

JEFFREY R. KOSEFF, PhD: Well, good afternoon, everyone. My name is Jeff Koseff. I'm one of the two directors of the Woods Institute for the Environment, and I'm very pleased to cohort today's panel, along with Jim Sweeney, whom you'll meet a little later. Jim is the Director of the Precourt Institute for Energy Efficiency at Stanford. I thought I'd just take a minute to just set the scene a little bit about energy, energy research at Stanford, just to give people a little perspective of what we're doing.

First of all, the Precourt Institute, one of today's sponsors, its mission is to promote energy efficient technologies, systems, and practices, emphasizing economically attractive deployment. And Precourt also works to understand and overcome market policy and technology in human behavioral barriers, and to inform both public and private policymaking.

We are also pleased to thank two other Stanford co-sponsors. The first is the Global Climate and Energy Project, which supports fundamental research in developing new energy technologies that have reduced

greenhouse gas emissions, and the Program on Energy and Susceptible Development, which is directed by one of our panelists, David Victor, which focused on global issues such as the political economy of electricity markets, the geopolitics of gas and energy and development.

Today's topic is "The Future of Energy is in Technology". And it's really appropriate that we have this discussion right here in the heart of Silicon Valley.

Now, the Woods Institute is hoping to embrace the same spirit that inspired Stanford's role in the development of Silicon Valley. What Woods is trying to do is pioneer innovative approaches to meet the environmental challenges of the 21st century from climate change to ocean conservation to sustainable food supplies and security.

What we do is, our goal is to actually harness the expertise and the imagination of the researchers at Stanford across all seven schools and bring it together with the thought and decision leaders, like yourselves, to create practical solutions for people on the planet. Most importantly, Woods is a neutral convener. We bring together people who represent all

points of view, and today's panel I think is a great example representing leaders from industry, venture capital, government, academia, and journalism.

Finally, I'd like to welcome you to the Yang and Yamazaki Environment and Energy Building. This is actually the first event of this kind that we're holding in this building, so you're pioneers. The Yang and Yamazaki Environment and Energy Building is an exemplar and an inspiration we hope. It represents what Stanford hopes to be as an institution, not only academically but operationally. It's built to conserve, it's built to inspire. It's built to teach.

It's built using the latest state of the art technologies in terms of energy efficiency and green building technology. For example, we hope that this building when fully operationally will use 56 percent less energy than a comparable building and 90 percent less potable water.

So with that, I would very much like to introduce the moderator for today's panel, David Jefferson, who's the Senior Business and Technology Editor

of Newsweek. Prior to taking this position in 2007, David served as Newsweek's West Coast editor and Los Angeles Bureau Chief, and before that he was with the Wall Street Journal. So without any further ado, let me introduce David Jefferson, who will introduce the panel. Thank you very much. [Applause]

DAVID JEFFERSON: First of all, thank you for the wonderful welcome. Usually when I'm up in Stanford, having been a graduate of USC, I'm not so welcome [Laughter], so I appreciate this. And also I can't thank you enough for opening up this building to us. You know, quite frankly, to be in this place, which is so green, so full of light, so sustainable, is exciting, and it's exciting when we're talking about this of issue to be a part of this. In addition to Dr. Koseff, I'd like to thank your counterpart at the Precourt Institute for Energy Efficiency, Dr. James Sweeney, and you'll all be hearing from Dr. Sweeney later in the program.

And this is a very special Newsweek executive forum. To begin with, you should have received a program, notepaper and a pen at your seat, and what we

want you to do is write down any questions that you might have during the program because this isn't just going to be me asking them questions; this is going to be interactive. We want your participation in this. We'll be collecting your questions throughout my dialogue with the panel, and during the final segment, they will be hopefully answering your questions. One final request before we begin, please silence your cell phones and pagers, and as they say at the theater, unwrap your candy now.

Newsweek and our advertising partner, API, are pleased to present this afternoon one of our four Issues 2008 Panel Discussions, this one entitled, "Energy's Future Is in Technology: Innovation, and Energy Supply, Energy Efficiency and Alternative Renewable Energy". This is our third partnership together in bringing energy issues to the forefront of a national discussion, and we've had preceding events in Washington, DC, and New York, so thanks going out to API for being a part of this.

Newsweek, just to let you know, has

committed an awful lot of resources, both domestically and internationally on the editorial side beginning last year to the topic of Energy and the Environment. Our international editors published a special issue devoted entirely on energy that was distributed at Davos in 2007, and we followed that special issue with the launch of an annual cover story on Environment and Leadership. The first publication coincided with our inaugural Global Environment and Leadership Conference, which was held at Georgetown University, and it featured Governor Schwarzenegger as the keynote speaker. You'll notice him over here. I edited that cover story. Please ignore any typos.

And then this year we had another event, which was with New York City Mayor Michael Bloomberg. He served as the keynote speaker at our Second Annual Global Environment Leadership Conference. We invite you to continue joining us in these events as we continue presenting these important issues to our readers, both nationally and here on the West Coast. There's contact information on the back of your cards if you'd like more

information on what we're doing in 2009.

Now, today we have a really impressive group of panelists, and our hope is that we will enlighten you on America's current position on the emergence and convergence of energy and technology trends that are worth noting. We're very excited, both because of the location here in Silicon Valley and here in my home state, which has demonstrated such leadership on environmental issues.

This topic is obviously of great importance as our economy is encountering many new challenges, and as we examine the leadership and insights of the candidates this election year in November.

So first off I want to begin with some introductions of our panel. I'll start at my immediate left in alphabetical order. My colleagues Andy Murr is our L.A. Bureau Chief. He's been in this role for a year.

He writes about California politics, science, the environment, global energy, and he's authored one of my favorite pieces, which was on zero energy homes, which I'm hoping to achieve one day, but not now. Andy's invaluable insights come from a media perspective, and they will

enlighten our discussion today. Andy's going to be talking about how the public is embracing the latest news on energy policy and innovation from Sacramento to Silicon Valley.

Paul Siegele is Vice President for Strategic Planning for Chevron Corporation. Paul brings a wealth of experience to our energy dialogue today because of his many years of exploration and geological experience in North and South America, the Middle East and Asia. He previously served in various leadership capacities with Texaco, and then following Texaco's merger in 2001, went to Chevron.

Jackalyne Pfannenstiel is Chairman of the California Energy Commission, an appointment that she received from Governor Schwarzenegger in June 2006. The chairman was first appointed to the commission in April 2004, and we look forward to receiving her invaluable perspective on how the commission's work is impacting the ability for the public and private sectors to come together in formulating constructive alternative energy policies.

Trae Vassallo is not only our exclusive Stanford graduate on the panel today -- yay! -- three times over, very impressive -- but is a partner with Kleiner Perkins Caufield and Byers. Trae's many years of technical and entrepreneurial experience in leadership now focus on working with companies in two main areas: green tech and consumer internet. Trae also served on Newsweek's inaugural Global Environment Leadership Committee back in 2007. We are fortunate to have her venture capital experience here today to further expand this discussion.

And Dr. David Victor is Director of the Program on Energy and Sustainable Development at the Freeman Spogli Institute on International Affairs. Dr. Victor also serves as a Senior Fellow here at the Woods Institute and is with the affiliated faculty at the Precourt Institute. As a frequent contributor to Newsweek, newsweek.com and Newsweek International, we are pleased to have Dr. Victor's global perspective here today.

All right. Now, to start things off, first

of all I have a confession to make. As I was thinking about energy and sustainability and being green, I realized I'm a bit of an energy pig, probably a lot like most Americans. I love the environment, I love polar bears, but when it comes to my habits, I'm probably light green at best. I use energy efficient light bulbs for the porch lights, but then I might not use them inside because they're not flattering enough and make me look a lot older than I am. In the morning, I'll wear sweats and slippers to keep the heating costs down, but then in the afternoon it gets warm and I crank up the AC.

I telecommute from time to time, but frankly it's because I want to stay in my sweats all day and not because I want to save gasoline. And even though I live in Hollywood and my co-worker here drives a Prius, I do not. I drive a gas-guzzling sports car. And it's -- you know, again, what can I say? I'm an energy hog. Okay.

Quite frankly, conserving energy to me means that when I get on the treadmill I walk instead of run. And the only time I really think of going green and

it becomes an urgent issue for me is when I pull up to the Chevron station and \$4 a gallon flies out of my wallet, thank you very much.

So here's my question to the panel. What are -- what is coming up in the future that will allow me to run my air-conditioner as long as I want, drive my car as fast and as far as I want without feeling guilty or going broke?

ANDREW MURR: Nothing. [Laughter]

JEFFERSON: Thanks a lot, Andy. So I have to change my habits, right? Is that the answer? But seriously, in terms of talking about technology, I think that what I'm trying to point out here is for most Americans, most consumers, we want to know "How are you going to get my bills down, and how can I feel good about being green without really radically changing my life?" So let's talk a little bit if we can. Maybe Trae, you were smiling at this question, so --

TRAE VASSALLO: It's an area that I do spend a lot of time on. Because of my history focusing on consumer internet and then my more recent history focusing

on the green tech side of the world, I've been trying to figure out those opportunities that really speak to consumers in a way where it's not about changing behavior, because it's really hard to get consumer behavior change and have a mass sort of product adoption. The key is finding those business opportunities where you're just hooking into a natural occurrence. And now let me talk about a couple of these.

One great example of I think a company that doesn't require huge behavior change is a company that we just invested in called Recycle Bank. People recycle, but there's no price signal to consumers around, "Okay, I'm going to throw away this plastic bottle or this aluminum can." They get no benefit. It's goodwill on their part to have to haul out the recycling bin every week.

Turns out there's a lot of value in these recycled commodities, and that if that value gets put back in the consumer's pocket, all of a sudden you get, you know, consumer behavior change because they can make money, they can feel good, and it adds up. And so I think there are opportunities out there like that that don't

purely rely on consumer goodwill.

Another good example is Fisker. You don't have to make a huge negative tradeoff to drive a greener vehicle. Now, it's probably not necessarily the most green, but Fisker is going to deliver the first plug-in hybrid, we call zero tradeoff vehicle. It's a four-seater, size of a seven series. It's an all-electric drive train. It'll go 50 miles on a battery. When the battery runs out at the end of the 50 miles, it switches over to a gasoline engine, uses the existing infrastructure. It's a much more efficient, much smarter way, and as a consumer, you don't have to make a big tradeoff, and you're still going to look good driving, you know, at 5 miles an hour in L.A.

JEFFERSON: It doesn't smell like crunch ... either, right?

VASSALLO: No, no vile fuels. So that's just a couple of examples of I think where you can hit low-hanging fruit.

JEFFERSON: Right.

: My answer to that would be the cheapest

barrel to find is the cheapest barrel you don't use.

VASSALLO: Yes.

JEFFERSON: Mm-hm.

: So I think as you've described your lifestyle, you've got plenty of opportunity there to find some cheap barrels.

JEFFERSON: [Laughs] More time at home in sweats, right?

: Yeah.

JACKALYNE PFANNENSTIEL: But let me jump on something, because I --

JEFFERSON: Yeah.

PFANNENSTIEL: -- think it was really interesting that Trae just used recycling as an example. And in fact, it wasn't too many years ago -- both of us are old enough to remember -- people didn't recycle. People didn't really think about recycling. You sort of had to think about paying people to recycle.

There's been a real change in the way at least Californians think about waste. We do recycle. And so my -- you know, you started by saying that it's going

to be hard to get people to change behavior, but I think fundamentally a lot of what we're talking about is getting people to change behavior, getting them to understand the value of doing things, getting people to say, "Well, this light bulb isn't going to give me exactly the same quality as this light bulb, but it's going to save me so much more energy that I'll think about it and I'll use it. I'll use it more often. I'll use it in more places."

So I think part of it is getting people the information and helping them understand. And I don't think we've done that very well.

JEFFERSON: Mm-hm.

VASSALLO: Well, and providing real value, though. I think California is in a way different situation when it comes to recycling than the East Coast.

You know, we have very good recycling rates out here. I think they're in the 30 percent range. There are many cities in the U.S. that don't have any recycling programs at all, and so it's really an ease. You know, as a consumer in California, my trash bin's not big enough. You know, I've got to put stuff in my recycling bin.

JEFFERSON: Right.

VASSALLO: But yet you can recycle 80 percent of everything we throw away, and we're not even remotely close to that number.

JEFFERSON: Hm! What would you say we're at percentage-wise?

VASSALLO: It's in the twenties. There's not great data on it.

JEFFERSON: Huh! Okay, okay. Paul, one of the things I'd like to talk about is, okay, earlier this week at Exxon, the Rockefeller descendants put some pressure on the company to reduce emissions and increase research into renewable energy. Now, that didn't pass. But if major shareholders at Chevron started to say, "What are you guys doing in this area?" what would you tell them?

PAUL SIEGELE: You know, Chevron has a very good record on this point.

JEFFERSON: Mm-hm. Right.

SIEGELE: We are very proud of our conservation record. We've saved 27 percent of energy

used per barrel produced over the last 15 years. We have a unique business model called Chevron Energy Solutions, which provides renewable solutions for businesses and government. It's really focused primarily at learning institutions and government institutions. But for instance, solar energy and fuel cells. So we're -- we make quite a bit of investment in that space. We're planning to spend nearly \$3 billion over the next three years on alternative energy. We're the largest geothermal producer in the world.

JEFFERSON: And I know we had talked recently a little bit about your experience with offshore drilling and some of what that involves in terms of what you guys are doing in the Gulf. And I found some of that fascinating, so if you could just illuminate the rest of us.

SIEGELE: Well, during my role at Streplin [?], my more recent job was deep water exploration leader in the Gulf of Mexico. And, you know, the story there is we're going deeper and deeper to find more and more challenged resources. So the example I like to use is if

you can imagine yourself in an airplane cruising altitude 30,000 feet and hitting a target the size of a pitcher's mound with a well bore that's the size of a coffee can: That's the challenge, and that's what we're doing in the deep water. We're going to 30-, 35-, 38,000 feet of water -- 38,000 of drilling in 10,000 feet of water.

JEFFERSON: Right, right. David, it looked like you wanted to jump in here.

DAVID VICTOR, PhD: I guess I wanted to underscore that I think all of the major energy companies are now spending serious money on improving efficiency and all of us can do obviously a lot more on the efficiency side. But when you think about the really big challenge here, think about the problem of climate change, which is going to require at least for this country a reduction in emissions of maybe 80 percent, the leverage there is going to come partly from behavioral change and partly from being more efficient in the way we use energy, but I think mainly by removing carbon from the energy system completely.

The way you're going to be able to sit in

sweats or a double set of sweats all day long and have the AC on high is going to be by using fundamentally electricity that comes from zero or extremely low carbon sources. And that's -- we'll talk later on the panel I'm sure about a whole range of really interesting technologies. There are a lot of interesting opportunities there, but I think the really big leverage is going to come in de-carbonizing the power system, especially electricity.

JEFFERSON: Right, right. Let's talk a little bit, you mentioned the technologies, and obviously that's a focus of this panel, so if you want to use this as a jumping off point to kind of elucidate all of us as what's really around the corner. What's --

VICTOR: Well, I mean there are a lot of people on the panel and in the audience --

JEFFERSON: Right.

VICTOR: -- who are working on these different technologies. I think what's tremendously interesting is we don't know what's around the corner. This is always a very dangerous time for public policy

because everybody gets some terrific idea about whatever technology it is, and they're going to pour money into it.

Usually the government pours money into things after they've already become viable or dead or -- [Laughter]

And so that's problematic.

But I think it's interesting that across the spectrum there are all kinds of ideas. So I'll start with the most radioactive: advanced nuclear plants. It's really interesting what's going on in the nuclear power industry. It takes a while to get going and so on, and a lot of this stuff will be tested in the developing countries first, not necessarily at scale in the industrialized world.

Coal, advanced coal power, coal plants that can remove maybe 85 percent of the emissions, a lot of work going on in that here at Stanford. Some people on the panel are investing in really interesting renewable opportunities. There are interesting ideas also even using natural gas and storing the CO<sub>2</sub>, the main cause of climate change, from the natural gas plants.

And I think it's an incredibly exciting

time in the energy business, and I'm focusing in my remarks on electricity but very similar innovations. A whole bunch of ideas. It's hard to know which ones will be successful on a commercial scale, on replacements for petroleum and ways to make advanced biofuels that have low carbon emissions and also help deal with energy security problems. It's really a tremendously, tremendously exciting period.

JEFFERSON: Fantastic. And I know you mentioned your remarks, and I know each one of you has some prepared remarks. And before we continue with the questioning, I'd like to get going on that. If you want to -- do you want to start? Did you --

VICTOR: Okay.

JEFFERSON: Please feel free.

VICTOR: Well, I mean, as I said, I think the great leverage -- and I agree with the tenor of the panel here -- which is the leverage on these problems is going to come mainly from technology, and they're going to come not so much from asking for major behavioral changes, but they're going to come from change the nature of the

system that delivers energy in ways that makes us much less dependent on oil and all the effects that are arising in the global market from excess dependence on oil, and mainly because of carbon dioxide, the chief cause of global warming.

But I think when you think about this, and especially here in Silicon Valley, there's a danger that we are, to paraphrase, kind of irrationally exuberant. I am concerned that our discussions here in Silicon Valley operate -- apply to the energy sector IT time. We're used to thinking about building companies, you know, YouTube, benefactors of this building. You know, here's an idea, some software and some hardware and some really important marketing. In a few years, you've got a multi-billion-dollar company. And in the energy business, the time scales are just really different. Radical change in the energy business comes over longer time horizons. And I think we may not be fully prepared for that.

The other thing I think that's going to be different about Silicon Valley meeting energy is that bringing new energy technologies in, especially ones that

are not immediately competitive with the incumbents,  
requires a political strategy that I think Silicon Valley  
for the most part has not been used to in the past,  
because we're used to investing in companies and ideas  
that have intrinsic value and take market share very  
quickly, whereas most of the things that are really  
exciting, like these advanced nuclear plants -- I'm not  
saying that folks from Silicon Valley are necessarily  
backing them right now -- but really interesting advanced  
renewables ideas, some are cost competitive right now.  
We'll hear about some of those. Most aren't.

A lot of the most interesting things on  
advanced biofuels are going to require supportive policy.

And I think there's a dialogue to be had with the  
political process that's really important. And if I can  
say you're also fighting against incumbents who are better  
at having that dialogue than we're used to here in Silicon  
Valley.

Remember that most of the energy business  
is a highly regulated industry, and most of the  
incumbents, especially in the electric power industry, are

used to using that incumbent position in a way that sometimes helps technological change, sometimes doesn't help technological change. And I think we ought to have some discussion about which kinds of regulatory strategies need to go in tandem with all the terrific money and ideas that are coming in around new technologies.

JEFFERSON: Terrific. Trae, do you want to

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VASSALLO: Sure. And I'll actually I think speak to a couple of the points that were raised here recently. So a little bit about the firm that I'm at, Kleiner Perkins. We're one of the older firms in the Valley. We've been around for 35 years. We actually did exist before it only took three years to build a multi-billion-dollar company. There were biotech investments, there were infrastructure investments that took significant dollars. And so there are certain cycles. Yes, this is a different style of investing, and that's why you've only seen I think a handful of venture firms actually decide to take the leap and really focus on this green tech sector.

We decided to do that about five years ago.

We started very slowly. We didn't know what we didn't know. We didn't have a network, and a lot of it is outside of Silicon Valley. So we did start slowly.

But it has generated a lot of momentum, and now it's over 40 percent of all of our investing. It's a global effort on our part, and we have over 30 companies that we've invested in this green tech sector across a wide, wide range of opportunities: everything from, you know, the more traditional IT kind of focused companies, which are more in the efficiency side -- demand gen [?], greening of the IT, or consumer-focused things -- to things that are more infrastructure-like. You know, Bob Fishman from OSRA is here. It's a large-scale solar power-generating company.

And so we're expanding what we do in a big way. We've even added a late stage -- later stage growth capital stage group to our fund where we hired a gentleman out of Goldman Sachs. Because there is a dearth of smart investors who are still -- who are willing to come in at that stage and provide the growth capital for all these

opportunities that we're seeing.

I wanted to address the -- kind of the incumbent point that was made. This is a different environment in that the energy industry has been around for a long time with relatively little innovation. What we're good at as venture capitalists is using entrepreneurs to be the seeds of innovation, and what we're seeing is a lot of these large incumbents actually reaching out and saying, "We're interested in working with you. We know we have a carbon liability. We know we have a problem."

Now, you know, success stories remain to be seen, but it is actually a really good indication that there are companies out there that want to be leaders in the industry, know they don't have this technology innovation within their companies, and are providing real dollars to our portfolio companies to help them move those technologies ahead. And so just briefly I wanted to give the group a sense of the general area where we've spent time investing, and not take up too much time. I'm happy to follow up with folks later.

But we've spent a lot of time on energy generation, all sorts of renewables from solar, many types of solar -- large-scale solar, thin-film solar, you know, next next next gen solar. Geothermal. We actually have a very exciting company that we seeded in geothermal. We have a coal company that actually gassifies coal into natural gas, reduces the carbon footprint by about 50 percent. They do have a carbon sequestration, carbon capture problem, which is another area where a lot of folks are spending a significant amount of time: How can you turn that carbon into a valuable product, how can you turn it into something that you can reuse, or how can you actually put it back in the ground. And we have a couple of very early stage investments in that area.

Transportation is a big area. You know, it's about clean electricity generation, clean transportation, efficiency. Those are sort of the three big alleys we break this up into. And we have three automotive companies we're focused on because we think that's a huge huge lever. And the big automotive companies are dealing with a lot of issues, and they're

big companies, and they have internal infrastructure that's going to prevent them from making these fast changes around new platforms of vehicles.

And then this last sector is really the efficiency sector that we touched on earlier, and I already mentioned a couple of companies there.

But, you know, it's a huge initiative for us. We see a lot of opportunity, and, you know, where Google required, you know, tens of millions of dollars of capital to get to where it is today, these companies may require an order of magnitude more capital, but the markets are also an order of magnitude larger. And they're not winner take all markets. So we see significant opportunity.

JEFFERSON: Paul.

SIEGELE: Well, you know, I just realized that all my good sound bites I've used up in the first question. [Laughter]

JEFFERSON: That's okay.

SIEGELE: But I just want to say thanks for the invitation here. This is a -- we're delighted to be

here as part of this forum. Energy security is one of the critical issues facing our nation, and I just want to start you reminding people that in the 90 minutes we're going to be together the world's going to burn through 5 million barrels of oil.

Global demand is straining the energy system. Emerging economies are seeking to improve their living standards. Populations are growing and the middle classes expanding. The world's not running out of oil, but there are accumulating risks to the supply of reliable energy to meet the demand. Global spare capacity is tight, access to new resources is limited.

Some believe that renewable energy will significantly reduce our dependence on foreign oil. However, fossil fuels will continue to provide about 85 percent of the world's energy needs, at least through 2030. Food-based fuels face practical limitations. Renewable fuels at commercial scale will require massive investments, new infrastructure systems, and long lead times.

We need solutions that balance energy

security, concerns for the environment, and economic growth. I mentioned the visual of hovering over AT&T Park in an airplane, but, you know, another challenge when we drill at those deep depths are the temperatures and pressures. The fluids at those depths are at greater than boiling point and the pressures are over 2,000 pounds per square inch, so drilling -- the technologies involved in drilling those depths and extracting are great.

The imaging technologies alone to see beneath this big layer of salt that covers most of the deep water Gulf of Mexico are amazing because the salt acts like a fun house mirror for the seismic soundwaves, so putting these structures back in the right location on our maps to drill the best prospects is a huge challenge.

Technology is also enabling the extension of life in our existing fields. Kern River is an example is a 100-year-old field located in Bakersfield. It just celebrated its 2 billionth barrel of oil. This is a mature steam flood, and the steam flood technology, which is quite advanced, has allowed extractions up to 50

percent of the oil in place, which is about 20 percent greater than a normal oil field.

So let me offer from Chevron's perspective three things that we need to do today to confront the energy challenge. We need to support rational energy policies. We need to expand and diversify energy supplies. And we need to conserve our precious natural resources.

Energy policies must support continued growth in conventional energy as alternative sources are commercialized. The American public shouldn't trade off economic prosperity to diversify our energy supply or address greenhouse gas emissions.

The U.S. possesses 400 billion barrels of oil and 250 trillion cubic feet of natural gas located in areas currently inaccessible for development. Much of this resource is located in the outer continental shelf, 85 percent of which is off-limits. It's unreasonable to expect other countries to expand resource development for our energy needs while we ban access to our own supplies.

We support the development of alternative energy to supplement fossil fuels. We need all the energy we can get from every source.

Lastly, we embrace conservation. I mentioned our own efficiency improvement over the last 15 years. We've done it by such things as improving the efficiency of steam floods, employing the co-generation of electricity, installing variable pumps on pumping jacks, and the simple things as changing of the light bulbs.

The situation is serious. It demands that we take action now to ensure our future. And we're here to do our part.

JEFFERSON: Jackalyne.

PFANNENSTIEL: I guess I couldn't begin without recognizing my boss, Arnold Schwarzenegger. And he was largely responsible for what we now have committed to in California, which is we've set ourselves some really stringent climate goals. We are going to be reducing our carbon footprint in the state by something like 30 percent by 2020.

So we talk about making changes gradually

and talk about the energy sector being one that takes a long time. We need to accelerate that. I thought what I would do is just talk about some what I see as technology opportunities in California in energy, based largely on what we're going to have to do to meet our AB-32 goals.

AB-32 will only get there, we'll only get to this reduction in greenhouse gas emissions we set for ourselves if we both advance the technologies in the state and change behavior. And so let's talk about what are the technologies that are actually going to do both of those.

The first and -- the two biggest strategies that we have for meeting AB-32 are energy efficiency and renewables. There are market mechanisms that we may need to go after those, but first we'd better do everything we can on energy efficiency and renewables.

Energy efficiency is the cheapest, most effective way of getting the reductions that we need. And this is efficiency in all sectors: in buildings, in appliances, in processes, industrial processes, as well as

in power plants. We've got to get those efficiencies.

And that's technology-dependent, all of those.

They mentioned earlier about zero energy homes or zero energy buildings. We're really focusing on how do you get to zero net energy buildings. It's a combination of more efficient buildings and some kind of alternative energy source -- read, solar -- for those buildings or solar geothermal or, you know, a number of other technologies.

California has been incredibly effective in energy efficiency, and there's a graph I use all the time.

I don't have the picture, so I'll talk you through it. Since about -- well, from the mid '60s to the mid '70s, the per capita electricity use in the U.S. and California both were heading up on an about even trajectory. Well, since the mid '70s, the U.S. has continued on that trajectory, and we're talking per capita electricity use.

And it's gone up about 50 percent since the mid '70s.

California has held per capita electricity use flat since that time. I mean, really, when you look at the graphics, they're pretty dramatic. And we've done

that largely through energy efficiency, largely because we went out and set building standards and appliance standards and programs that encourage the reduction in use. And then you plot on that same graphic the per capita GDP during that time, and you find in fact that California and the U.S. have both done quite well on a per capita GDP, and at some point California surpassed the U.S. So you're not in fact trading the economy for efficiency.

Now, the other path that I said on meeting the AB-32 goals is going to be renewables. And what we need to be doing in renewables is driving the cost down. Totally technology plays. We need to incent lower cost of the renewables.

Then let's take a different path here on consumer behavior. And we all know that's a harder thing to get at, and we really haven't done a very good job on changing consumer behavior in the electric sphere. We've done some things better, but primarily we're still sort of incenting and rewarding people to do what may in fact be in their own best interest.

But even as I'm speaking, there are going on in California the major electric companies are installing these new electric meters on people's homes, and eventually every home at least for the industrial [?] utilities, will have these smart meters. Well, what's the big deal about that?

The big deal is that the amount of information that's going to be available to the home owner is going to be enormous. It's going to be what people are calling the Prius effect. People are going to be able to see for the first time how they're using electricity, and there is no doubt in my mind that with some appropriate price signals and that information, we're going to have a big change.

My office has been full over the past several months of people coming in with new technologies that they think are going to work with all of this information in home display, smart appliances, smart grids, the whole gamut of what can be done with this new information.

So let me stop with that. I just want to

get back and emphasize that the subject of this panel, which is that energy's future is in technology, is what I see at the Energy Commission every day, so I absolutely endorse that.

JEFFERSON: Andy.

ANDREW MURR: I'd like to put in a plug for changing consumer behavior. I guess what -- as somebody who covers the energy field only fitfully here and there, what I see is a state that sort of comes along two or three -- where the consumer comes along two or three or four years after the fact and begins to get it when -- and sometimes it seems only when -- there's a price disincentive built into it. David was incorrect in saying I am a Prius owner. I was a Prius owner until my Prius was stolen last month.

: Oh! That's terrible! [Laughter]

MURR: But it was -- it's sort of been a fascinating and sick experience. It turns out that there's not much of a market in used Priuses. There's a big market in used Prius bumpers --

: Bumper stickers, yes.

MURR: -- with stickers, and I didn't have one, so that wasn't the reason mine was stolen. I'm still not quite at the bottom of why mine did get stolen.

But a year ago -- I bought in March 2007, so I was hardly an early adopter -- there were 58 Priuses on the lot at the Toyota of Santa Monica where I bought. Gas prices were seemingly high, but not really high.

I now have to stand in line for six weeks to get one -- it's back to the early early days of Priuses -- and had to put down \$1,000 and had to be assured by my dealership that other dealerships were charging \$3,000 as a sort of gouge fee.

It's also clear that the consumer has figured out that used Priuses are valued. You know, you always go by the rule of thumb that you lose 20 percent of the value of the car by driving off the lot. Apparently I'm losing about 8 percent by having it for a year and driving it for 16,000 miles. And maybe there's some other factor, but as far as I can tell, the difference is that gas has hit \$4 and -- or \$3 and some tipping point up in the mid 3 range -- and suddenly people get it. People

have known about the cars. People have known -- have been subjected to lots of advertising. People have been -- have had a choice of a lot of sorts of hybrids, and suddenly they're buying.

So it seems to me that we really do have to concentrate on changing folks' behavior and finding ways that aren't just price sensitivity because that has a sort of ugly downside, particularly in the -- in poorer communities. A lot of energy costs are pretty regressive, and we've got to figure out a way in which to change people's behavior, change permanently the way they do business at home and on the road and at work without punishing people too badly.

JEFFERSON: Obviously there's a lot of bad news. But in many ways, it's good news for everybody who's sitting at this table, whether we're talking about high gas prices, whether we're talking about climate change, good things can result from that. And Trae, I wanted to ask you a little bit about what the mood is in the venture capital community, again, and which may be a little counterintuitive to what it is among consumers.

VASSALLO: Yeah. Well, so just let me spend a moment just looking at the investment numbers. I think if you look over the last three years of venture investment in the green tech industry, it's pretty much doubled every year. So I think there is a consensus that, you know, this crisis is an opportunity, and it's an opportunity to do what we do well, which is take this innovation and apply it to this problem that hasn't had innovation thrown at it in a long time.

We often talk about, you know, the Moore's law in IT, and where is that in green tech. And I just -- there are some interesting numbers that I went and looked up just to share with folks to realize that we have come a long way and we have yet another long -- we've got a great future in front of us if we can continue these trends.

But solar just in the last couple -- just in the last year, I wanted to say, solar in sells [?] rose 125 percent, wind was 45 percent increase, and biofuels was a 32 percent increase, so things are starting to trend the right way. And there was a -- shoot, I just -- oh, here's the -- wind costs are down an order of magnitude

since 1980, solar is down 60 percent in the last 15 years, and ethanol is 45 percent more efficient than what it was in 1982.

So we have made great strides. And if I just look at our portfolio ahead of us, you know, it excites us in a huge way. So, you know, internally in our firm we see huge opportunities, and I think in the other firms, and I know there are other investors here who have, you know, seen the lay of the land and figured out kind of where opportunities are, there is excitement.

There's going to be a lot of money lost, too. You know, as was pointed out, this is a different style of investing, and unless you understand the market dynamics, distribution is really tricky here, a lot of people are going to lose a lot of money. But, you know --

And look at the public markets, too. I think a lot of the huge, you know, public events have been in the green tech industry, and it's the one area where the markets are very very favorable.

JEFFERSON: Hm! David, I'd like to throw this out to you. How does the U.S. compare with other

countries in doing this sort of investment? And do you think that the government is being supportive enough?

VICTOR: Well, I'd like to talk about major developing countries in this context. I think the single most important thing for us to keep in mind is scale here.

There's been a lot in the news about how China and India -- China in particular -- have -- China's now become the largest CO2 emitter in the world -- nobody actually knows, but maybe that's true -- as of last year. It's still important to keep that in perspective. On a per capita basis, their emissions are still a lot smaller than our emissions.

It's also going to be really hard for the United States to play a constructive role in helping create some kind of a serious international effort to deal with the climate change problem when we're not really doing much here at home. California is doing something, but it's not the whole country, and federal legislation is going to start -- that debate will start on Monday of this next week. But that's going to take a long time for people to put that together.

I think maybe the single most important force in innovation in this industry right now has been high energy prices. You know, there are a lot of regulatory -- points of regulatory support and that helps the kinds of projects that Trae was talking about, but there's nothing like really high energy prices to get people focused.

All that said, and mindful that we can do more in changing people's behavior, I think it's really important that we go back to the basic numbers and think about where the leverage is. If we're going to deal with the carbon problem, we're talking about just massive reductions in emissions from our current trajectories.

And so we're going to need technologies that have -- that are competitive not only in these marketplaces here with high energy prices, but are also competitive in the Chinese market, in the Indian market and so on. And on that front, for the next couple decades, I'm actually very very pessimistic. I'm optimistic about the long term. But I think over the next few decades, if you look at the cost of building a

conventional coal-fired power plant in China, which is now one-third the cost of building the same power plant here in the United States, it is really hard to see that big economy at least, and India to some degree, just a much smaller economy, those economies changing radically from their current trajectory.

JEFFERSON: You bring up a very interesting point, and this is actually -- Jackalyne I'd like to follow up with you on this question, is the kind of piecemeal approach we have to legislation. We're at the forefront here in California. Obviously the federal government is going to start kicking around its own legislation next week. The President has been against caps. Can we really leave this up to states and municipalities and not have a national and beyond that global policy to address this?

PFANNENSTIEL: No. Absolutely not. It is a global problem, and we do need to address it globally. On the other hand, you know, you've got to start it somewhere. And I think that California -- and actually I get asked this a lot: Does it really matter? Does it

matter what California is doing? And my answer is absolutely it does.

I mean, first of all, we're going to lead in terms of setting up some rules and show how it can be done, show what can be done. And a lot of what we're doing are things that are very directly applicable elsewhere, so like energy efficiency and like the technology development. Those things, if we can get them done in California and demonstrate how to do it, then it does go elsewhere.

We're also assuming in California that as we get our program for AB-32 set up, it then becomes part of a Western states, and the New England states have a market going on, and others are talking about it. So, you know, you're going to get the states, the regional groups of states are going to start working on it. And then presumably, and I think we fully expect, that then that sets the model for the national picture.

And it is going to happen, and there will be a model of a national picture. It may take longer, and that's why we need to get started.

JEFFERSON: Mm-hm. I'd like to follow up with some other thoughts on this, as well. I mean, you expressed some extreme pessimism.

VICTOR: Well, I'm pessimistic about changing the near-term trajectory. Even in this country, if we had -- say an epiphany arrives in Washington next Monday, and the Senate votes through and the House immediately follows [Laughter] -- it's kind of a dream world, but -- the House follows through with legislation and you have 60 votes in the Senate, and all this stuff goes through. Maybe you need more because you have to override a presidential veto.

Then it's going to take years to put the implementing legislation in place and things like that. And California's tied up in various legal battles and so on. All of which is to say that people aren't just sitting on their hands. Serious people are investing serious money. But it takes a long time to move the needle in the energy business, especially on the supply side, on the heavy iron, because power plants take a while to turn over and there are siting issues and this, that,

and the other thing. And so even in the countries that are plausibly going to do something about the problem, it's going to take a while.

And then you've got these incredibly rapidly growing countries in Asia mainly, notably in China, which again, they have other priorities. Their per capita emissions are lower than ours. I'm not saying they should go change their behavior immediately. And I think in many respects Beijing has lost control over large parts of the economy, so even if they wanted to change their behavior, they couldn't.

But diffusing new technologies into practice and making these kinds of deep reductions is going to take a while. And so I just think we need to be sober about the scale, the time scales that are involved in here. And it does mean -- and I don't want to rain too much on the parade -- but it does mean that in the near term we are committed to some warming [?], and possibly with all of this new evidence that the climate's possibly a lot more sensitive than people originally thought, we're committed to some possibly already dangerous warming.

You know, it's a very very scary scenario, I think, for which I think the governments of the world for the most part don't have a lot of near-term leverage.

JEFFERSON: One of the things in talking about the various technologies, and obviously the regulation around this and what individual government entities do to support and discourage is such a big part of it. One of the things I was amazed to find out because I didn't realize it was that the folks who are running around with their converted Mercedes diesel cars running on fry oil, apparently have to pay an 18 cent per mile road tax that they found is a disincentive. And in fact, the governor's own converted Hummer, he didn't realize that he had to pay this 18 cents. Some of them are facing fines.

Yet at the same time, the governor, you know, is proud of the fact and has said that California's environmental policies are driving a whole new industrial revolution in our state that's opening up huge opportunities for California companies to grow. My

question being why are opportunities open for California's companies and not for the fry oil folks? Why are they being discouraged with this mass of fines and 18 cents a gallon tax?

: Is 18 cents a gallon a big deal?

JEFFERSON: 18 cents a mile, sorry. 18 cents a mile. I mis-spoke. 18 cents a mile road tax.

PFANNENSTIEL: If that's to me, I have to say I have no idea. I'm glad that I don't drive one of these, because I wouldn't have --

JEFFERSON: Yeah, 18 cent a mile road tax.

PFANNENSTIEL: -- been paying the 18 cents a mile road tax.

JEFFERSON: Apparently it's to even them up with pay at the pump, what you would be paying at the pump. And maybe Paul, do you know a little more about the structure of what that is?

SIEGELE: No, I don't know anything about it. Never heard of it?

JEFFERSON: What the gas tax is at that

pump? Anyway, no.

PFANNENSTIEL: Never heard of it.

SIEGELE: We find petroleum --

JEFFERSON: Eric, go ahead.

ERIC: So there is an 18-cent excise tax in California on every gallon of diesel. That needs to be paid no matter what ...

PFANNENSTIEL: Oh, it's on diesel.

JEFFERSON: Ah!

ERIC: Also a 24.4-cent federal tax, whether you're putting vegetable oil or diesel fuel in your car, all are subject to that same tax.

JEFFERSON: Okay.

: Because it pays for roads?

ERIC: Correct.

JEFFERSON: Is that what it is.

: This is not the story. This is a rounding error.

: Yeah.

: This is a -- to paraphrase one of our candidates, this is a stunt. You know, 18 cents a gallon

is within what we've seen, albeit we're in an unusual period in the oil markets right now, it's within what we have seen at the pump in a few weeks. It is tiny compared to the kinds of signals, which are much bigger signals that you need to -- in order to induce changes in demand so that people will go buy Priuses and not have them stolen, you know, all of this stuff, so that we can actually make a dent in emissions. And this is not even talking about the carbon problem, which itself is going to require a pretty significant price signal.

So I think there's a tendency to kind of seize on these particular almost micro-initiatives in policy and micro-facts and lose sight of the bigger picture here. I don't think 18 cents is the story.

PFANNENSTIEL: I also am a little concerned about focusing on the current high gasoline price. I mean, what frightens me is those of us who remember the OPEC oil embargo in the mid '70s and there were spikes in prices and everybody wrung our hands and what were we going to do. And some things changed. There was some energy efficiency that happened and some structural

change.

But I think for the large part people waited it out. And that's what frightens me now. I'm -- you know, maybe people will in fact buy the Priuses now or the other hybrids or go out and do things. But if people are just going to wait it out then I don't think we're going to take advantage of the opportunity that's in front of us.

I think what I want to hear more is the fact that the investors are investing in the new technology. I mean, I'm encouraged by the fact that there's a lot going on in the technology space right now to do all of this so that people aren't looking at it as "I'll hold my breath and then it will go away and then I can go back to my SUV. I'll park it in the back of the driveway and then, you know, in another six months or another business cycle, another couple years, it'll be back to normal." I think people need to start thinking about normal as being something that a few years ago might have been inconceivable.

: But what happens if normal is -- in

their minds is 3.50, so once we've gone from 4 to 4.50 and everyone gets scared, we go back to 3.50. That seems normal, acceptable and people revert. How do you keep them from reverting?

PFANNENSTIEL: Well, I don't know that you can keep them from reverting. I think that the discussion that we're having about behavioral change is to get people to understand that you can drive a hybrid, or use as a compact fluorescent light bulb or get the more efficient air-conditioner, and you don't lose anything. I've driven a hybrid -- a Prius for several years now, and it's got like 90,000 miles on it, and, you know, I don't really lose anything from driving it. And you don't really, with the right technologies, you're not really losing stuff.

But people need to see that. We need to help them -- give them the sense of the products and the technologies that will allow them to do it.

JEFFERSON: And how do you do that when so much of the factor is based around price? When we're talking about so many of these technologies are still very expensive when compared to fossil fuels. How do you

encourage that sort of change? And also, you had made the point, which is right, that, you know, the cheapest gallon you -- how did you say it? You said it much more eloquently than I. Is the one you don't use.

SIEGELE: I'm an explorer, so I put things in terms of finding them and how hard they are to find.

JEFFERSON: Right.

SIEGELE: You know, maybe back to what was being said earlier, there's a scale thing here that I think we're missing bit, particularly as we look to the solutions that might involve alternative energy. And our view is we're going to need every molecule, so that is not to say that we are dismissing the role of alternative energy. It's going to be incredibly important. But when you just look at the numbers in terms of the demographics of where the world is growing, and who's demanding the oil, and what's driving the price, which is tight supply and demand, and very likely continued growth and demand, all of the forms of energy are going to grow, and the demand is going to continue to grow.

So, you know, back to the price, as -- I

don't fear, for example, that prices are going to go right back down to 30, you know, and people are going to go back to their big cars. I think the era from where I sit as an explorer, the era of finding cheap oil is over. That isn't to say that there isn't abundant supply, but it's getting to be very costly. And so we're gradually raising the floor of where oil can be traded because the costs are so enormous going in. And it's a scale thing.

You know, one of these good technology solutions that are out there, part of what limits them is the distribution scale. It's not that the technology can't be done, but it's how do you get it distributed at a massive scale, like exists for gasoline today?

JEFFERSON: Right. You were talking about not seeing it go back down to 30, but in fact I guess in a recent interview with the San Francisco Chronicle, green technology investor, and I may butcher this name, Vinod Khosla, can somebody else --

: ...

JEFFERSON: Thank you. Thank you. I have no question that in 10 years there's no way oil will be

able to compete with biofuels, even in five years. Now it will take a long time to scale biofuels, but I'm not the only one in the world forecasting oil dropping in price to \$35 a barrel by 2030. Do you agree? And I'll -- not just you, but others.

: Well, let me just say a couple -- First of all, forecasting price right now in the oil markets is particularly difficult because demand, as we've been talking, demand takes a long time to respond, so demand is not very responsive. The curves are nearly vertical. And supply right now is nearly vertical because price goes up, people start looking for more oil, it takes a while to get projects on-line, to build rigs. Some people are -- some major oil suppliers don't even know what to do with all the money they're bringing in so far, especially in the Gulf, and so their incentive is to produce more oil, and so great.

And so you have two curves. If you think of them kind of geometrically, two nearly vertical curves, and little shifts in those curves can magnify -- along with what's going on in the financial markets -- can

magnify the effect in the oil price. So it's very very difficult right now.

But if Vinod's right, and you know, he's got four dozen bets on different companies, and you folks have bets and lot of people have interesting bets, and 95 percent of them are going to fail, and some of them are going to succeed maybe. And then you might have a new supply of liquid fuel that can compete head-to-head with oil. And that would be terrifically interesting. And then you'll see the demand side on oil respond and maybe not \$30 a barrel, but oil prices will come back down.

I think then one of the tests will be how many of these enterprises survive in that lower energy price environment. I think we need -- as a matter of policy need to be ready with price support, not mandates, but using price signals and then to be patient with the price signals to let the new ideas come into the marketplace and actually take market share. And just as we see in the athletic shoes industry, in the bubble gum industry, and all kinds of other industries.

JEFFERSON: What specifically, though,

about the comment on biofuels? Biofuels the answer?

: I think we don't know. Today -- I mean, the conventional biofuels have a lot of horrors associated with them. The advanced biofuels, some of them work in the lab, but not yet at scale. They might work at commercial scale, we don't know. One of your companies is working on pluggable -- in effect, pluggable hybrids, so there you have electricity competing with biofuels competing with oil. That's going to change the world, potentially because then you're going to have fungibility between the electric power system and oil.

Traditionally economies as they mature, the electric power system takes over one part of the economy and liquids take over the other part of the economy because there's no fungibility between the two. You can't load up an airplane with coal and go fly off into the skies. And if you start to have fungibility between those two, then the energy markets as a whole are going to become much more competitive. That could drive oil prices down. It nonetheless could drive the share of oil in transportation down because more things will be cost

competitive. I think this a tremendously exciting world, but it's very hard to predict.

JEFFERSON: Okay. Andy, I've wanted to ask you a little bit about specifically some things that are going on here in the state, since this is the area we cover. Beyond the well-known AB-32 and the renewable portfolio requirements, what other programs are there here in this state that you see are going to get us to a cleaner mix?

MURR: Well, one that doesn't get a lot of discussion is something that was also passed in 2006 that requires the -- I guess it's 1368, I might have it wrong.

PFANNENSTIEL: 1368, yeah.

MURR: 1368, that essentially requires the big -- I think, it is all of the electricity suppliers? -- to essentially --

PFANNENSTIEL: Yes.

MURR: -- stop using long-term contracts for coal-based plants. You can have five years or less in relationship with your coal supplier. Anything that's less efficient than natural gas has to go on a short-term

basis. In some parts of the state that doesn't matter that much. I'm from L.A., where L.A. DWP gets 50 percent of its energy from coal plants in Arizona, Utah, and other parts of the Southwest.

I've talked to people who say that there's a tremendous advantage to this and a tremendous effect that it's already having in just two years, not just in California, but in other parts of the West. I guess the State of Washington has passed something fairly similar, so there's a sort of encouragement that is fanning out. So I think that's important.

We were talking about fuels, and I guess there's a 10 percent carbon reduction that's beginning to -- that's in place now that's going to take a while to -- by 2020 I guess we have to reduce the carbon in fuels, in transportation fuels by 10 percent. We haven't seen anything yet, but that will amount -- if that spurs the sort of research and technology that it should, that should be important.

The portfolio standards are interesting, too. I don't think we're going to -- there's a -- in 2002

we decided that by 2017 I think at first we were supposed to get --

PFANNENSTIEL: Oh, that's right. We accelerated it.

MURR: And then we accelerated it so now we're not going to meet the 20 percent renewables by 2010.

Probably not going to meet it. In part because we don't have the means to get the power to the markets. I think I'm right in saying that the utilities have led enough contracts to produce 20 percent renewables, but they're not on-line and in some cases you just couldn't get the power into the cities because the transportation structure is not there.

PFANNENSTIEL: But we will be pretty close.

MURR: You think so?

PFANNENSTIEL: Yeah, I think --

MURR: It's what, 13 now?

PFANNENSTIEL: We're about 11 now, but a lot of these contracts are ready to go, so we're probably not going to make 20 percent by 2010, but it will probably be by 2011, 2012.

MURR: Mm-hm. And I dimly understand there's some sort of 3-year lag time built into the rule.

PFANNENSTIEL: Well, the PUC has the ability to allow some flexibility in terms of when this happens.

MURR: Okay. And then the governor's supporting boosting that to 33 percent by 2020.

PFANNENSTIEL: Exactly. And in fact, I think that in some ways you can almost think about 33 percent as being more attainable by 2020 than the 20 percent by 2010 because as you say the transmission needs to get built to move that to market.

JEFFERSON: All right. I have the real challenging questions. They're yours. Okay. Andy.

MURR: Yes.

JEFFERSON: What would you like to see McCain, Obama, Clinton, whoever, do about energy and technology in the first 100 days?

MURR: That's a good question. Well, I guess get rid of any sort of idea that we should loosen up on the federal gas tax over the summer, [Laughter]

although the 100 days would begin in -- next January, so I guess that danger would be past.

I guess I'm torn between thinking that they ought to act precipitously and so they should not probably commit themselves to too much in the 100 days, but it is I think crucial that the next president show as we've begun to show here, that this is compared to almost anything else the undertaking that that presidency and the next several presidencies are going to have to regard as the more important thing, barring, you know, huge war time catastrophes.

Exactly what he or she does to signal that, I'm not sure. I think the Department of Energy could use a green fire lit under it to move it along, and there are probably lots of ways to reverse the damage that's been done in the last seven years. With all respect to Chevron and everyone, it's clearly a little too petroleum-centric in this Administration, and they need to branch out. They need to show what the -- to show the country that we collectively mean business, and renewables are very important. They're not just something to talk about, that

using oil, natural gas and other petrol-based has to be done in a much more efficient way, both by the consumer and by the companies.

JEFFERSON: Jackalyne, the people ask for specific people here. So, the biggest leverage we have on emissions reduction today is the personal choice to consumer -- to consume less energy. What are we doing to educate the public about this no-cost option that's available to us today?

PFANNENSTIEL: I'd say not enough is what we're doing. We have two programs very active and longstanding programs in California. One is to set standards, actual maximum usage for both buildings and appliances. And once the Energy Commission finds that these appliances and these measures for homes and buildings are cost effective and technologically feasible, we can put them essentially into law. So you can't buy a refrigerator in California that doesn't meet a certain standard and any new building has to meet certain standards. So that's one area. You can do standards. You can do programs that the utilities,

that the investor-owned utilities are doing very actively, and those are a lot of incentives and those are rebates and, you know, trying to convince people to buy the right appliance or do the right thing. And those have been effective. They're expensive, but they're effective.

And then as part of that, but also I think separately from that, there needs to be a real focus on how to give people the information about the fact that different appliances use different amounts of energy or that there are different technologies you can use to accomplish the same thing. Again, the example I use all the time is lighting. People don't understand that the amount of light you get isn't measured in watts. The amount of light you get is measured in lumens. The amount of energy to get those lumens is measured in watts. And you can get just as much light with a whole lot less energy.

That's an information -- that kind of information is true just of a whole mass of different energy usages -- isn't out there very effectively. Most of the communication that we've been doing tends to be

relatively crisis-based. it would be, "Gee, it's a hot afternoon. Turn off your air-conditioner or turn down your air-conditioner." So we need to take some of the information that we're going to have more available to us from this better, more advanced metering, and feed it back to customers to help them more readily see what they can do.

JEFFERSON: Okay. Paul, how much does Chevron invest in technology -- I assume this means new technology. I don't know who asked this -- and what types of advanced technologies are oil and natural gas companies like yours using in developing to find resources? I know you covered some of that.

SIEGELE: Yeah, I guess I was focusing on the alternative energy investments. And just to reiterate, you know, I think our plans are to spend 2.7 billion over the next three years. We spend considerably more than that on conventional research and development. I don't have that handy, but we could certainly get it. It's in the billions of dollars a year. So they would be in things like deep water drilling. They'd be things in

steam flooding, oil shale development, that kind of thing.

So we have a pretty aggressive R&D program and it's targeted to a number of both conventional oil and gas extraction technological challenges as well as alternatives.

JEFFERSON: And they also ask if you would please invest in their -- no, they don't. [Laughter]  
Trae, how will the early money investment business model be adapted to meet the capital volumes in energy and fuel?  
Okay, next question. [Laughs]

VASSALLO: That's kind of a broad question.

JEFFERSON: Yeah.

VASSALLO: I can take a swag at it. I think just like any investment industry, you invest in very early stage companies to seed some technology, vet a technology, vet a new business process. And then there are other investors, later stage growth capital companies, private equity companies that come in. You know, we have a bunch of partners that we've used historically in the biotech and IT side, and we're developing those on the green tech side.

There's been a lot of activity by the Morgan Stanleys, Goldman Sachs of the world. We saw a big gap in the middle, in the growth capital area, and so that's why we started a growth capital fund. And, you know, but it's not that much different than it is in other areas of venture capital.

JEFFERSON: Okay. David, if politics follows markets, how do you think we build new and robust markets for clean energy technology products?

VICTOR: Well, the answer to that I think as good public policy is we use price signals, and we encourage them and we are patient, because the time scales are longer. I think the answer that is good politics is you use mandates and you bury the cost, and you distribute the cost, as we do with renewable portfolio standards and we do with a lot of the mandates in this area. You tell the market to do something, and then you just diffuse the cost so that people don't really know about it. That's what we've done traditionally with our ethanol fuel mandates. That's why we're in the horrific situation we're in right now with traditional ethanol.

And that's -- people have learned that lesson. That's political economy 101. That's what we teach in classes, and it's the way people use the regulatory system for their particular advantage and diffuse the costs across people -- other folks who are not as well-organized.

So I think there's this great tension, and as we try to deal with these huge challenges, this is going to be one of the big tensions is how do you keep the public policy system at least more or less on the right course so that we don't generate massive distortions in the economy by telling, you know, folks exactly what technology to use and burying the costs and so on.

JEFFERSON: I think it's an interesting question. Do some of the other panelists want to jump in on that?

SIEGELE: Well, I would just echo exactly -  
- I'm exactly where David is on this. You know, I think there is a big danger of unintended consequences here, and certainly as we think about AB-32 and the questions earlier about can we do -- can we solve a global problem

in the United States, let alone California, only. There are questions that harken back to how -- what the patchwork solution to clean fuels is today. And all those well-intended state by state and even region by region initiatives that have really hampered now gasoline distribution in this country and have increased the cost particularly in times of short supply.

So I think taking a measured, slow response back to this comment about what should the candidate -- successful candidate do in the first 100 days, probably not a lot. Think a lot and in the scale that David has mentioned in the past --

: Price on carbon, maybe? [Laughs] That would be great.

SIEGELE: Yeah.

: Energy policy passed.

SIEGELE: I mean, a price on carbon is an interesting point, and maybe to the AB-32 issue, right, and to Chevron, for example. You know, a price on carbon and the capital and the cap in trade. The thing that we would support in that is point source cap trade. Where we

differ or the point of departure is in cap in trade for the procedures to pay for the end user fuel consumption. Right? Because it goes to the transparency issue. The cost is buried into the producers now passing on costs to the consumer, and, you know, that's where we get into all these kinds of unintended consequences.

PFANNENSTIEL: You know, I want to go back to the what would I want the new president to say. And this is not original we me. This was in a Tom Friedman column yesterday, I think, which is don't lie to the people. Tell the public the truth about energy costs, that they're high, they're going to stay high, there's a reason they're high, it's not bad that they're high, and in fact figure out, you know, let's start working with what we have in this world.

And that gets really to the point of, well, you know, is that all bad news, is that all negative news.

I think what we need to look at it as is a platform for making changes and making changes in our economy. I think that we have certain things we need as bridges. We're not going to -- it's absolutely correct. We're not going to

be able to move off of fossil fuels tomorrow, but if we think as a society that we should be putting a tax on carbon and starting to change how we do things, well, let's be honest and get out there and talk about how we can do that, not so much the fact that if you hold your breath it will go away. It's not going to.

VASSALLO: I also just wanted to add another point to the question about what candidates should do, or, you know, once we have a new government in office that actually wants to take action on this. You know, the government has not stepped up in a funding perspective to the size of the problem. If you look at both health care and the energy industry, they're I think both about 15 percent of GDP. The NIH spends -- I have the number here somewhere -- about \$28 billion in research a year. The budget last year for renewables was less than \$2 billion. Exxon makes about a billion dollars a day. This is a \$6 trillion market. I mean, you know, private early stage venture capital is spending more than our government is at this point in time, and that's --

: Wow!

VASSALLO: -- that's a big problem.

: You're probably spending it a lot better than the government would, though. [Laughter]

VASSALLO: I don't deny that. But this is back to our research institutions, you know.

: I agree. But, you know, if we're going to do this at scale, and I think what's interesting is that all the viable candidates this fall -- this may not actually be an issue in the fall campaign in a major way because there's not as much daylight as you might expect, given the parties' histories here between the positions.

But if we're going to spend billions of dollars, say \$10 billion a year on new energy technology in various ways at the federal level, we're going to have to get a whole lot smarter at how we actually spend that money because our track record in the Department of Energy, maybe in particular in the Department of Energy, is not terrific, and there are a lot of other models that we can learn about from the NIH --

VASSALLO: Absolutely. Absolutely.

: -- and other areas. And this has the

danger of being just a huge pork fest if we don't get our act together in organizing this properly.

VASSALLO: Yes.

JEFFERSON: Trae, you mentioned the size of the investment. Here's a question that says, "Will the future growth in renewable energy and alternative energy, such as solar, wind, et cetera, be stifled by current and future increases in commodity costs, like steel, copper, and glass?"

VASSALLO: Actually, you know, it's interesting. I mentioned that, you know, we've got a company that -- Bob Fishman is here, you know. And that's something that anyone who's building a large plant right now and he's trying to sell electricity back to the utilities is dealing with. Steel prices I believe have tripled in I think like the last nine months. It's something -- it's absolutely unbelievable. And so, you know, the commodity prices are creating issues, but it's creating issues across the board to all new production.

And so the key is that relative to, you know, a new coal plant, are we advantaged. And so clearly

the commodities market is presenting some issues, but it's also presenting some opportunities, like I mentioned earlier on the recycling side of the world. Recycled aluminum uses 95 percent less energy. There's big value there.

JEFFERSON: That's huge. That's huge.

Here's an interesting one in the spirit of conservation begins at home. Jackalynne, most state cars are not hybrid, those that are bought by the government and issued, especially those that have drivers, I guess driving people around. For example, law enforcement insists on using Crown Victorias or similar. What is the explanation and rationale for this?

PFANNENSTIEL: Oh, I think it's probably cost. I mean, it would cost a lot of money to change out the state fleet. Just as any homeowner has to make that decision about when to buy the new car, I think changing out the state fleet. I believe there either is or has been legislation proposed all the time about changing out the state fleet to put in more efficient cars. I don't know where it's -- whether there's legislation pending

right now.

But I think what has to happen, and certainly -- the car I drive is a state-owned Prius. So the state is buying more efficient cars, and should.

JEFFERSON: Okay.

: I want to see one of those helicopter shots in L.A. where you've got a trooper in a Prius chasing down a guy in a pickup truck. That'll be so California. [Laughter]

JEFFERSON: All right. In two minutes, I'm going to be closing up the questions here, and we have an awful lot of questions here, so I will ask one more. And then for the rest of you who didn't get your questions answered, you're certainly welcome to come up and talk individually to our panelists at the reception. All right. Let me find a really good one. Ah! Okay.

David, you made two very interesting comments. We don't know what is coming next, but we need government policy to help us achieve success. You said both things. How do you see us setting policy that makes sense of what we don't know?

VICTOR: I think the single most important thing you have to do is start with price. As I mentioned already there's been a lot of innovation because of the high energy prices, which is not an active policy of the government, although some of it's a byproduct of some unusual policies. And then the complement to that is carbon price. I think you get those pieces in place -- they're not going to be enough on their own. We're going to need to spend money on a portfolio of crucial technologies, these advanced coal plants and some renewables ideas and so on. We have to come up with better ways to spend that money, so the government doesn't, you know, just burn it.

But all that said, the more that the policy is not anchored in price, the higher the risk that the policy will do perverse things to the economy.

JEFFERSON: Okay. Well, thank you so much to all of our panelists, and before closing I want to hand this off to James Sweeney of the Precourt Institute -- he is the Director -- to say some closing remarks. Thank you for allowing me to bombard you all with irrelevant

questions or relevant questions as they may have been.

Thanks. [Applause]

JAMES L. SWEENEY, PhD: Thank you. I'd like to offer my thanks to Newsweek, to our great moderator, to the panelists. But being an academic, I can't stop at that. I just have to make a couple of summary comments because there's a few themes that I think are really important, and I just want to summarize it so we all go home with them.

I think first we really heard that the issue of energy is not unidimensional. It is about the environment. It is about international security. It is about the economy. And if we think about it as being only one or the other, we're missing the point.

Similarly, what we heard is that energy policy and energy solutions aren't all just technology. We heard that there are human behavior issues and those can be motivated by prices, and I as an economist agree with David we've got to get the prices right. But we also have a lot of evidence that even when you get the prices right, if the consumers don't actually have knowledge

about the relationship between what they can do and what the costs are going to be getting the prices right is not going to be sufficient. It may be necessary, but not sufficient. So we need to be very cognizant of the behavioral dimensions and start getting those right.

We need to start getting policy much better than we have now, and we have to educate at least two presidential candidates. I assume by November they'll only be down to two. I can't be sure of that. [Laughter]

And so it's a multidimensional set of solutions that we have to be dealing with.

And I guess my only final observation is, and one of the things that we've got to all guard against, is picking up on the tiny niches and pretending they're solutions. I go and look at for my own area, the energy efficiency and recognize of the 100 quads of energy we use, 86 of them are oil, gas and coal or fossil fuels. If you can use those 10 percent more efficiently, that's 8 1/2 quads that you don't need, and the cleanest energy is clearly the energy that you don't need in the first place.

But what's that just 10 percent increase in efficiency? Well, if we can -- some people love nuclear energy. We can double the whole nuclear industry in the United States and get 8 quads, which is slightly less than you get from that 10 percent increase in energy efficiency. Or wind and solar, you can increase them by a factor of 25 -- a factor of 25! -- and get about 8 quads, which is about what you can get from energy efficiency.

So if we really think in this short run, we've got to actually pay attention to how we use energy wisely. And that really has to be an essential element of it. So if we talk about the niches, even biofuels, that's a big niche, but if you think about the land constraints in the United States, how much land you can use without diverting our corn crop and our food crops and creating the disaster we're creating now with ethanol, that at most is about a third of the -- excuse me, about 20 percent of the fuels that we use for cars and trucks, which is less than we can get for this 10 percent increase in energy efficiency.

So I think that we've got to sort of work

the numbers and recognize that it's multiple dimensions,  
but we've got to be realistic about where we can get  
solutions in the long run and not jump at niches as if  
they're the big answer. And on that point, I'd like to --  
given that I got my editorial in -- I'd like to thank all  
of you for being here and point out that the final  
opportunity you'll have is for a tour of this remarkable  
building, very energy efficient building, but more than  
energy efficient, wonderful natural light, very  
comfortable to live in. Go to that sign and you'll be  
escorted for a tour of the building. For anybody that  
wants it, you're welcome. So thank you very much.

[Applause]

[END OF RECORDING]