Sustainability/resource depletion
- US deficit in gasoline and refined product production
- Customer economics along with similar convenience, safety, reliability, etc. compared with incumbent fuels and technologies

Concerns:

- Markets are difficult to sustain, especially when states or agencies act in isolation
- Is the public sector, even when acting in concert across regions or states, large enough to drive change in manufacturers?
- Cost—of new alt fuel and infrastructure development
- Eroding and unstable transportation funding for current and needed mobility
- Performance/convenience of customers must be maintained throughout the transition
- Customers need to see a real-world benefit

Selected State Action Highlights:

- Florida and California have strong, governor-led, performance-oriented hydrogen goals for their states. This is seen as consistent with clean and green policies across state agency and mission-specific objectives; it is also tied in with hopes for economic development and leadership within the states. New York and other states are following with their own hydrogen plans.
- A wide variety of other fuels, and hybrids are being deployed by states for their own internal reasons, including regional availability, production capability or local economic advantages.
- Many agencies spoke of using demonstration projects to illustrate “new value propositions”—and to help new models for both regulation and business practices, as well as the interrelationship of the respective public and private sectors.

Fuels:

- Need national standards for biodiesel to ensure fuel consistency
- Issues of cold climate being worked out in some cases (New York, Vermont)
- Need to compare fuels on well-to-wheels basis, looking at multiple environmental, energy and cost issues (carbon, sulfur, particulate, water use, net energy, etc.)
- Need to compare fuels on a “subsidy-neutral” basis
- Pick fuels that work in short- and long-term (for New York, CNG works. e.g.)

Vehicles:

- ❑ Near zero-emission vehicle (ZEV) and clean diesel vehicles will make great strides over next ten years—how will this affect comparison with hydrogen?
- ❑ The alt fuel vehicles work—they should no longer be purchased as “demonstration” projects. They should be purchased because they provide benefits, and are part of the transition.
- ❑ They have to show economic and other benefits in the market for customers to buy them
- ❑ Issues of fuel cell performance in cold climates being worked out in some cases (New York, Vermont)

Fleets:

- ❑ Fleet managers can work together by finding the highest levels of commonality in their vehicle needs, and moving forward from there, in order to work with OEMs and help the emerging market
- ❑ You can't purchase vehicles that aren't for sale: the problem of spotty and inconsistent availability of certain types of vehicles. State investments can be at risk when OEMs withdraw alt fuel vehicles from the market
- ❑ Employee buy-in, management commitment and operator and mechanic training are critical to successful introduction of alt fuel fleets

Infrastructure:

- ❑ Public/private partnerships allow for cost, risk and benefit sharing
- ❑ New York took a bare-bones, low-cost approach to deploying the initial 30 stations. Modular components allow later expansion.

Needs:

- ❑ Stable “guiding star” for the long haul: policies, mandates, regulations or incentives that promote alternative fuels apart from any one issue (e.g., criteria pollutants)
- ❑ Need to include “sustainability” as an explicit policy driver in addition to air quality, energy security, etc.
- ❑ Be more rigorous about quantifying benefits and costs of alt fuels; disseminate this information
- ❑ Need for federal leadership to compensate for disruptions to state policy continuity due to change in state leadership; and to help coordinate or resolve inter-state policy conflicts
- ❑ Need stable funding sources (federal involvement)

Role of State Agencies (DOTs & DEQs, etc.) Relative to Alternative Fuels

- ❑ Obvious mission-related roles: protect public health, provide mobility, protect environment, promote healthy economy, fiscal responsibility with public monies, etc.
- ❑ Keep mandates in place, as appropriate or possible
- ❑ To provide opportunity for public service application of new technologies (e.g., transit applications)
- ❑ Instigators, innovators, incubators of new technology
- ❑ Create and maintain optimal amount of stability for investors, innovators and the public
- ❑ Create partnerships with technology players *and* end users (public)
- ❑ Cooperate to put pressure on federal government to assist in programmatic and funding needs of state initiatives

Emerging Themes:

- ❑ Regional cooperation has worked in some instances, but not all
- ❑ Multiple goals, multiple contexts require solution sets that are flexible and diverse
 - Risk: we split the still-small demand pie into too many fragments for the market to respond to
- ❑ Need for stable policies, regulations or mandates
- ❑ Urban planning, ITS, transit have to be part of the solution
 - Green building approaches
 - Mobility vs. access view of transportation

Regulation:

- ❑ “Three-legged stool” includes regulation, incentives and R&D/deployment programs
- ❑ Current vogue for “voluntary incentives” and market subsidies
- ❑ Recognition that real, measurable progress, especially in California, has been through combination of incentives with strict regulation, mandates and government controls
- ❑ Multiple goals and an outcome-oriented regulatory system make sense

Financing:

- ❑ Gasoline tax has been de-linked from vehicle miles traveled
- ❑ Infrastructure costs are rising substantially
- ❑ Infrastructure needs are increasingly local, yet gas taxes are still collected at federal level
- ❑ Solutions:
 - Increase tax revenues
 - Use demand management—including pricing
 - Borrow more
 - Leverage private money more effectively
- ❑ Increase likelihood of raising tax revenues by expanding our understanding and analysis of who benefits and who pays

Institutional Strategies and Issues:

- ❑ Need for inter-agency cooperation within states
 - Tennessee has linked multiple state agencies and Clean City participants, in order to make best use of differing agency strengths
- ❑ Wide acceptance of need for public/private partnerships
- ❑ Address border issues (eg., refueling across state line)

Cautions:

- ❑ Don’t pick winners; encourage and enable promising and realistic options and let the market do the picking.
- ❑ Technologies are still working themselves out; beware of promoting policies that cause premature technological lock on future innovation of alternatives.
- ❑ Avoid fragmentation and subsequent collapse of previous wave of alt fuel programs (early 1990s TDM programs)
- ❑ Continue to address the mobility/congestion/access issues that will not be solved through deployment of alt fuels

Toward ACTION—Observations, Approaches and Tools:

- ❑ “Do what you can, when you can, every time you can.” (Catherine Rips)
- ❑ “Move forward even when you don’t know everything. Do what you do know.” (Jim Whitty)
- ❑ Remember that there is no single solution
- ❑ Take a more completely integrated approach—incorporating land use, green building and design principles
- ❑ Continue with demonstration projects (though some speakers noted that many vehicles are proven technologies at this point)
- ❑ Financial incentives (various levels from minimal to aggressive)
 - Corporate income tax credits
 - Sales tax incentives
 - National grant programs
 - State grant programs (Carl Moyer, TERP)
 - Incentives for utilities
- ❑ Creating market pull
 - DOTs should pool market power and go to the OEMs, get sustained vehicle and engine production in exchange for sustained and adequate demand. Work out kinks such as warranties, codes, standards.
 - Transit as early adopter
- ❑ Formalize and codify state initiatives to ensure stability of programs and funding
- ❑ Establishing uniform standards for fueling infrastructure
 - Uniform standards and codes where there is agreement or can be compromise, increases the states’ regional and national market power, through focusing on a uniform fuel or technology, and not unnecessarily fragmenting the market.
 - Example: Florida’s statewide uniform siting strategy
- ❑ Leveraging state university R&D
- ❑ Corridor-level implementation strategies: Case studies in development and deployment
 - Intrastate—e.g., hydrogen highway plans in Florida and California; biofuels corridor in Tennessee.
 - Interstate—Such as possible West Coast Corridor on I-5, linking Washington, Oregon and California, with public/private partnerships used to develop alt fuel stations at rest stops
 - International? –e.g., extend West Coast Corridor into Canada (implementing its own alt fuels infrastructure) and Baja California
- ❑ Seize opportunities offered by life-style/convenience advantages of home fueling
- ❑ Look for good examples of alt fuel deployment both within this country and abroad. These are ones that have been consistent, growing, and widely embraced by customers (not just regulators and advocates).
- ❑ Manage public expectations about new fuels, vehicles and infrastructure; keep in mind the diversity of the American public now and in the future
- ❑ Begin primary school education and workforce training for the inevitable paradigm shift in fuels/energy