UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF ENERGY POLICY AND SYSTEMS ANALYSIS

QUADRENNIAL ENERGY REVIEW STAKEHOLDER MEETING NO. 4

THE WATER-ENERGY NEXUS

PUBLIC MEETING

DATE: THURSDAY, JUNE 19, 2014

TIME: 9:00 A.M.

LOCATION: SAN FRANCISCO CITY HALL
1 DR. CARLTON B. GOODLETT PLACE
SAN FRANCISCO, CA 94102

REPORTED BY: FREDDIE REPPOND

A P P E A R A N C E S

MEETING FACILITATOR:

Peggy Welsh, Energetics

INTRODUCTIONS:

Jonathan Pershing, Deputy Assistant Secretary and Deputy Director, DOE Office of Energy Policy and Systems Analysis

OPENING REMARKS:

Dr. John Holdren, Assistant to the President for Science and Technology and Director of the White House Office of Science and Technology Policy

Mike Connor, Deputy Secretary of the Interior

PANEL 1: AN INCREASING URGENCY TO ACT ON THE WATER-ENERGY NEXUS

Peter Gleick, President and Co-Founder, Pacific Institute

Rob Oglesby, Executive Director, California Energy Commission

John Andrew, Assistant Deputy Director, Climate Change, California Department of Water Resources

Adnan Mansour, GPM-Monitoring Solutions, GE Water and Process Technologies

Nathan Bracken, Assistant Director and General Counsel, Western States Water Council

Marcus Griswold, PhD, Water Resources Scientist, Natural Resources Defense Council

Catherine J.K. Sandoval, Commissioner, California Public Utilities Commission

PANEL 2: INTEGRATING WATER AND ENERGY OPERATIONS, POLICY AND PLANNING: LESSONS LEARNED AND REMAINING CHALLENGES

Eric Schmitt, Vice Operations, California ISO

Alex Coate, General Manager, East Bay Municipal Utility District

Randal Livingston, Vice President, Power Generation, Pacific Gas & Electric Company

Frank Loge, PhD, Director, Center for Water-Energy Efficiency, University of California at Davis

A P P E A R A N C E S (Cont.)

Randy Howard, Assistant General Manager, Los Angeles Department of Water and Power

Jim Herberg, General Manager, Orange County Sanitation District

Keegan Moyer, Western Electricity Coordinating Council

MEMBERS OF THE PUBLIC:

Peter Wright

Walter Robinson

James Farrow

Judith Iklé

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P R O C E E D I N G S

MS. WELSH: Good morning. Welcome to the fourth Quadrennial Energy Review public meeting here in San Francisco in the beautiful City Hall.

My name's Peggy Welsh. I'm with Energetics. My company is the technical support contractor to the U.S. Department of Energy; and we're honored to have the role of supporting the QER team. I'm going to act as your facilitator today. And I want to welcome all of you in the room and welcome those who are listening in via live streaming.

Couple housekeeping notes before we begin: We're anxious to hear from everywhere who is interested in the QER. So we ask those in the room, if you wish to speak and have not signed in, to do so. Please do that now. And those who are listening in via live streaming, we ask you submit your comments in written form to qercomments@hq.doe.gov.

We've got a stellar group of speakers today; and their presentations will be on the DOE Website shortly after the meeting is over. And that address is www.energy.gov/qer and look for the June 19th public meeting. There you'll find not only the speaker presentations but a background memo setting the stage for this topic, which as we all know is the energy-water system's nexus and issues surrounding that.

So before we also get started, I wanted to just talk about the purpose of this meeting today. And let me just read a short statement to you.

Pursuant to the Federal Advisory Committee Act, the purpose of today's meeting is to ask for your individual input or your organization's input regarding energy-water nexus issues and to provide a forum for exchange of information. To that end, it would be most helpful to us for you to provide these recommendations and information based on your personal experience, your individual advice, information, or facts regarding the topic of energy-water nexus.

The object of this session is not to obtain any group position or consensus. Rather, the Departments of Energy, Interior, and the White House Office of Science and Technology Policy are seeking as many recommendations as possible from all individuals at this meeting.

I want to note that today is a very special day in that we have three federal agencies -- three federal entities, I should say -- co-hosting this meeting.

The Department of Energy serves as the executive secretariat to the QER task force, but it is made up of agencies across the federal government. And we also have the Department of Interior and, as I said, the White House Office of Science and Technology Policy.

So with that, let me turn to Jonathan Pershing, who is the Deputy Assistant Secretary and the Deputy Director of the DOE Office of Energy Policy and Systems Analysis; and he will have the pleasure of introducing our first speakers.

MR. PERSHING: Great. Thank you very much.

And I'd like to thank all of you for coming today. This is one of a series of sessions which we are doing as part of the Quadrennial Energy Review, an effort to solicit input to collect comments. So it's really very helpful, very important as part of the process that we get a good sense of the expertise that's out there in the community and a better understanding of the options and issues that we ought to be addressing as we do our own work.

Today is one of a series of these sessions and the focus today is on the energy-water space. With that particular point in mind, it gives me pleasure to introduce our two lead speakers in the opening session.

Speaking on behalf of the administration and the work that we are doing, one is Dr. John Holdren, who is one of the co-chairs of the Quadrennial Energy

Review. The second is Mark [sic] Connor. He is from the Department of Interior. They'll both be speaking, so let me introduce them both to you at the same time; and then we can hear from them both in their opening remarks.

Dr. Holdren is the Assistant to the President for Science and Technology. He's also director of the White House Office of Science and Technology Policy. He's the co-chair of the President's Council of Advisors on Science and Technology, known as PCAST. Prior to joining the administration, Dr. Holdren was the Teresa and John Heinz Professor of Environmental Policy as well as the director of the Program on Science, Technology, and Public Policy at Harvard University's Kennedy School of Government. He was also a professor in Harvard's Department of Earth and Planetary Sciences and director of the independent nonprofit Woods Hole Research Center. He's been on the faculty at the University of California in Berkeley, where he co-founded in 1973 and led until 1996 the interdisciplinary graduate-degree program in energy and resources.

During the Clinton administration Dr. Holdren served as a member of PCAST, the President's council, and in that capacity chaired studies requested by President Clinton on nuclear materials, weapons, plutonium, prospects for fusion energy, R&D strategy in the energy sector, as well as international cooperation on energy.

He holds advanced degrees in aerospace engineering and theoretical plasma physics from MIT and from Stanford. He is a member of the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences, as well as a foreign member of the Royal Society of London and the former president of the American Association for the Advancement of Science.

Clearly, he'll bring a great deal of substantive expertise, but he also serves critically in this context as the co-chair of the Quadrennial Energy Review interagency effort.

Mr. Michael Connor, sitting to my right, is the Deputy Secretary at the Department of Interior. He's served there since nominated in July of 2013; and he was confirmed without opposition in February of 2014. For those of you who follow these things, it's really a substantial achievement. As Deputy Secretary, Mr. Connor is the second-highest-ranking official at the Interior Department. He has statutory responsibilities as the chief officer of an agency with more than 70,000 employees and an annual budget of about $12 billion.

The Deputy Secretary is a key leader in implementing the administration's priorities for the department, including water policy and relations in the face of an unprecedented Western drought that all of you are quite familiar with. He also serves as the head of the department's land buy-back program, the land consolidation of the Cobell Settlement.

Mr. Connor has got more than two decades of experience in the public sector. He served as the Commissioner of the Bureau of Reclamation from 2009 through 2014. During that capacity he led efforts to promote the sustainable use of water to address current and future challenges associated with water supply and power generation in the American West. As a Commissioner, he forged major Indian water rights settlements and worked to resolve water conflicts in California, in New Mexico, in Oregon, and in other Western states. He's led the Department of Interior's efforts on two major bi-national agreements with Mexico on the Colorado River that have received international attention. And he's also directed the Reclamation's efforts to expand hydropower generation at existing facilities.

Until his confirmation as Reclamation Commissioner, Mr. Connor served as counsel to the U.S.

Senate Energy and Natural Resources Committee, where he helped enact significant legislation addressing both the Bureau of Reclamation and the U.S. Geological Survey as well as Native American issues that were within the Energy Committee's jurisdiction. He also previously served in the Department of Interior from 1993 to 2001 in the Solicitor's Office and then as the Director of Secretary's Indian Water Rights Office.

He holds a JD from the University of Colorado Law School and has been admitted to the bars in Colorado and New Mexico and is a native of New Mexico, also holding a degree in chemical engineering. So he brings the science and the policy together.

So with that introduction, let me first turn to Dr. Holdren, who will give us some opening remarks and frame some of the issues before us. Dr. Holdren.

DR. HOLDREN: Well, thank you, Jonathan, for that kind introduction. Let me add my welcome to this fourth regional stakeholder meeting for the Quadrennial Energy Review. And let me convey greetings from President Obama to this group. He is following this QER process very closely.

President Obama's energy vision is one where affordable, clean, and secure energy contributes to multiple national goals. One, of course, is economic growth, competitiveness, and job creation. Another is protecting our environment and, most challenging, protecting the global climate. And yet another is contributing to ensuring U.S. national and homeland security.

Achieving that vision and those goals, of course, requires a comprehensive and integrated energy strategy. And that integration goes well beyond energy per se. The President understands and his vision and strategy for energy reflects the understanding that energy is closely linked with a variety of other technological issues; a variety of other environmental issues; and, again, particularly closely with the overwhelming challenge of managing and coping with global climate change. In fact, the decision to understand a Quadrennial Energy Review, which was initially recommended in the first term by the President's Council of Advisors on Science and Technology, the ultimate decision to press ahead with that was part of the formulation of the President's climate action plan which he rolled out just a little less than a year ago, on June 25th, 2013.

The Quadrennial Energy Review process, as has already been briefly suggested, is built on three pillars. One is strong analysis led by the Secretary in the Department of Energy with contributions and interactions among the many other federal agencies that also have stakes and responsibilities in the energy domain; and involving as well active engagement of external stakeholders, which, of course, is what this series of meetings -- and this is the fourth -- is all about. We in the QER central operation learn a lot from these interactions. I expect to learn a lot today.

The focus for the Quadrennial Energy Review in its first year is the nation's infrastructure for transporting, transmitting, and delivering energy. And I stress that "quadrennial" does not mean that nothing happens until four years, when we issue a report. There is a moving-spotlight approach to the QER in which the spotlight for this first year is on these infrastructure issues.

It is, I think, particularly telling that relatively few members of the public and, indeed, relatively few of our policy-makers really understand the extensiveness of the energy infrastructure on which our country depends. They don't generally understand the expensiveness, how costly this energy infrastructure is. They don't understand that, in part as a result of the very large capital investment in this infrastructure and the characteristics of the technology, it turns over very slowly so that, if you want the energy infrastructure 30 or 40 years from now to look very different from the energy infrastructure today, you better start changing it now, because these capital investments ordinarily only turn over with a characteristic time of 30 or 40 years.

And very few people understand how interdependent the energy infrastructure is with other elements of our infrastructure -- for example, the transportation infrastructure, the communications infrastructure, the electricity infrastructure, and so on.

One of the most important of those interdependencies is the one between energy and water. And that is a subject that is going to be the main focus of the presentations and discussions at this meeting. I think there are four major aspects of this intersection that make it particularly challenging and make this a particularly opportune time to look at it. We have come to call this the energy-water nexus -- and that is a term I think you will hear repeatedly in today's conversations.

And the first of those developments is that global climate change is affecting patterns of temperature, patterns of precipitation, snowpack, evaporation from soil and surface water. And those factors together are influencing -- and mostly for the worst -- water availability in California and in much of the rest of the American West.

Secondly, U.S. population growth and regional migration trends are telling us that the population in the West, including particularly the Southwest, is going to continue to increase, which further complicates the management of energy and water systems and their intersections. Many of you may have read in the paper just the other day that there is a threat of reductions in water supply to cities in Arizona if upstream users in the Colorado River Basin are not able to considerably reduce their demands in this particularly demanding year.

A third factor is the introduction of new technologies, both in the energy space and in the water space, are shifting demands and patterns of supply and transport of both sets of commodities, the energy commodities and the water.

And, finally, developments in policies addressing water rights and the water impacts of energy production are posing additional challenges, but of course also some opportunities for policy-making.

An overarching issue that adds to the

complexity of this whole domain is how diverse the array of decision-makers is that have to deal with it. State planners, electric utilities, power-plant operators, environmental regulators, regional water-resource managers, water utilities, refineries, oil and gas producers are among the constituencies that play important roles in this domain. And while those diverse stakeholders often act independently and sometimes have goals that are in competition or intention, the impacts of the individual decisions they make are all intertwined.

So this is a big challenge. And given this extraordinarily complex and extraordinarily coupled system, it is, I think, particularly important that we take a clear look at where the most urgent questions in the water-energy nexus are. That will be the general subject of the first panel today. The second panel will take a hard look at what has been learned in recent years about the opportunities and the remaining challenges of integrating operations of our energy systems with our water systems and vice versa.

And I should add that these questions are also the focus of a report issued just yesterday by the water-energy-tech team at the U.S. Department Of Energy. It's called "The Water Energy Nexus: Challenges and

Opportunities." It is available on the DOE Website at www.energy.gov/water-energy-tech-team.

But now we're going to have the opportunity to learn firsthand from a variety of distinguished experts on these topics. And I'm pleased indeed to have the opportunity to listen to them, to interact with them, to learn from them.

And, with that, let me turn to my colleague, Deputy Secretary of the Interior Mike Connor, who, as Jonathan Pershing's introduction has already made clear, brings tremendous expertise and background to this topic, particularly from his time as Commissioner of Reclamation in the Department of Interior and from his service prior to that with the Senate Energy and Natural Resources Committees.

So, Mike, the floor is yours.

DEPUTY SECRETARY CONNOR: Thank you, Dr. Holdren.

I appreciate the opportunity to be here with all of you today and make use of this dialogue that we're having as part of the Quadrennial Energy Review. I appreciate the very generous introduction by Jonathan. I was struck in two ways as he was going through the bios, that, one, given Dr. Holdren's biography, I should just say, "Me, too," to whatever he said. And, secondly, I hope I'm not judged by how well I've resolved water conflicts in California, because hopefully we'll get there, but we're obviously not there yet with all the water issues exacerbated by this drought going on this year.

This is an incredibly important topic. And I appreciate the leadership from the White House and the Department of Energy in this Quadrennial Energy Review process and its recognition, of course, of the importance of energy and water issues and how they are linked.

I had the opportunity to participate May 27th in the dialogue in New Orleans on the transmission, distribution, and storage of petroleum products. And even in that capacity, water issues came up. And so part of this review, I think, getting this foundational assessment of how energy and water issues are linked, is important overall to the review. And particularly, teeing off of one of Dr. Holdren's comments, we need to be planning now and understanding all the linkages now in order to meet the challenges, the changing market demands of energy resources in this country.

And from that standpoint, the Department of the Interior very much agrees that our energy services are key to improving our economic productivity, of enhancing quality of life; to our overall security issues; and, of course, how we deal with our energy services now and in the future. Those needs are also key to protecting our environment and addressing the challenges posed by climate change. And we know the high-risk that exists to both water supplies in particular; but how that can impact our energy infrastructure and energy services, given the third national climate assessment that came out, I believe, last month in identifying the number of challenges and impacts that we're already experiencing and that will be exacerbated by climate change.

So, as Dr. Holdren mentioned, the DOE report that just came out talks about the water-energy nexus and the challenges that exist. But also the title itself is "Challenges and Opportunities."

And there are opportunities. There are opportunities for policy-making. There are necessities, at least, with respect to policy-making. And I want to talk a little bit about where Interior has been in trying to address the energy-and-water nexus and how it really goes across all of our programs that exist at Interior. And from that standpoint, I think we've been active. I think we've been engaged, but I recognize that there is much more to do in this area.

First of all, back in 2010 Secretary Salazar convened a number of us in his water-and-science-leadership team and asked that we put together a program to address certainly the need for increased water conservation, given the challenges we face, but also to address the interaction of energy and water issues. So that ultimately resulted in Secretarial Order 3297 in 2010 under Secretary Salazar's signature that recognized the linkage between energy and water and instituted a number of programs to address that and also directed us to integrate policies associated with energy and water as much as possible.

The outgrowth of that Secretarial Order was the creation of the WaterSmart program within Interior, which has a number of different aspects to it. One -- a couple that I want to talk about.

First, the water-and-energy efficiency grant program that exists. This is a program where we've invested well over -- in the last five years -- well over a hundred million dollars to leverage significant local and state resources to implement water conservation projects. And the change that we've had -- this has been a program that was in existence prior to the Obama administration coming in. But we have modified the program to incentivize the integration of either energy conservation or renewable energy-generation projects in association with these water-conservation projects.

Last week we just announced our awards under the 2014 program. Overall there's, I think, 36 projects that we're funding about $18 million. That's going to increase water conservation by 67,000-acre feet on an average annual basis. Also, we've got, I think, 6.1 megawatts of new generating capacity based on the integration of renewable energy projects associated with those water projects -- typically, improved piping systems, taking out earthen canals, eliminating seepage and waste where it makes sense for local entities, and making use of the drops that exist in those water-delivery systems to put small hydropower units on that -- on those systems.

Overall, over the past five years, we have now, with the announcement of the 2014 grant program, facilitated and created an additional 800,000-acre-feet of water supply across the West through these water-conservation initiatives.

We've also -- I think you can see the escalating aspect of the renewable-energy immigration. In the prior four years I think we had had 6.1 megawatts of new generating capacity. We added 6.1 just this last year. So 12 megawatts of new generating capacity just through this grant program associated with water-conservation projects.

And, of course, as part of that we also asked grant applicants to identify the energy savings associated with these water-conservation projects. And a great part of that happens here in California, where localized supplies are used in Southern California, which reduces their reliance on the Bay Delta and the pumping associated with bringing water over the mountains from this region down to Southern California. So it's a good program. It's growing in its scope. It's got a lot of support on the ground. Who can argue with increasing water-supply reliability and reducing energy costs in association with carrying out water-delivery activities?

A corollary is the basin-studies programs. And part of, I think, what's key to this Quadrennial Energy Review is the planning and the assessments that are ongoing. And, certainly, our basin-studies program at the Interior is consistent with that. It looks for cost-share partners in individual river basins to want to engage in a detailed analysis, long-term, of water-supply-and-demand imbalances and to start to identify adaptation strategies to address that imbalance and also to assess the impact on our energy infrastructure in association with those basin studies. An example is -- and probably the largest one that we have had -- is the Colorado River Basin study. Seven basin states and a number of local entities as well as NGOs participated in the development of that study.

Certainly there's strong concerns as you look out over time over the next 50 years. We've got a projected 3-million-acre-feet imbalance between supply and demand. That has implications, obviously, for a lot of existing uses that are dependent on water supply. It also has projected impacts to our overall ability to generate hydroelectric power on our facilities on the Colorado River. And as an example of how that planning and that basin analysis is being used two-fold, it's being used to address the water-resource needs that we've identified and we are engaging now with states in a very active planning effort for a drought-contingency plan.

We have worked with seven basin states through a number of agreements over the last decade to produce about a million acre-feet of water of additional supply that we've stored in Lake Mead. That's worth about ten feet of elevation. Notwithstanding that action, we see ourselves with declining reservoirs in a situation where by 2016 there's a 23-percent chance that we will experience the first-ever water shortages in the lower Colorado River Basin. In the upper basin we're concerned about the elevation of Lake Powell, because if we fall below elevation 3490 in Lake Powell we cease to be able to generate hydropower at that facility. So these are really serious concerns that we're trying to address through our WaterSmart program.

We've also got an MOU in 2010 that we're actively working on with Department of Energy and the Corps of Engineers related to our sustainable hydro program. We're trying to increase hydropower-generating capacity at existing units, implement an array of small hydropower programs, and also better optimize the use of our hydropower-generating capacity. All told -- and as an aspect after the basin study, part of this analysis, also, we are retrofitting our turbines at Hoover Dam and other facilities so that they can generate the same level of hydropower at lower head levels, given the declining levels of our reservoirs. So the low-head turbine projects that we are implementing across the West, our overall goal was to generate the same amount of energy with less water because that's what we see in our future.

All told, that program has resulted in over a hundred megawatts of new generating capacity at our existing facilities. And we look to expand upon that in the future.

Couple of other items, just briefly: Assessing and understanding and getting better data is obviously part of what we need to do to better address the energy-water nexus. USGS have been very active. It has a partnership with the Energy Information Administration at Department of Energy to better assess and understand the consumption of water at thermoelectric power plants. We all know that it's been the largest diverter of water -- even though it's not the largest consumer of water, those power plants -- but we want to better understand the nature of that water consumption associated with those plants and how that changes over time. Through the national water census, USGS will facilitate a better database on water uses, which will help in energy planning overall. It is assessing produced water in the Powder River Basin in Wyoming and produce water from coal-bed methane extraction and development to understand whether that produced water can be treated and used for beneficial purposes.

And, finally, I would just mention, beyond what I think it pretty evident about this energy-water nexus we have in our unconventional-oil-and-gas development, a large focus of the Interior Department has been on the new technologies associated with hydrologic fracturing. We have a regulatory initiative ongoing right now that we hope to complete by the end of this summer with new regulations for hydraulic fracturing. I would just note that the focus of that has been well-bore integrity, water management for flow-back water, and chemical-disclosure aspects. And we think those in particular are areas that we need to focus on to continue to demonstrate safe and responsible energy development to build the public confidence and to ultimately protect our water systems because I think that is a source of concern from a lot of communities. And so I think we're in sync with a lot of the states in that area. And that is something that we look forward to finalizing over the next couple months.

So that's just an example of the programs ongoing at the Interior Department. I'm sure there are more opportunities. And that's the basis for why I wanted to be here today to participate in this effort to learn from all of you and be part of the dialogue. And so from that standpoint, I look forward to listening and stop talking. That's the end point.

MS. WELSH: Thank you very much.

I'm going to let this panel go on for just a minute, because we're anxious to hear from you. There should be a microphone in the back of the room. We'll take a couple questions. Please identify yourself if you have a question for either of these two VIP speakers. Don't be shy.

Do you mind going to the mic? Thanks.

MR. WRIGHT: I have a question, mostly for Mike. I'm not sure this is on --

MS. WELSH: Can you identify yourself, please.

MR. WRIGHT: Yes. My name is Paul Wright. I'm the director of the Berkeley Energy and Climate Institute at the campus. I'm also a mechanical-engineering professor.

The campus-wide concern, of course -- and I fully resonate with the data you're collecting on the use of the water in the hydraulic fracturing. I'm actually, as a mechanical-engineering professor, very confident about the importance of this technology is the shale revolution that we cannot ignore. But I want to get as much data as I can as quickly as possible to do the same thing that you want to do, which is assure my public, my rebellious students on the campus. And even though I'm speaking in a very calm and pleasant way, I get a lot of unpleasant attacks on campus. And I think it's worth sharing that. And I'd like to see that data collected as fast as possible and encourage us to do many scientific projects that address that head-on and get the information out to the public as quickly as possible.

And my last comment, I think we all know, is that since geological formation is so incredibly varied, not only in the U.S. but all through the world, this is not something you can solve necessarily in a comprehensive way unless you look at every single geological formation and the impact it has.

So there's several parts to my question. And I guess I'm urging fast collection of data specific to geological regions and getting the information out as quickly as possible.

I'm talking a bit too much now, so I will hand it back to our distinguished panel. Thank you.

DR. HOLDREN: Let me jump in even ahead of Mike to mention that, number one, the Obama administration shares the very strong interest in making sure that hydro-fracturing is done in ways that protect surface water and groundwater and that very much limit the fugitive emissions of methane to the atmosphere, which are an important driver of global climate change. We released some weeks ago now, maybe a couple of months ago now, a national methane strategy which entails a number of components that address --

It is on the -- it is on the Web. You can find it on White House Website, www.whitehouse.gov. You search on "methane" and you'll find that very quickly.

In addition, there is an interagency task force hard at work on the wider questions of hydro-fracturing and looking at questions of data collection and what the most appropriate approaches to monitoring and regulation are. So this is an issue whose importance we very much recognize.

DEPUTY SECRETARY CONNOR: Absolutely. Just to -- obviously, the Interior Department is part of that effort and we're working hand and hand with the White House as well as Department of Energy and EPA, because we agree. Good data and information is the key to making good decisions as well as to build public trust for a lot of the things going on. We fully believe that communities in the areas of significant energy development, they value that economic opportunity; but they want to know that it's being done safely and responsibly and that their communities are protected. And so that's our goal to help achieve that good information and then good policies through our regulatory process.

MS. WELSH: One more question?

Well, please join me in thanking our very distinguished and honorable speakers.

(Applause)

MS. WELSH: So I'll ask the next panel to come up. Dr. Holdren has very kindly agreed to stay on and participate in the panel. Undersecretary Connor will be in the audience. So go whisper in his ear, if you like.

And for those who are watching live streaming, just give us a moment to set up the stage.

Thank you.

MS. WELSH: Thank you very much for bearing with us as we change out the tent cards, et cetera. Let me also point out that the live streaming bandwidth is having some issues. So for those of you that are watching live streaming, you will need to refresh on a regular basis. So, if you will, please do that so that you don't lose us as we begin this excellent panel.

I want to remind the panelists that you have five to seven minutes. I'll hold up this stop sign. So something my way when you think you're going a little long and I will interrupt if you go too long.

I want to also say that we have a tremendous group of panelists today. But their views that they are going to express are their own. They are not those of the Departments of Energy, Interior, or the White House.

So let's introduce them. I'm not going to read the bios, as Deputy Assistant Secretary Pershing did. I will just introduce them by name, title, and affiliation.

Next to me, of course, remains Dr. Holdren, who has kindly agreed to participate in the panel asking you throughout the morning. Next to him is Peter Gleick, president and cofounder of the Pacific Institute. Ron Oglesby, executive director of the California Energy Commission. John Andrew, deputy director for climate change for the California Department of Water Resources. Adnan Mansour, Monitoring Solutions for GE Water and Process Technologies. Nathan Bracken, assistant director and general counsel of the Western States Water Council. Marcus Griswold, water resources scientist at the National Resources Defense Council. And the Honorable Catherine Sandoval, California Public Utility Commission Commissioner.

So with that, let me turn it over to Dr. Holdren to say a couple of words; and then we'll get started on prepared statements.

DR. HOLDREN: Well, I had my say a moment ago. I just want to take the opportunity to introduce two of my colleagues who are with me at this meeting. Dr. Bob Simon, who is senior advisor for environment and energy at OSTP and the President's nominee to be the associate director for environment and energy, is standing in the back.

And Kristin Lee. Kristin, if you would stand. Kristin Lee is the director of strategic communications at the White House Office of Science and Technology Policy. So you may want to take the opportunity to quiz them during the breaks.

MS. WELSH: And, with that, let me say that we will hear from all the speakers, so please hold your applause until all speakers have made their presentations, some of whom have PowerPoint slides; so we'll be sliding around up here so that those live-streaming and those in the room can see.

But with that, Mr. Gleick, the floor is yours.

DR. GLEICK: Good morning, everyone. I'm Peter Gleick from the Pacific Institute in Oakland. I'm happy to be here. A Quadrennial Energy Review is a good thing. Once every 400 years is certainly not too much for a country like ours.

I'm going to talk about water and energy and climate and security. But before I start, a little teaching moment here: We are in California, in San

Francisco. We have some of the best tap-water supply in the world, mostly gravity-fed. We did an assessment at the Pacific Institute a couple of years ago of the energy required to produce bottled water in the United States. It's the equivalent of about 17 million barrels of oil a year for primarily the plastics, but distribution, transportation, processing. So here's another piece of the energy-water nexus, if you will.

I'm going to talk about energy and water. I'm going to talk about climate and security and the integration of these things into policy and then a little bit about emerging issues in five to seven minutes, so --

MS. WELSH: Can I interrupt you for just a second?

DR. GLEICK: My time is up. Thank you very much.

MS. WELSH: Can the panelists kind of scoot around so that people can see the screen? That's why we got chairs on rollers. Awkward as it may be, we want you all to see the PowerPoint slides.

DR. GLEICK: That doesn't come out of my time, does it?

MS. WELSH: No, it does not.

DR. GLEICK: Okay. So I'm going to start at the end so that when I run out of time you'll have heard it.

Water and energy are closely linked. Limits to each are beginning to affect the other; and yet we rarely integrate these things in policy together. The drought is a great example in California, where it is a very severe drought. We're going to lose hydro generation this year. We're going to see an increase in energy costs for pumping of groundwater in the Central Valley. Another quick example for you.

Considering those two issues together offer substantial benefits; and other speakers will speak about that. But there are economic benefits; there are environmental benefits. The reality of climate change affects policies on the energy side, on the water side, both of the above. And there are growing risks over conflicts worldwide over water resources and energy resources as well.

The energy-water nexus used to mean one thing. It used to mean the water requirements for energy systems. And a lot of work has been done on that. We did a lot of work early on at the institute about this. Water is required as inputs to each piece of the fuel cycle for energy systems from extraction all the way to waste disposal. But I would note that an equally important piece of this is that there's an enormous energy demand for our water systems -- for source and conveyance; for treatment; for distribution; for end-use of water in particular; for wastewater treatment.

Again, the Pacific Institute has done a lot of work on this. The Energy Commission in California has done a lot of work on this to try and understand this piece of the energy-water nexus. And we've seen already in the past headlines where water constraints have limited our energy production, primarily not because of shortage of water but more for formal constraints for protecting ecosystems, have shut down or de-rated power plants in the Tennessee Valley Authority area and other parts as well. But there are other connections we have to think about as well.

And here's another example. The Pacific Institute did a study a couple of years ago looking at energy scenarios in the Intermountain West. And this is a complicated slide, but I just want you to see a couple of things. The first is the difference between the light blue and the dark blue is the difference between withdrawals of water and consumptive use of water. And there's a distinction. But energy is a big demand on our water systems, both withdrawals and consumption. And the bar on the far left is, for 2010, the total water requirement for the energy system in the Intermountain West system of the U.S. Withdrawals and consumption. The next bar over is a projection for 2025; and it shows a slight increase if we go business as usual, increasing demand for water.

The thing to understand is we looked at different scenarios for cooling systems and for swapping out more renewables rather than fossil-fuel systems; and the implications are that the choices we make about energy have enormous implications for water. I don't know which scenario we're going to go to, a low-fossil-fuel, high-renewable scenario, a once-through cooling versus dry-cooling systems; but the choices we make about energy have big implications for total water demand. And that's a key conclusion as well.

In addition, the amount of energy required for our water choices varies. These are bar charts -- hard to read in the back -- but these are bar charts for different water options for Southern California. The biggest bar is ocean-water desalination. Very energy-intensive. The second biggest bar is the energy to run the State Water Project to move water from Northern California to Southern California. The biggest single consumer of power in the State of California when the pumps are running are the pumps that move water over the Tehachapi Mountains into the Los Angeles Basin. If you save a gallon of water in Los Angeles and you save a gallon of water in San Francisco, you're saving more energy if you're doing it in Los Angeles. And so our choices about water supply have energy implications.

Groundwater pumping is there. Energy use for reclaimed wastewater is very low. Brackish water, desalination is low. Different choices have different energy implications.

There's a climate link. All of these energy water issues have a link with the emissions of the greenhouse gases and our choices about energy and water options affect greenhouse-gas emissions. It's pretty clear that some climate change, perhaps significant climate change, is already unavoidable; and the truth is we're already seeing evidence of climate change. And we are seeing the impacts, the influence of climate change on water systems in the United States and on drought in the Western U.S. We have to move to avoid those consequences we can't manage and we have to learn to manage the impacts that we're not going to be able to avoid for both water and energy.

And there are policy implications. Water and energy are tightly linked. The links are increasingly better understood but not perfectly understood and they're rarely interested in policy. Decision-makers and corporations and local agencies and communities have to integrate energy issues into water policy and water issues into energy policy. And our failure to do that is inevitably going to lead to disruptions in both water and to energy.

Some comments about water and fracking. Again, the institute did a report on the water risks of fracking; and we're doing two more now, one for BLM and one for the State of California, to try and understand for California what are the water risks of hydraulic fracturing and, more broadly, oil and gas extraction. The science says water and fracking don't mix. The truth is they do mix; and that's the problem. And figuring out if we're going to pursue hydraulic fracturing or other enhanced oil and gas production, we better do it in a way that protects our water resources, minimizes demand on water, protects groundwater from reinjection. There are a whole series of water-related risks that are not adequately understood or addressed in policy.

And it's more than science, this issue. This issue is a national security question. There's a lot of debate about fracking. Some people think, look, this oil and gas revolution, the shale revolution as it was just described, is an important thing because we don't want to import energy from the Middle East. That affects our international policy. That's part of the debate. I'm not weighing in on it. I'm raising it as an important part of the policy debate; and it's linked to this question of oil and energy and water and policy.

Last couple of slides. Definitions of security vary. National security means a lot of things to a lot of different people. I would say the definitions are varying and growing. And we do a lot of work on conflicts over water internationally. There is a growing risk of disputes and violence over water resources internationally. Those conflicts have taken many different goals -- many different forms. Water is a goal. I want your water. That's a tension in many parts of the world where water is scarce. But water's been used as a weapon. It's been used as a target. It's been used in development disputes. There's a connection between water and terrorism. And the risks of these disputes are growing, including disputes over what we call peak water. That is absolute limits on water availability and -- I'm pretty close to the end.

And these water-related factors are going to have direct and indirect impacts on security and conflict.

I'm just show this slide quickly to show that we maintain a history of water-related conflicts world wide. Those conflicts are growing, not shrinking in number; and increasingly are subnational not international.

So some recommendations. There are strong and growing links between water and energy and climate and security. We rarely consider those integrated policies together to address those links. The failure to address those links is going to lead to inappropriate decisions or actions and unnecessary risks. And, conversely, smart policies can be very effective and very efficient. And choices now have to consider water, availability and quality, I would note.

Water-efficiency efforts offer substantial water and energy savings. And Deputy Secretary Connor mentioned this: Some of the cheapest energy improvements now are water-efficiency improvements, not energy-efficiency improvements. Water-efficiency improvements that save energy. Water-energy strategies integrated together can lead to fast and cost-effective greenhouse-gas-emissions reductions.

This is my contact information. A lot of our publications are on our Website. And I'm happy to stick around for a discussion afterwards. Sorry.

MS. WELSH: So I hate to cut Mr. Gleick off, but we've got a lot of other speakers. I want to note that all speakers' full presentations will be on the Website. That address again is www.energy.gov/qer, with this meeting's date.

So thank you very much. I hated to cut you off. Very fascinating.

Mr. Oglesby.

MR. OGLESBY: Thank you.

So I'm Rob Oglesby. I'm the executive director for the California Energy Commission.

First, I want to thank the opportunity to be here and present our thoughts on water and energy. This is a great process and we're happy to be here.

I would also mention that we presented lengthier comments in writing and I'm just going to hit a few of the highlights. But I also included a series of links to various reports and documents that I hope will help inform the process and provide some background that you might find useful. I'll be mentioning a few here, but there are various links in --

MS. WELSH: We'll make sure the right staff see those.

MR. OGLESBY: Great. Fantastic.

Peter's opening comments are a very good setting. He covered some of the topics I wanted to get to. I will adapt to that.

But one of the challenges in dealing with water energy is the fact that we've basically created government infrastructure in silos that deal with water and energy and climate to a certain degree and making progress in understanding the issues. And developing public policies requires bridging those silos. So in California I just wanted to open by mentioning that we're attempting to do that; and I think we've done it pretty well by creating some institutions, some activities that attempt to recognize the link between climate, water, and energy and get this cross-communication among policymakers and different governmental jurisdictions.

And some of those include an organization with the unfortunate acronym of WET-CAT. And it was formed under the auspices of our major overarching climate legislation, AB 32. And it's essentially the water-energy team of the climate-action team. And it's been meeting regularly to develop policies, share information, and provide input on the scoping plan, which is kind of the blueprint for our climate reduction goals here.

It's also -- another mechanism that's been created under the Brown administration is the energy principles. That's where the heads of the agencies responsible for energy and climate and water meet monthly to coordinate on policy and share information on development. And that's been a very effective tool to make sure that we are on track and basically on the same page as we pursue our climate and energy and water goals.

And, finally, the -- we mentioned the drought. It's a very deep drought, a very serious drought. And there's been an ad hoc drought task force of all the major state agencies that have a hand in it and that are meeting weekly and broken into subcommittees to coordinate policies.

So I think one of the first messages I'd like to leave with this is that it's important to be able to have cross-connecting structures as we tackle water energy and climate nexus.

Very quickly, on some of the other elements, we talk about the collaboration of these agencies. Those have led to the scoping plan. Again, these are referenced AB 32. We've done a series of climate assessments, about to embark on another one.

Safeguarding California Plan, which deals primarily with adaptation as well as various things related to tracking what's going on with water and energy related to the drought. There's a Web page set up for that.

You mentioned the connection between water and energy. I think it's important to note there are a lot of different statistics that get thrown around about how much energy is related to water. It basically relates to the assumptions and what's included or not included. At the Energy Commission we refer to it as 19 percent of electricity embedded in water. That includes wastewater treatment. It's a fairly comprehensive inclusion of just the energy use. We don't net out energy generation.

And as you noted in your presentation, it is very variable throughout the state. Clearly, a great deal more energy is embedded in water in the southern part of the state than the northern part of the state, as you noted.

In terms of direct generation from water in California, it's gone down as a percentage of the energy use. It used to be about 60 percent in-state generation of hydro feeding into our grid. It's now down from -- this isn't a normal year, so perhaps I should qualify that and call it the old normal. It seems like we're headed for a new normal. But historically it's been around 14 percent in recent years, down from 60 percent. This year, of course, will be much, much less. But we also import hydro generation from over the border. And so our total hydro profile in average years in recent history has been about 25 percent.

Water is clearly a precious commodity and limited. And so we do a number of things to try and reduce our need for water and to recognize that. One of the things we do -- and the Energy Commission is also responsible for siting power plants -- is take water use into consideration. And so we look at reuse, wastewater, recycled water. And then the state has a policy that phases out once-through cooling statewide -- and that is on schedule -- primarily ocean water impacts, but it also drives once-through cooling policy elsewhere. It's the statewide rule.

And, again, one of the other things that is a dramatic impact on our need for water in our power grid is the advancement of renewables that are not water-intensive. We have great growth in solar and wind. We have state policies that mandate renewable energy to 23 percent in 2020. We're at about 20 percent right now. And, by the way, that doesn't include large hydro, so we're on track to do that.

Another rule of the California Energy

Commission is to adopt energy-efficiency standards. We have authority over buildings and appliances. And through that authority that we've exercised since the middle '70s, we're reduced water consumption substantially. Our per capita water use is reduced by about 19 percent.

In appliances we have water-efficiency standards over ten types of fixtures -- faucets, showers, urinals, toilets, and so forth and -- since 1977. And we've reduced water use by 39-million-acre feet. The cumulative minimum efficiency standards that we've adopted now result in 2.1 million acre feet of less water used per year for the state. That's like having two Lake Folsoms or it would be the equivalent to having every year the city and county of San Francisco under 65 feet of water. So it's been a great cumulative benefit in the state in commensurate energy use and conserving resources. The Energy Commission has a rule-making under way to increase that by about a quarter million acre-feet, adding some additional time.

Let me just close by noting that one of the remaining areas that helps advance water-energy policy is the research that we invest in. We have invested $12.8 million in the last eight years on water supply and conveyance, water and wastewater treatment, energy from wastewater, energy recovery from wastewater, and water end-use efficiences.

So with that, I'll conclude my remarks. And thank you again.

MS. WELSH: Thank you.

Mr. Andrew.

MR. ANDREW: Thank you very much. I am John Andrew. I am actually the assistant deputy director of the California Department of Water Resources. So thanks for the promotion, but I think I'll pass on it this morning. Maybe some day. I oversee all of the department's climate-change activities; and, again, appreciate the invitation to have our department on the panel this morning to engage on this conversation.

In my five to seven minutes of fame here I'm going to hit very quickly on probably three or four things. I'll talk a bit about what our department does and its role in the water-energy operations planning and policy. Talk a bit about -- sort of link with Rob's presentation on strategic planning at the state level, which is something that we do. And I'll close on some challenges and opportunities that may be fodder for discussion later.

Our department does provide a number of service -- water-management services -- to the state of

California. We have a -- we're over $3 billion in annual budget and well over 3,000 employees now. A couple of those activities relate directly to water and energy.

One is that we are the owners and operators of the State Water Project, which Peter mentioned in his presentation. We were No. 2 in the blue -- heights of the blue on the chart there. I think we used to be No. 1, but fortunately, desal has shown up to out-do us. The local NPR affiliate actually once said that there was -- 50 percent of the energy in California was used to pump water over the Tehachapi Mountains. It's certainly a big number, but it's nowhere near -- orders of magnitude lower than what was reported in that story.

The State Water Project, for those of you who may not know, conveys water from Northern California to the San Francisco Bay Area, to the southern San Joaquin Valley, Central Coast, and then over the mountains into the South Coast Basin.

One of the other things that we do is the -- and I'd be happy to talk more about the energy and climate implications of the project, but maybe we can get to that in the discussion -- because one of the other things that we do is that we also are statutorily required to develop the state's water plan -- strategic plan for water, which is called the California Water Plan Update. We've been updating it -- the original California Water Plan was issued in 1957; and we've been updating that roughly every five years, usually a bit late every time that it's due. And it sets out the vision, if you will -- high-level vision -- of water in California.

Just to give you an idea of what -- and I should note that Peter was actually an advisor on our 2005 Water Plan Update. And in that, just to give you an idea of the growth of water-energy at the strategic planning level in California, in 2005 in that update there was exactly three paragraphs out of literally of hundreds of pages on water and energy -- the water-energy nexus. I know that because I wrote those three paragraphs.

So, fortunately, our folks across the street -- Rob's organization -- actually had a complete appendix when they were doing their version of the strategic plan for the integrated-energy policy report that year; and much of our information and views of how the numbers that Rob mentioned come from that foundational report back in 2005.

Going back to giving you an idea of how that's grown within our strategic planning process, if it was three paragraphs, eight, nine years ago now, the update that we are about to issue -- it's in draft -- it's the California Water Plan Update 2013 -- again, a bit late -- which should be issued in 2014 at some point -- each of the 30 resource-management strategies -- and by "resource-management strategies" I mean things like water conservation, recycled water, and storage. And there's 30 of these -- 30 types of strategies that local water agencies, local water stakeholders can use to address their water future. Each one has an in-depth discussion of energy and at times carbon in them.

We also divide up the state into ten hydrologic regions. And I think, as was mentioned by, I think, Rob -- maybe it was Peter -- there's a real difference -- actually, probably both of them -- there's a real difference in the regional energy intensity. And so for each of the ten regional reports that are part of the California Water Plan Update this time, you will actually see the different water supplies, whether they be surface water, groundwater, recycled water -- there's usually ten or so in each region -- you will actually not only see how much of that type of water is used, but what is the energy-intensity of that water at the regional level. So quite a bit of growth. I don't think it's an exaggeration, but the three paragraphs was not an exaggeration; and I don't think it would be an exaggeration to say that there's been an explosion of growth in terms of linking water energy at the strategic level with the State Water Plan.

Going back to some of the numbers very quickly -- and, again, this has been mentioned by Rob and Peter as well -- the -- of all the energy-intensity that there is statewide in water systems, about 80 percent of that is at the end-use, especially urban users. So the water to convey, to treat the water, to especially what the customer does with the water -- the end-use, the heating, the pressurization sometimes used for cooling, and then the collection -- the wastewater collection and treatment and disposal -- that's 80 percent of all the energy-intensity in the water sector.

So I don't want to diminish the role of -- you know, the impact of energy -- on energy in California from our water system or any other water system at the local level. But it's really what the customer does with the water is where the greatest potential is for reducing the energy and the carbon impact of water in California.

And for even a bit of a pessimist like me when it comes to water issues, that's actually good news, because there's very good reasons -- again, touched on before by Peter -- for reducing our water use in California. And so reducing, especially, urban end-uses of water is good for water. It's good for reducing the energy and carbon footprint of California. It's consistent with the State's Water Plan. It's consistent with state law, which we have a state law passed in 2009 which requires a 20-percent reduction in urban -- for capital water use by 2020. With the drought, who knows? We may hit that in 2014, well ahead of the 2020 deadline. So this is an area where actually water and energy line up very well in terms of policy, planning, and law.

I'll close if I -- oops, I'm stopped.

I'll close with just a couple of challenges and opportunities. And maybe I'll mention one of both. I think opportunities -- I think it's important that organizations like Rob's and mine and Commissioner Sandoval's coordinate. But I think it's more important what's going on at the local level. And I think there's many collaborations going on between local water and energy utilities around California. And I think continuing to facilitate and support those are very important. And I'm hoping we'll hear more about that in the second panel today.

In terms of the challenge, I think we talked a lot about the water-energy nexus, quote/unquote, but I think the nexus with other water-management objectives is sort of our next frontier. We have important water-management objectives for public health, for water-supply reliability, public safety, climate adaptation, ecosystem restoration. It -- there's a need to be able to integrate not only what we do on water and energy, but also what we're going to do on a lot of -- for a lot of other water-management objectives.

Thank you very much.

MS. WELSH: Mr. Mansour.

MR. MANSOUR: Good morning. Thank you for the opportunity to be here. My name is Adnan Mansour and I am the general manager for monitoring solutions a GE Power and Water, Water & Process Technologies.

GE Power & Water is a $25-billion business unit which sits really at the very intersection of the energy-water nexus. Our suite of power-generation technologies produces 25 percent of the world's electricity. And in addition to that, we are a global leading supplier of water treatment, wastewater treatment, and process systems solutions for water. Our treatment systems provide clean, safe drinking water to millions of people in water-scarce regions around the world. They also are a critical resource for helping industries minimize water usage in support of their operations.

It is a privilege to share with you this morning our water business unit's thoughts on some of the opportunities to address the energy-water nexus. At GE Water, we are not only focused on treating drinking water, industrial water, and wastewater, but also on reducing the amount of energy used in running and maintaining these critical operations of these complex water systems. And so today, really, I am going to talk about how we are using Big Data and analytics to do this.

The Industrial Revolution and the Internet Revolution are two waves of transformative innovations that have unequivocally shaped the modern world. It has been argued that the third wave -- the Industrial Internet -- is at a point of convergence for the advances of the preceding revolutions, the Industrial and Internet Revolutions. The core elements that comprise the Industrial/Internet dialogue are comprised of three things: Intelligent machines. These are machines that connect -- this is the method by which we connect the world's myriad machines, facilities, fleets, and networks with advanced sensors, controls, and software applications in new ways.

Advanced analytics, wherein one can capture the power of advanced models, predictive algorithms, automation, and deep-domain expertise in material science, electrical engineering, and other disciplines to understand how machines and larger systems operate and interact.

And then there's people at work, of course. And that's where we connect people, whether they be at work in industrial facilities, offices, hospitals, or anywhere on the move at any time to support more intelligent design, operations, maintenance, as well as higher-quality service and safety.

At GE Water & Process Technologies, the Industrial Internet is a process and required infrastructure to transform water-system operational data into meaningful, actionable information that produces a better result in terms of reliability, sustainability, and performance over time. We do this through secure enterprise cloud-based platforms. Within the water business we call it Water and Process Insight, a GE Predictivity Solution, that provides for multiple opportunities to manage these capabilities, these water systems. Visualizing current conditions and their trajectories; diagnosing problems and seeing opportunities for improvement; alarming on events and trends before they threaten asset production or integrity; and reporting on key performance indicators and their impact on business objectives and operations optimization.

All of this allows one to respond immediately to operating issues. In other words, it provides predictivity for performance and proactive optimization of assets and subsequent improvements.

For example, the U.S. Energy Information Administration reports that energy usage accounts for more than 40 percent of the total operating expense for a typical refinery, excluding crude acquisition components. Software and analytics simplify the visualization of status and trajectory of key performance indicators in critical refinery-water assets. Hidden cause-and-effect interrelationships are brought to light. Troublesome events and trends are detected at incipient stages, with speed to resolution and confidence that production operations are not compromised and no unplanned downside occurs, which obviously leads to significant cost in energy consumption and losses. The Industrial Internet provides refineries a lens to aggregate resources and expertise to break through the next threshold of optimization that drives total cost out, of which energy typically is the largest component and contributes to sustainability.

These capabilities and benefits can be translated across industries and public works. Whether in refining or in other sectors, for the past several decades, we have seen a steady stream of innovations in sensing, chemical delivery, and local automation hardware for water-treatment applications and processes. These advances are and will continue to be welcome contributions to the benefit of operators of water systems.

GE Water is really in the early stages of using Big Data and analytics to make efficiency improvements at the energy-water nexus. But we are at the same time nonetheless already achieving significant operational efficiencies for our customers in terms of water consumption, water usage, and energy consumption as well. Looking forward, we are on the verge of what we believe to be a new level of productivity and predictivity that will drive better management of energy consumption as it relates to water treatment.

I want to thank you again for holding this very important meeting and certainly will answer questions relative to Big Data and analytics as it relates to the energy-water nexus and water-treating systems. Thank you.

MS. WELSH: Thank you.

Mr. Bracken.

MR. BRACKEN: Thank you very much. It's a pleasure to be here today.

The organization I represent, the Western States Water Council, serves as an advisor to the governors of 18 western states on water issues. And as you can imagine, when you represent 18 western states with very different issues, there are a lot of issues that are important to the states. Sometimes they're different. Sometimes they're the same. The energy-water nexus is one of those issues where there's a wide and broad swath of agreement that this is an issue that warrants attention. So I want to talk to you today about two important things that can help the western states plan for future energy demands associated with water.

The western states are primarily responsible for the management and allocation of a lot of different waters. Currently most of the water that's withdrawn and used in the West is used for agricultural purposes. However, the West is also the nation's energy breadbasket and is home to many of the renewable and nonrenewable energy sources that will power our nation in the coming decades. And so we're expecting to see significant energy demands associated with energy extraction -- as mentioned, hydraulic fracturing and other energy-extraction activities. Many of the population centers in the West are also experiencing significant population booms, which will also entail increased demand for electricity generation; which will entail, in turn, new power plants, which will also require water both for their construction and ongoing operation. All of these pressures create a situation where the amount of water that's currently used for energy will likely increase.

And that raises significant policy considerations about what happens when the whole pie of water is reallocated. In order to plan effectively for our growing energy needs as well as demands associated with growing populations, environmental needs, and other issues, the states need reliable and accurate data. And this is an issue I think that has been hit on repeatedly this morning over the course of this meeting. And I'd like to add that part of the challenge that western states have right now with managing their water resources is that many of the critical and vital federal data programs that the states rely on haven't received the amount of funding that they need. In many cases we are seeing a lack of capital investments that have led to the discontinuance, disrepair, and obsolescence of key data programs. And this creates significant challenges for the western states.

You can't manage what you can't measure and we need these vital data programs in order to do that. And there are a couple key programs that we have long supported. There are many that we rely on, but two big ones are U.S. Geological Survey's stream-gaging programs; the Landsat satellite series that's operated by USGS and NASA; and the Natural Resources Conservation Services SNOTEL sites, the snow-survey program. All three of these programs provide vital data that states use on a daily basis to manage their water resources and make sure that they allocate water rights efficiently.

At the state level, the council embarked on a pretty important initiative in 2011. It's called the Water Availability Data Exchange. And the purpose of this effort is to improve access to state data on water resources. States collect a variety of data on water use and availability. And the goal of this particular initiative is to create a data port -- an online data port where people can go and access the best available state data. It's real-time access to the state data, not necessarily the water conditions on the ground. The idea is to help plan -- to help improve planning and give people a better sense of what's happening to the West.

I was also asked to comment briefly on some of these steps that my organization has taken over the years to support greater certainty for water-rights administration. Much of the water in the West has already been allocated. And what that means is, if you need water for a new energy purpose such as extraction or a power plant, you will likely need to get it from an existing use. Part of the challenge that we have is that we have significant water rights that are yet to be adjudicated. Specifically, many Native American communities have significant claims to water that predate nontribal uses. And those uses are significant, both in their size, but also in the fact that because they're older they have a potential to displace existing state uses. And that creates a lot of uncertainty. It makes it very hard for states to manage water when they don't know exactly when these water rights will be claimed.

So for the last 30 years my organization has worked with the Native American Rights Fund and the Western Governors' Association to support favorable federal policies that support a negotiated resolution of tribal claims. We've worked very closely with Deputy Secretary Connor and his office and his staff; and they've been great partners in helping us with this. And one of the things that we found is that settlements are the preferred way of resolving this issue, partly because they allow tribes to receive benefits that they wouldn't otherwise get through litigation, namely funding to build water-infrastructure projects, drinking-water projects, and water supply -- things that most of us take for granted. At the same time they provide for mechanisms that allow the state uses to continue without too much displacement, thereby providing the certainty that the states need to plan effectively for the future.

However, we've been able to support or contribute to a process that's resulted in 27 authorized settlements. But there are hundreds of tribes across the country, most of which are located in the West. And that creates a significant amount of uncertainty, both for planning for future energy needs as well as any other future water uses. And so our position has long been that these settlements are a federal trust responsibility. They require, I think, a greater recognition of their importance and their role in planning both for water use and energy use in the future. And it's something that they probably don't get. And so we would urge that settlements and basic data be considered as tools at the federal level that can be used to help plan effectively for the water needs and uses associated with energy development, both in the nation and in the West.

Thank you.

MS. WELSH: Thank you very much.

Mr. Griswold.

MR. GRISWOLD: Good morning and thank you.

Natural Resources Defense Council uses law, science, and the support of 1.3 million members and online activists to protect the planet's wildlife and wild places and to ensure a safe and healthy environment for all living things.

I would like to thank the Department of Energy and the task force for tackling the climate-water-energy nexus. Water and energy will be the two most challenging issues of current and future generations; and when combined with climate change will involve the most important decisions our society makes.

Our nation stands at a fork in the road: To maintain the status quo and build and water-and energy-intense systems or expanding the use of our sustainable, low-carbon energy systems that are both water- and energy-efficient. A step in the right direction, a step that can save as much as 190 billion gallons a day in water withdrawals, would upgrade existing power plants to closed-cycle cooling or better, as required by Section 316 of the Clean Water Act. By upgrading these outdated systems, industry can reduce environmental risks, improve the health of our rivers and lakes, and prepare for the impacts of climate change, impacts that would reduce vital reliability and increase costs.

So we've moved beyond the "if climate change occurs" phase. As we know, some climate impacts will occur even with greenhouse-gas reductions we already have in place. Recent droughts and rising temperatures provide a window into the potential impacts of climate change.

Water levels at Lake Mead, as we heard before, have dropped over a hundred feet since '99, reducing the electric capacity by 33 percent. In 2012, the drought in the Missouri River Basin reduced energy production by three billion kilowatts in 2012. Because of drought, generators at Browns Ferry nuclear plant were shut down four out of the past six years to protect aquatic ecosystems in the Tennessee River.

Newly proposed wind-speed power plants continue to be planned in water-starved states. We cannot expect to build a water- and climate-smart energy system by using outdated technology.

Investments in low-carbon/low-energy systems, wind, natural gas plants, dry-cooling, and reclaimed water have allowed Texas to avoid a water-energy conflict during the 2011 drought.

President Obama's recently announced Clean Power Plan provides an initial and important step toward securing a low-carbon future, but we must ensure this step includes water-smart strategies as well, strategies that it should invest heavily in energy efficiency and renewable energy, strategies that could reduce water withdrawals by one estimate by 17 trillion gallons by 2030 compared with the "business as usual" scenario. Such strategies would give as much as 9 to 13 billion gallons a year back to farmers in California or Colorado, reduce groundwater withdrawals in the Colorado River Basin by two trillion gallons by 2050, and cool down the Coosa River in Alabama by as much as 13 degrees in the summer, which will protect the fisheries downstream.

Locally, NGSC is working with the California Public Utilities Commission to address the amount of energy that's embedded in the water system. We encourage DOE and the task force to continue to evaluate embedded energy in the water sector at the national level. We also ask the DOE to work to resolve key challenges to low-carbon, low-water energy systems such as carbon-capture and storage technology that requires 40 to 90 percent more water than coal-powered plants; concentrated solar power plants that require twice as much water as coal plants; and unconventional natural oil and gas development which requires nearly five times as much water as conventional natural gas, which can increase greatly with enhanced recovery processes.

Water availability is not just about the amount of water but the water quality, the quality affected by a legacy of energy development. We encourage the QER process to address these risks. For instance, in Montana, brine has contaminated the Fort Peck's tribe's drinking water sources; and nearby in the Bakken oil and brine spills have increased by 42 percent in the past year. Coal ash has leaked from waste sites polluting millions of gallons of river water with heavy metals. and discharge from power plants kills billions of fish annually and overheats downstream waters. Given that much of this waste is exempt from federal regulations, we should take every step to ensure we safely reduce, reuse, and regulate waste or the legacy of conflicts between energy and water will continue.

A water-resilient energy system shall recycle water to the greatest extent scientifically possible. And for power plants Section 316B of the Clean Water Act would support this. For unconventional oil and gas systems, water on-site and water reuse on-site can decrease water-management costs by as much as 44 percent as well as reduce infrastructure needs in those well heads.

To address this water-energy-climate nexus, we need decision-relevant data during the development of a national framework for energy and QER should ensure that a water-resource plan is concurrently developed. Understanding the life cycle water use of energy systems is critical to plan for our water-constrained future. We encourage QER to model possible energy futures and identify outcomes on ecosystem and climate result resilience, an effort that would also identify regional risks and benefits of such futures. We need access to consistent water data. We as well support the USGS surface water and groundwater data we believe are critical for these water-energy decisions. But, again, they continue to lose funding for these important services. We need access to water-reduce data from power plants that includes the facility of fuel-type information and to accurate domestic and agricultural water-use data, which is in many cases self-reported.

DOE and its partners could provide guidance, support, and funding for an improved water withdrawal use and reporting system to address water constraints within the energy system. And without due consideration for existing water stress from growing populations and climate change, energy prices will rise and water conflicts will become more common. Planning now for anticipated water and energy infrastructure can curtail use and reduce environmental impacts.

Thanks for your time.

MS. WELSH: Thanks.

Yeah. Can you all do a little switching around so Commissioner Sandoval can be on camera?

COMMISSIONER SANDOVAL: Thank you. Can you see me now? Good morning, everyone.

MS. WELSH: I think we can see you on camera. And let me welcome you, Commissioner Sandoval. The floor is yours.

COMMISSIONER SANDOVAL: Great. Thank you. So thank you to the Department of energy for this invitation. And it is a pleasure and an honor to be here on behalf of the California Public Utilities

Commission, as several of my colleagues from the CPUC are here with me. Our office is right across the street, so we really appreciate this opportunity for collaboration with our federal partners as well as our state partners.

So I wanted to focus, in fact, on a proceeding that the PUC is doing that is focusing on exactly this issue, the water-energy nexus. I am the assigned Commissioner for our water-energy nexus proceeding. We are in the throes of finalizing our scoping memo which defines the issues that we're going to address. So we expect to get that out very, very shortly. So I wanted to talk to you about a few of the issues that we have identified in our scoping memo that we will be analyzing through our proceeding.

So, first of all, is a water-energy cost-effectiveness tool. So this is a project that we've been working on for some time through a series of workshops developing a methodology for determining the embedded energy in water as well as the embedded water-and- energy nexus. So we're going to be looking at these methodologies. I mentioned there have been workshops and that will continue. We already do have a number of tools that we use to identify cost effectiveness. And so this will come up with regard to energy efficiency, which I will mention shortly.

So we also want to use this proceeding to look at actions for the water-energy nexus in multiple contexts. For example, water conveyance, delivery and use for water storage, stormwater capture, water-recharge delivery, and other types of areas. So this is one of the issues that Governor Brown has also addressed in some of his emergency measures this year to deal with the California drought, just to try to make water conveyance easier and water transfers easier.

I have spent a lot of time as well in the communications industry. I've taught telecommunications for over a decade. I directed a department at the FCC for over six years. And I mention this because, when you look at water, water is very much where communications and energy was over a hundred years ago in terms of having many disparate unconnected systems. It's like -- water is a lot like energy without transmission, with the exception of some grand projects such as the California Water Project and the Federal Water Project. And so doing what we can to share information but also create opportunities for conveyance and exchange is really critical to our future.

As was mentioned, our proceeding will also look at the role of water and energy production, but also in agricultural pumping and irrigation. Here in California agriculture is the largest sector that uses water; and, of course, also residential and commercial landscaping is a huge part of the use. So we cannot address our drought effectively in California without the agricultural sector and without also helping residents to understand how can they get to the next level of conservation. We've already heard this here, even as we have entities like the Russian River Valley -- they've asked for 50-percent cutbacks -- that people are reporting that they are struggling to cut back because they've done a lot of the things that are easy. And so we also want to make it easy for people to understand what are the next level of things that they can do both indoors and outdoors to make a difference and to save water. And we'll also do this in part through our energy-efficiency programs, which, again, I'll mention in just a second.

So we're going to be also focusing on interagency coordination, coordinating with our sister agencies, the California Independent System Operator, California Energy Commission, the Department of Water Resources; and also with tribes as well as state, local, federal, and regional governments; and then, of course, coordinating with other related agencies, including federal agencies.

Through intra-agency coordination, we're going to be focusing on what we can do to harness a variety of programs, including our energy-efficiency programs. I'm the assigned Commissioner for the CPUC's Energy Savings Assistance Program, which is the partner to CARE, California Alternative Rates for Energy, that helps low-income users. So one of the things that we have put into the decision that actually we already adopted for the smaller multi-jurisdictional water utilities this year is promoting the energy-water nexus as a step in energy-efficiency savings for this year. And we have also directed them -- these are companies like Pacific Power that serve over 45,000 households in California -- and we've directed them to include the energy-water nexus in their energy-efficiency savings plans for the next cycle. Right now we are considering the proposed considering the proposed energy-savings assistance plan petition for modification privilege for 2014 and also the guidance document for the large investor-owned utilities. And, again, one of the centerpieces that we made of this area was to also address the energy-water nexus, both this year and coming years.

So as was mentioned, there are a number of things that can be done indoors to address the energy-water nexus, especially things like hot-water heating, wrapping of hot-water pipes are things that can really help with the energy-water nexus and the end-user; but also going deeper into collaboration with community-based organizations, consultation with tribes, and looking at working with different entities, including landlords. Addressing multi-family housing is absolutely critical.

When we look at low-income Californians, a third of all California households are low-income. Two-thirds of those household are renters. Now, in California we also have a different renter profile than in the East. Most of those renters live in single-family homes, although single-family is apparently classified in Energyland as up to a four-plex. But most California renters are not in the tall apartment buildings that may characterize some of the East Coast and large Midwestern cities, but are in smaller rental units. So thus cooperation with landlords is absolutely critical.

We've also talked to you a lot about the energy-water nexus and in fact the energy-water climate-change nexus. And I would also like to introduce another stool to this leg, which I believe is critical and was mentioned somewhat in the discussion of sensors, which is the energy-water-communications nexus. So this is another area that our proceeding will look at is to examine the nexus of water, energy, and communications; for example, the use of information-management systems, high-speed Internet access, and supervisory control and data-acquisition systems for water management and treatment and the communications needed to be able to manage transfer, use water, to gather data, to do analysis, and also to have water for wildfire and other public-safety areas. And on this we also would evaluate the access to electric-gas storage and renewable energies to address the energy-water nexus, including the link between power access and communications facilities.

So let me give you an example of why this is critical. Whether we're talking about in a city like San Francisco, which is a very, very crowded city -- in fact, more crowded per capita than Manhattan -- you still have places where you have communications valleys and cellphones that don't work because of a variety of ways that things are set up and that there still are constraints in terms of our ability to be able to use communications. So as we look at the development of the Internet of things, we also need to make sure that the Internet of things is also enabling us to analyze our use of water, to address our use of water, and to be able to facilitate wiser use of water. And we need to analyze where the lack of access to communications facilities constrains our ability to manage water.

So I'm very glad that you're here, Secretary Connor, and to hear about your work with Native American reservations, as this is demonstrated most graphically in our Native American reservations here in California.

California has more Native American tribes than any other state. And I've had the pleasure and the opportunity to spend some time with our Native American tribes in far Northern California, particularly the Yurok tribe, the Karuk tribe, the Hupa tribe, that all have issues with lack of access to communications facilities and in some cases lack of access to electricity. So what's happening is in these places, where we all work very hard to bring electricity to the Yurok tribe, which is near Eureka, they got access to electricity in most of the tribe but not all of the tribal area in June of 2013. They got plain old telephone service, in part but not all of the reservation, in April of 2014. There's no cellphone service up there. They face the wrong side of the mountain. The trees are too tall. They don't have satellite.

So what you see in a lot of these places is an amazing number of people who have cellphones in places where there's no cellphone service. And what they do is that they drive every day about 45 minutes each way to get to a place where there's a cellphone signal, text their messages, do business, and then drive back into a place where they may as well be back in the 19th century.

There's a lot of greenhouse gases being burned for lack of access to communications facilities. And this is really dangerous in an area that is a high wildfire-danger area. And when I met with the chief of the Hupa tribe -- and we also met with some of the tribal facilities leaders -- the water facility director said, It is really difficult to run a water facility in an area where you don't have enough broadband to properly run your SCADA system. And that could be really scary. If you have don't have enough broadband for your SCADA system, your pumps could fail to open; it can create problems with treatment, let alone with conveyance and ability to go to the next step.

Let alone, when you also talk about farmers and what you can do with agriculture, one of the things that I heard from Fresno State, which is one of our centers for looking at energy-water nexus and they also have a WET center, Water Education Technology Center, is while there are great advances being used with sensors, one of the big barriers to the use of sensors in the field is the lack of communications technology in the field, which is also driven by the lack of electricity on the field.

So one of the things that we're going to be doing also to look at this issue is that I have also proposed that we look at some of the things that California has done in the past, in fact, with farmers where we have created incentives to, instead of using diesel to power water pumps in the fields, to change to electricity, which helps with climate and get them access to cleaner electricity and particularly since so many of the farmers are in the Fresno Basin, which is one of our most impacted air basins.

So we are also working with the tribes to see if we can use this model to count how many people are out there. I have been to the elementary school on the Yurok reservation, which is still being run by diesel. K-through-8 children breathing diesel every day. And people who are using diesel because of lack of access to electricity. And this affects not just climate but also water.

So we expect to be putting this out within the next few days. And we look forward to your participation and your collaboration. And I look forward to working with you on those issues.

Thank you.

MS. WELSH: Everyone has such great information. I hate to stop. But we want to get into a discussion and have time for that.

So let me throw out the first question. And I'll ask Commissioner Sandoval to start and then we'll move down the table.

You all have expressed, very articulately, that there is great challenges, in the West particularly. But the QER task force is tasked with looking at what should the federal government be doing in this space. So a lot of what you talked about, Commissioner, is at the state level; but you did mention some federal programs. Can you and then can the other panelists talk about what you think, if you had the ability to tell the task force one specific recommendation, that the federal government should be doing? What would that be? Would it be in the executive space? In new legislation? Give us your one very specific recommendation.

And then from there we'll go to Mr. Griswold and then come down.

COMMISSIONER SANDOVAL: Well, I'm confined to one. So one suggestion that comes to mind is, again, when we talk about coordination with Interior, federal parkland, being able to create the connections, for example, to develop broadband Internet that can cross through some of the federal parklands and some of the Interior lands is going to be absolutely critical to addressing the energy-water nexus, because some of these things you really can't do unless you have the communications infrastructure; and especially whether you're talking about the source of water or some of the users of water, coordinating to make it easier to be able to deal with that is critical. And that will also help with addressing wildfire areas that both affect federal lands as well as state lands. So that would be one suggestion.

MS. WELSH: Mr. Griswold.

MR. GRISWOLD: Yeah. As I mentioned in the beginning, I think --

MS. WELSH: Can you speak into the mic?

MR. GRISWOLD: As I mentioned in our statement, one of the key steps is to move forward with technology we already know is useful. So part of that is the DOE's role in developing and fast-forwarding that technology through working with universities and others that have that technology resource and ultimately getting the funding out there to move that technology forward today instead of 10 or 20 years from now. I think that's the critical --

MS. WELSH: Thank you.

Mr. Bracken.

MR. BRACKEN: Well, if I only have one, I would say basic data. Fund it and make it a priority. And one of the things we often see, at least in the water world, is we see a lot of other programs that are good, that are worth doing, but basic data shouldn't come -- they shouldn't be the scapegoat. These programs shouldn't happen at the expense of the basic data programs, which really are the fundamental thing western states need to manage water effectively.

MS. WELSH: Mr. Mansour.

MR. MANSOUR: Sure. So in the context of Big Data analytics, from a position of the federal government and what role it can play in planning and implementation of water research and development, you know, if we really want to change how our nation addresses looming water-scarcity challenges and addressing issues relative to the water-energy nexus, it's going to take a community of government and national labs and academia and industry in close collaboration. And from the context of, again, Big Data and analytics, advanced sensor development to provide the sensor and monitoring and broadband development to enable the acquisition of data and analysis of data to ensure that issues are addressed appropriately is going to be paramount.

MS. WELSH: Thank you.

Mr. Andrew.

MR. ANDREW: Thank you. I'll go back to my -- one of the -- the opportunity that I mentioned in my remarks, which was supporting local water-energy collaboratives. And I guess the federal government could lead by example. It's certainly our -- there's just such a huge number and variety of federal facilities in the West; and it's the federal government but not -- I suspect in many cases there are also local water-energy customers. And to the extent that they can set an example, that would be the one thing.

MS. WELSH: Great.

Mr. Oglesby.

MR. OGLESBY: It's kind of a toss-up. But since California has standard-setting authority for efficiency, what -- and speaking for this state, I'd say funding research. There's a great deal of opportunity out there to improve the way that we handle water, treat water, convey water. And I think fundamental -- the resources available to advance technology in that area could use additional support.

MS. WELSH: Mr. Gleick.

DR. GLEICK: So what does the federal government do? They do national standards and regulations, cross-state responsibilities. They operate some infrastructure, especially water-related infrastructure in the West. Federal lands. So my one recommendation would be integrate water and energy in those responsibilities. We have Water Sense and Energy Star standards at the federal level. That's an effort just trying to integrate energy and water. And I think there should be much more of that.

MS. WELSH: Thank you, all.

Let me turn to Dr. Holdren, as I know he's got a plethora of questions for all of you.

DR. HOLDREN: Well, I don't think we have time for a plethora, but thank you, Peggy.

You actually asked what my first question was going to be. I was going to focus a little more narrowly and ask, if you had five minutes with the President of the United States, what would be your ask or your proposal? Pretty similar to your question.

So what I will suggest on that one is that people who have additional ideas that they would like to convey to the president, convey them to me. My email address is jholdren@ostp, as in Office of Science and Technology Policy -- .eop.gov. I read my own emails. It's not filtered.

MS. WELSH: Do you want to say that into the mice, because the people listening by live stream --

DR. HOLDREN: Jholdren -- no caps, all one word -- jholdren@ostp -- as in Office of Science and Technology Policy -- eop, as in Executive Office of the President -- .gov. Suggestions for what the federal government could or should be doing constructively in this area that we're not already doing would be most welcome.

I will say I was gratified by quite a number of the comments on what they'd like the federal government to do, because many of them are things we're already working on, particularly in partnerships on Big Data and analytics, in opening up government data in machine-readable and user-friendly forms across a number of the domains we've been talking about. These are things that we are already working on.

The other question I had is probably really mostly a question for Dr. Gleick and Dr. Mansour. And that is how close are we to having a meaningful supply curve for water supply on the margin, say, in the State of California?

And by "supply curve," for those of you who are not familiar with this context, a supply curve is a graphic that tells you how much you can expect to get at a given cost and at a given time. So -- and you arrange the potential contributions from the least cost to the highest cost contributions. And what supply curves in energy have typically shown are that the cheapest and most abundant sources of energy on the margin come from saving a kilowatt hour or saving a gallon of fuel rather than producing one from scratch. And of course from the standpoint of the economy, a kilowatt hour or a gallon saved is every bit as good to the economy as a kilowatt hour or a gallon produced, because the one saved can be used elsewhere.

The same obviously is true of water. A cubic meter or an acre-foot or a billion gallons a day saved is as good as one produced, as far as the economy is concerned. But I've personally seen some very impressive and informative supply curves for energy. I haven't, that I recall, seen one for water supply. Are we close to being able to produce such a thing? And what would it tell us?

DR. GLEICK: So that's a great question. It's a difficult one in part because there's so many different options. You could build a reservoir here or a reservoir there. You could do groundwater storage and recharge and extraction. You could do water conservation and efficiency.

There has been some work done developing supply curves for water. In a report done a couple of years ago on urban water called "Waste Not, Want not" at the Pacific Institute, we did a supply curve of conserved water, looking at replacing a toilet, replacing a washing machine, building new reservoirs -- sort of a comprehensive assessment. Obviously, depends on where you are, depends on the choices you make. There are different models of washing machines. There are different ideas for reservoirs. So it's not an easy thing to do.

The short answer, from what we know so far, is that conservation and efficiency is by far the cheapest. It's cheaper to save a gallon of water than to find a new source of supply in the western U.S. We're reaching peak water. There aren't really many new sources of water. And the gallon of water that we're wasting with inefficient toilets is a gallon of water we've already collected. We've already spent money to collect and deliver, treat and deliver to our homes.

We just released a series of reports on drought options looking at urban and ag efficiency and wastewater reuse and stormwater capture and reuse for California. Those are new supply increases in demand reductions and the potential is very significant. The costs vary and more work needs to be done really on the cost side of things.

DR. HOLDREN: Dr. Mansour, do you have --

MR. MANSOUR: Certainly. I'm not -- I am going to echo what Peter said. And in addition to that, from our standpoint we think about conservation, efficiency, and reuse primarily. So really is a broad-brush look at supply curve. I don't know that we've got everything that we need to know to be able to establish that, but certainly reuse is a big component, conservation is a big component, and efficiency is a big component.

Just take, for example, a thousand-megawatt power plant and taking cooling tower blow-down from that power plant and reusing that, figure out how to reuse that within the facility. That basically translates to about 15 percent of the energy required -- energy required to bring in water and treat that water for discharge as well. And from the standpoint of what that translates to, it's about the power for 350 homes on an annualized basis. So there's that component.

From the standpoint of reducing a thousand gallons of water of use intake and then treating for discharge as well, it's about eight kilowatt hours to do that. So that's a significant amount of consumption reduction as well.

So reuse is a big deal. Taking gray-water and using that as well and bringing that into systems for cooling towers. There is technology available to be able to treat gray-water appropriately such that it enables cooling towers to operate efficiently and effectively. So really taking gray-water and not treating that to completion for potable use -- to that level of reuse -- is something that would be advantageous as well. So really managing resources from the standpoint of reuse, consumption, and efficiency is a big driver.

DR. GLEICK: If I can give one more specific example, when we did this assessment of efficiency -- this is why energy and water is so important to look at together -- we looked at the potential to save water with dishwashers -- efficient dishwashers. The amount of water an efficient dishwasher saves is significant, but not a lot from an economic point of view. And it was not cost-effective.

But when we looked at the energy savings as well of heating the water, it became cost-effective to the consumer, to the end-user, to replace that inefficient dishwasher. And this is relevant for Commissioner Sandoval's work at the PUC of integrating these things together. You get benefits that you don't expect when you integrate the energy and water numbers together from a cost point.

MS. WELSH: So one of the things I've heard all morning is the critical need to start thinking about these systems in an integrated way, that regulators are approaching things in a stovepipe way and we need to bring them together. The federal government has found that public-private partnerships have often been a good way to bring all the players to the table.

Commissioner Sandoval, you mentioned collaboration. Several others on the panel mentioned it. Is there a role for a public-private partnership effort that the federal government could serve to bring some of the collaboration needs and thinking together in the energy-water nexus? You want to start, Commissioner Sandoval?

COMMISSIONER SANDOVAL: Yes. Thank you.

Yes. So we also think that private-public partnerships are really critical. I would add community-based organizations, tribes, other community organizations as part of that collaborative. I think understanding -- one of the questions that I always ask is what are the barriers? What are the barriers to development in terms of going to the next level of whatever it is that the business wants to do or that the community wants to do.

And one of the things I was going to mention is, when we talk about some of these water uses or energy uses, one of the key barriers is the energy intensivity. And so getting back to priorities for the federal government, I would echo the priority of supporting research and also supporting some of the state efforts to do things like look at storage. We have a very aggressive storage-procurement mandate here in California. And there are some very exciting things that are happening in this space. So I think particularly if we could look at how could we integrate and use storage to be able to help us address things like the energy intensivity of desal, the energy intensivity of fracking, the lack of energy in some of the wildfire danger areas. These are all areas where we could help with collaboration in terms of the private sector initiative. But also one of the things that is stopping deployment in some of these areas is some of these barriers and some of the gaps that could be addressed by some very exciting new stuff that is going on in storage.

MS. WELSH: Terrific. Anybody else want to weigh in?

All right. Well, let's talk about technology. We have heard about Big Data and the use of data, the need for accurate and reliable data. What other technologies would you recommend that the federal government look into, fund, conduct R&D?

Dr. Mansour, you want to start and then we'll go up the line?

MR. MANSOUR: Certainly. So from my standpoint, I can certainly say that accurate and reliable data is critical. In order to receive accurate and reliable data, you need good communication as a starting point to receive it. But to acquire it is going to require advanced sensors, advanced capabilities to sense -- and not just sense key parameters -- but also to measure those key parameter, right. So not just to see whether are not they're there, but to be able to quantify how much is there. So that's, I think, a significant requirement. The other piece is --

MS. WELSH: What is the federal role in that?

MR. MANSOUR: So encouraging and establishing research and development priorities around that and funding priorities around that --

MS. WELSH: Got it. Thank you.

MR. MANSOUR: Sure. That's one component of it.

And the other part of it is really working in partnership from the standpoint of sponsoring or collaborating in terms of pilots and being able to validate the technology that is developed as well. So working in partnership. You mentioned public-private partnerships. Certainly, developing partnerships to ensure that there's a close collaboration to develop that technology and make sure it's recent.

MS. WELSH: Anyone else? Mr. Gleick?

DR. GLEICK: So we don't measure groundwater extraction in California. For those of you not from California, you may find that shocking.

One of the things the federal government could do is support -- and it's in the sensing category -- is support satellite systems, earth-observing systems. We've learned a tremendous amount about groundwater extraction in California from the GRACE satellite system, which is a gravity-measurement system circling the earth. And it looks at groundwater storage around the world. And it's identified, especially in the western U.S., some quite remarkable changes in groundwater. Until we're doing on-the-ground measurement of water use more accurately, there's an enormous federal role for remote sensing from satellite systems, which are increasingly sophisticated and, I would argue, underfunded.

MS. WELSH: Great suggestion.

Commissioner.

COMMISSIONER SANDOVAL: Yes. So I wanted to jump on the water-management-sensor bandwagon and say that this is very important. Also, that there's an opportunity there to help to address the electricity-and-communications nexus in order to be able to do that. The Rural Utility Service and the Rural Electrification Administration run by the federal government was hugely effective in helping to bring electricity to rural America. However, they tended to concentrate on the farmer's house. So when we talk about the deployment of sensors, one of the things that we're hearing is that when you get to the fields, actually one barrier to deploying sensors is you get to the point where there's not only not the traditional telecommunications infrastructure, but there's no electrical power.

So we're looking at how can we do things like build off of what we already did to try to move the farmers from the diesel-based pump to electricity to then be able to harness, now that you've got electricity in the fields, how can you mesh networks and other things to push out beyond the place where the farmer's house was connected by RUS long ago to be able to push into the fields to be able to get the sensing technology so then you could feed into lower thermal infrared satellites or other types of technology and then looking at where the gaps in terms of electricity or communications.

When we talk about public-private partnerships, also one of the largest communications networks in rural America is run by John Deere, Because they have a need to communicate with the users of their tractors. They have long sought out the farmer with the farmer with the tallest silo or the biggest barn to be able to put their communications technology. So our communications division has reached out to John Deere to see what we can do to work together. But working with John Deere as a resource, how can we also help the farmers be energy-efficient is going to be absolutely critical. And how can we work together to build a communications technology that will give us the ability to manage and to sense and create data.

MS. WELSH: So share the results of that with the White House, if you would.

Mr. Bracken.

MR. BRACKEN: Yes. I just wanted to add to Dr. Gleick's comments about --

MS. WELSH: Can you bring the mic close?

MR. BRACKEN: Yes. I just -- I wanted to support the comments about remote sensing. That's something that we've actually long supported, particularly the LandSat satellite. As I mentioned before, it has a terminal infrared sensor that allows water managers to actually look at consumptive use on the ground. It's a very cost-effective way of doing that.

I want to add one caveat to the topic of new research. And that is we don't want it to come at the expense of stuff that already works. And the TRS sensor, the thermal infrared sensor on LandSat is a key example. There was a lot of uncertainty with the last LandSat satellite launched last time year about whether it would have a thermal infrared sensor. And that was a big challenge for the western states. So we had to go and argue quite thoroughly and extensively to get it on the satellite. And part of the challenge that we kept bumping into is, This isn't new science. And our response was, We don't care. It works. It works now. We don't want to have something that works become obsolete just because it's not new.

So, yes, new science is needed. I think remote sensing is a great way to do it, but we need to make sure that we're not throwing out the stuff that already works.

MS. WELSH: Thanks.

Last comment, Mr. Andrew -- Mr. Oglesby. Excuse me.

MR. OGLESBY: I'd be remiss if I have an audience of the Department of Energy if I don't observe that with the amount of hydro that we use in the West and with decreasing availability of hydrowater resources that part of the investment in technology should be to further renewable technologies that are less reliant on the water as the driving force on that side. I would add that to the discussion.

MS. WELSH: Great recommendation.

So let me give the floor to Dr. Holdren to conclude our fantastic discussion here this morning.

DR. HOLDREN: Well, let me start by saying I'm very grateful to the panelists. I think we got interesting ideas from everyone. I took a lot of notes.

I think three themes really stand out. One, Peggy mentioned a moment ago, it is clear that integrating assessment and planning for energy and water would bring many benefits, many insights. And, as Dr. Gleick most recently commented, one often finds that thinking about them together underscores opportunities that you night not otherwise have recognized as paying off.

Second point that came up again and again and again is we need to do better with the interaction of sensing, monitoring, communicating those data, making them available, applying Big Data analytics to understanding what the patterns are actually telling us. This again is already a major thrust of what the federal government is trying to do in this domain and many others.

The satellite issue is one very close to my heart and close to my responsibilities; and we are working on it as best we can under some rather constraining budget circumstances in the federal government.

The third theme that comes through again and again and again is the importance of partnerships across federal, state, and local governments and national labs, universities, companies, community organizations, planners, tribal leaders. And that applies to both of the other domains: Partnerships to figure out how to better collect and use data, partnerships in terms of understanding how best to integrate assessment and planning across the water and energy domains.

So I've got a lot of more specific notes that came out of the comments of the panelists and I'll take those back. And I'm sure that our Department of Interior and Department of Energy colleagues will do the same.

Thank you.

MS. WELSH: Please join me in thanking this stellar panel.

[Applause]

MS. WELSH: I'll now ask the next panel to join us.

And while we're doing that, let's remind folks that we want to hear from you. Even though I'm cutting people off this morning, it doesn't mean that we don't want to hear from each of you. So I'm going to repeat that the address for submitting comments is qercomments@hq.doe.gov.

Thank you very much. And we'll get the next panel set up here. Thank you.

For those of you who are listening via live stream, let me remind you to refresh again. We heard a lot about communications technologies; and we want to make sure that the technology we're using this morning, the live stream, is working well. So, everyone, please refresh.

We're going to go out of order this morning from the printed agenda that's on the Web because some of our speakers have PowerPoint slides and some do not. So we're going to ask those who do have slides to go first. And if there is a way we can ask the speakers to kind of move around so that the screen can be seen by those in the room and it can get on camera, I would appreciate it. So if we need to do some musical chairs, let's do that.

I want to remind everyone that the panelists we've invited today we are honored to have. Their views, however, are their own and are not the views of the Department of Energy or Interior or the White House.

With that, let me start with this panel. I'm going to first introduce Frank Loge, who is director for the Center for Energy -- excuse me -- Water and Energy Efficiency at the University of California at Davis.

We then have Randy Howard, who is the assistant general counsel at the Los Angeles Department of Water and Power.

Keegan Moyer with the Western Electricity

Coordinating Council.

And I can't see all the way down there. Eric Schmitt, vice-president of operations for the California ISO.

Alex Coate, general manager for the East Bay Municipal Utility District. I'm not sure if I've got you in the right order because I can't see all the way down there.

Randal Livingston, vice-president, power generation for Pacific Gas and Electric Company.

And last but certainly not least we have Jim Herberg, general manager with the Orange County Sanitation District.

Thank you, gentlemen, for being here. Let me turn the floor over to Dr. Loge.

DR. LOGE: Good morning. So I personally feel that there's four critical areas that need to be functional to really drive innovation in the water-energy space. And those four areas are illustrated up here on the schematic to your right.

So the first three are policy, technology, and either businesses or business models and then the fourth one is data; and to really have policy and technology and business models driven by data. And I think the biggest impediment to really driving innovation in the water-energy space in the State of California to date is the availability and accessibility of data.

And I'll be brief because this has already been mentioned. I think we really are leaders within the policy space, but data is the biggest impediment. So that's going to be my principal thesis for today.

So very simply stated, our center has focused largely on the energy that goes into the water sector. You can look at that in one of two ways. This is a very simple schematic. So the first kind of graphic across the top is you can focus on reducing energy use in the water sector by making energy use more efficient. So the lightning bolts and the water cups are becoming smaller and thereby you're saving energy.

The other way is by conserving water. So the second kind of line down there is representing you can save energy in the water sector by conserving energy.

Now, when you begin to look deeper into this very simple schematic, these two systems get a lot more complex. So I just want to use one slide, the next slide is an illustrated case study to begin to illustrate the complexity of dealing with the water-energy nexus. So I'm going to focus on the bottom portion where we're going to look at conserving energy and, of course, find energy saving -- I'm sorry --

conserving water and the corresponding energy savings. And the one thing that's needed is having an understanding of what the energy intensity is in those cups.

So this is a study that we recently completed in collaboration with Pacific Gas & Electric and East Bay Municipal Utility District. We looked at the energy intensity just down here, which is measured in kilowatt hours per million gallons as over a year, which is shown down here, over a time period that spans from 2006 to 2011.

And the first take-home message here is that you do see quite a bit of variation in the energy intensity over the course of a year. You see even more variation when you begin to look at the differences in energy intensity spatially across the East Bay MUD service territory. So there's roughly a 12-fold variation in the energy embedded in water across the East Bay MUD Municipal Utility District.

Having an understanding of this level of granularity both in time and space is really critical to understanding energy savings associated with different types of water-conservation technologies and therefore the businesses and the types of policies that might be rolled out to help enable those types of joint savings.

Now, this study focused on only ten pressure zones. East Bay MUD has about roughly 120 pressure zones. We focused on ten, largely because of the complexity of the data. And when you begin to look at that complexity now overlaid on top of what a lot of us are talking right now, about looking at the meter and looking at the households and the businesses and their energy use, because much of the energy that's embedded in water and much of the energy that's associated with water use is at the end-use, you begin to add on those layers of data as well as all the data upstream and you begin to then look at that throughout the State of California; and the complexity of the data becomes overwhelming. And for many people, I personally feel, it's really inhibiting activities in the water-energy space in the State of California.

So the greatest thing that can happen to help drive innovation in this space, from my point of view, is to really focus on building a centralizing data platform that can integrate data from multiple sources into one easy-to-use format that then could drive analytics to help advance activities in the water-energy space. So those analytics shown up here, I just gave a few. There's many. But you can look at water-use bench-marking, targeted conservation, leak-loss detection, you can do the monitoring and verification necessary to assess many of those programs. And you can do similar things in the energy sector. So you can look at energy intensity in the water. You can do demand-response and issues like that. But it's those innovations -- or those activities are only going to be possible by combining these data-sets together and beginning to use them in the management of this joint resource.

So if you look at the next steps, I think immediately one of the next steps is to get stakeholders together who really -- who work within the space and begin to build that joint platform with a lot of user input. And one of the critical issues that is going to have to be addressed that we've seen over the last couple of years as we've worked in the space is the security and privacy provisions associated with that data. So if you begin to try to get water-utility data for East Bay MUD and corresponding utility data for PG&E for customers, it becomes very difficult to begin to integrate that data to get it let alone make it accessible to people who can build those analytics to help drive innovation in this space.

So anticipating some of the questions you might ask, I think one of the greatest things the federal government can do to help advance activities is, one, is to help expand the WaterSmart program that, from my view, largely focuses on kind of hard infrastructure into the soft infrastructure of information technology. I think one of greatest things is that if you can get the federal government helping fund the joint -- the development of this platform between water and energy utilities and provide some sort of guidance on standards around that, that is going to drive innovation, in my view, over almost anything else.

And this is -- in particular, there's a lot of comments on the other panel about sensors. So we're not only talking about combining large amounts of data that currently exist. We're talking about adding to that amount of data. So, to me, that's the most important thing the federal government can do.

Thank you.

MS. WELSH: Thank you very much.

Mr. Howard.

MR. HOWARD: Good morning.

MS. WELSH: Can everyone see the screen? Okay.

MR. HOWARD: So good morning. I need to first correct Peggy. I am not counsel at LADWP. I am the senior assistant general manager of the power system.

I have -- one of the benefits most of the other folks up here don't have, within our title we're water and power. So we have a nexus within the framework of our organization. We are a city department of the City of Los Angeles, the largest municipal utility in the United States.

So I'm going to quickly go through -- got it.

All right. So first up, on the power systems, just to give you a quick overview, we remain a vertically integrated utility. We own generation, transmission, and our distribution system. We serve all of Los Angeles and Owens Valley. We have about 1.4 million electric meters, 4.1 million people that we serve. We have a large thermal generation.

And what this slide shows, it shows you a depiction of a lot of our transmission system. We own or operate about 26 percent of the transmission in the State of California. Many of these go to far-off generating stations, but what you see now on this map is you see renewable-energy facilities that have been co-located and clustered around hydro facilities. So up in the Pacific Northwest we've now developed a number of wind farms up and around our point of interconnection in the Pacific Northwest. Around Hoover Dam we're currently developing and constructing about

500 megawatts of solar as well. We're the largest off-taker of Hoover Dam. And then I'll go over to some more details of our additional hydro and clustering strategies that we've put in place for renewable energy.

Our water system. We currently have 338 miles of an aqueduct from the Mono Basin, 233 miles from the Owens Valley to Los Angeles. So two major aqueducts feeding what used to be our primary water supply. This year, due to the drought conditions, about 80 percent of our water is purchased. It used to be historically at least 80 percent were delivered through our own aqueduct systems. So that's water that would come off of the State Water Project through the Colorado River. And as most Californians know, there is not water being delivered through the State Water Project down into the Los Angeles Basin this year due to the drought.

We have multiple energy-storage reservoirs in addition to tanks. We have open reservoirs within the city and we use about 215 billion gallons of water annually. But we do have one of the lowest usages per capita of any major, metropolitan entity.

What I just wanted to do -- and there was some earlier discussion about carbon intensity -- because I think that needs to be a factor considered when you're looking at the nexus of both water and energy. And what it shows is, where we were in 2013 on the blue dotted line, it shows the intensity based on our current resource mix. It shows -- and then on the red line where we are going as a utility. And most of the utilities in the state as we're changing our resource mixes and getting out of coal-fired generation, going to a cleaner fuel source, as we're looking at intensity. And so LADWP, being a water and power entity, has that ability to cross functionally, look at the strategies between the two sides of the business and look at what will optimize the reduction in carbon intensity.

So this just depicts currently we're at 21 percent 1990 levels, expected to be 55 percent below 1990 levels by 2028 for our CO2. And much of this is because of that nexus in addition to changing out of the coal strategy.

So a couple of things on operations: What can we do and what have we done related to the planning that goes on between the water and power systems?

One, we have developed a coordinated and optimized energy and capacity production strategy on the energy side that will minimize the impact to our water-filtration and water-delivery system. So they're coordinated approaches. We move water when it is optimal to generate electricity for the power side, but it also will minimize the impacts to when they need the water to move into the water-filtration system for delivery into our system.

We implement a number of cost-effective approaches using the water for our energy, backing up our renewable energy using that hydroelectric generation. I'll discuss that in a little slide ahead.

We also have a high level of solar-incentive-program participation on all water-system facilities. We utilize as many of those reservoirs, tanks, and locations to locate or co-locate solar facilities as well.

We jointly coordinate all of our energy-efficiency and water-conservation programs for our customers. We also partner with the gas company, so we deliver both the energy and the water side within the city. It's become quite efficient in looking across the board for a customer as a one source for helping them conserve both the water and the energy.

We share common right of ways. Why is that important? Because we use right of ways for transmission to also do water capture, stormwater capture, and collection for reuse.

We have an extensive recycling program and plans to continue to expand that. So using your transmission right of ways jointly with your water system so they can take advantage of that land is quite important.

We also coordinate all training and emergency response because for the City of Los Angeles and the prevalence of earthquakes, that's a very important feature.

This is going to be hard for you to see in the back. It depicts a transmission system that goes from our eastern side of the Sierras up from our Owens Gorge plant down into Los Angeles. And what it depicts is along the way of this hydroelectric transmission line that was built almost a hundred years ago delivering water, it follows the aqueducts down into Los Angeles. We have a number of reservoirs and power plants.

Our strategy has been to co-locate renewable-generation facilities along that pathway; and we're building some additional transmission that are in the dotted red line and a new station. It will be the first new system to tie extensively a large renewable region to pump storage. We have a Castaic power plant. It's a 1,250-megawatt pump-storage system. So you can see there's a number of solar projects that are currently in construction along this pathway or in potential development. There are wind farms as well.

It goes through one of the most robust solar regions of the United States, as well as the wind. So you have an opportunity here to optimize how the water is delivered. We now dispatch the water down those reservoirs when we are not generating new electricity from the renewable sources. And we are now able to -- or will be able to -- put some of this renewable energy in the pump storage when we don't need it in the city at that time.

I've got to close it up. But we provided some recommendations for policy and planning based on our own experience. We would echo many of the comments related to data collection. We've done a joint study with UCLA that will allow customers to see how they compare to all their neighbors in usage. They don't get to see the exact address, but they get to see their neighborhoods and see how they compare. It's had incredible benefits in savings as people have some peer pressure. But we've provided a number of recommendations.

We do think there are still a number of challenges out there. Some of the environmental regulations in drought years have caused some great grief. We currently put as much water on the Owens Dry Lake to keep dust mitigation from occurring as the entire City of San Francisco uses; and we do that annually every single year. So there are things that can be done and need to be done to look further at some of those activities.

Thank you.

MS. WELSH: Thanks much.

Mr. Moyer. And there may be some seat changes that need to take place here, if you don't mind. And we'll get your PowerPoint set up here in a second.

Let me remind everybody, because I'm cutting people off, that full presentations are on the Website, www.energy.gov/qer.

MR. MOYER: Thank you. Thank you for having me here this morning.

My name is Keegan Moyer. I'm the manager of transmission-expansion planning at the Western Electricity Coordinating Council. The Western Electricity Coordinating Council, or WECC, has a role in ensuring the reliability of the bulk electric system for the western interconnection. The western interconnection is essentially the high-voltage and power grid covering the 14 western states, two Canadian provinces, and the northern part of New Mexico [sic], an area of approximately 1.5 million square miles.

WECC completes its reliability mission through a number of functions. One of those functions is transmission-expansion planning; and we leverage a board-level committee known as TEPPC, which is the transmission-expansion planning and policy committee. TEPPC is a multifaceted stakeholder group that helps guide our transmission-planning function at WECC, where we focus on looking at very different but plausible long-term 10- and 20-year scenarios and evaluating their impact to the transmission system. So that process, of course, creates a number of different documents and data-sets that are used widely across the Western electric industry. And given that we strive to incorporate different driving factors within the industry, we have some inherent interest in quantifying and coordinating the impact of water into our planning efforts.

As we've talked the last couple of hours, the connection between water and electricity has been made very clear, so there's little need for me to go into that any further. But WECC's interest in this area is unique from probably two perspectives, the first of which is our regional focus. Again, I mention we're focused on a sort of overall picture of the western interconnection in that region. So I find that unique.

And also our focus on strictly the electric reliability aspect of the water-energy nexus. So, again, those two things sort of set us apart in terms of how our perspective may differ from those offered by other parties here today.

So what I'm going to talk about in the next couple of minutes is some of our past experience, some of the things we've done to incorporate water into our planning efforts and things we're looking at going forward. So our four main kind of areas of effort that WECC is pursuing as it relates to connecting water and energy are listed here.

The first one is around collaboration. Our main partners for our efforts thus far has been the Western Governors Association, the WGA. I mentioned TEPPC and the diverse stakeholder group there; and then, as of late, the Western States Water Council. It became apparent to us early on that this topic is not one that a roomful of transmission planners has the expertise or the capability to address from the electric perspective. We needed the input of a broader set and we're attempting to gather that through our collaboration.

The next effort, which I'll talk more a little bit here in a minute, is the evaluations of study cases. WECC has a significant analytical foundation to build from in this area. Specifically, we look at evaluating and studying long-term drought scenarios and varying hydro conditions. I'll talk about those in a minute, as

I mentioned.

The third area of effort is around the development of long-term scenarios. So this is creating a depiction of how a 10- or 20-year future might look considering a number of different drivers within the industry, water being one of them.

And our last area of efforts is the application of research. Through a grant made available to WECC from the Department of Energy, we've been able to collaborate with a number of national labs to incorporate water into our long-term transmission-planning tools. And so I'll give an example of that here in a minute as well.

So I mentioned some of the study work that we've performed. Here's an example of some work we did about a year and a half ago evaluating in the 2022 time frame a 10-year study on the drought impacts for the western interconnection. This study took into consideration the impacts of higher temperature, a lack of availability for generating from hydro resources, and also a lack of cooling water for thermal units. And we devised this scenario with significant input from Sandia National Labs, Argonne National Labs, and made available through federal funding. And you can see kind of the basis for this analysis here was using water basins and identifying which types of generation within those water basins were hydro-generation; at-risk thermal generation in terms of those resources could be at risk in terms of the impact from the drought; and thermal generation that was perceived to have a low risk. And so we took this information in and incorporated it into our models and studied this future scenario. And what we learned based off this first iteration -- again, we're still learning more about this -- is the impact from the lack of hydro resources sort of masked any impact that we saw from the lack of cooling water available for thermal resources. The obvious driver here is that in some years the Western Interconnection meets its load with about 25 percent from hydro resources. So that again was a big driver of our study results.

The other area of our past work that I wanted to show an example of today was the consideration of water availability in our long-term planning exercises. This work stemmed from Argonne National Lab and Sandia National Lab working to identify the water basins and the amount of water that would be available in those basins in the 10-to-20-year time frame and the amount of water use in those same basins by electricity generation. And we were able to feed this into our long-term planning-tool model. And it gave us the ability to do our generation and transmission expansion studies considering water as a constraint, meaning we were not able to add a generation -- electric generation -- beyond what was available in terms of the water supply for those resources. So, again, some early work in terms of WECC trying to focus on drawing a link between how water could impact the future reliability of the system.

Next steps for our group here is basically based around coordination. And so you can see here a large list of stakeholders that we're trying to draw into our efforts. And our first effort, again, is going to be focused on developing a plausible future scenario that considers the different drivers associated with climate change and water availability and developing studies to feed into our long-term planning models.

So with that, my comments are submitted to the Department of Energy. And I think I'd be happy to take any questions once we conclude.

MS. WELSH: Thanks very much.

All right. So everyone can come back to the table. And I'm having a hard time seeing who is next, but I believe it's Mr. Schmitt. And welcome. The floor is yours.

MR. SCHMITT: Thank you.

MS. WELSH: For only seven minutes. And I'll be cracking the whip.

MR. SCHMITT: Thank you. I'm Eric Schmitt, vice-president of operations for California ISO. And we're responsible for balancing electricity supply and demand in about 80 percent of California. We do that by way of sort of security-constrained economic dispatch model which is long for the optimized resource in the market given transmission systems and a portfolio of resources which includes -- certainly includes hydroelectric.

So let me just give you a couple of numbers, at least for our system. It's a long-standing really historic relationship that California has enjoyed with hydroelectric or energy and water. And in any given year that contribution from hydroelectricity can be between 12 and 15 percent of all the electricity that we use and bring to the marketplace. Obviously, in drought years those numbers can be lower. And there also can be local considerations versus system considerations, so those numbers are system-wide. But some 14,000 megawatts, about 400 hydroelectric plants of varying sizes in the system. And Cal ISO dispatches about 60 percent of that, so that's -- if you do the math, it's about 8,400 megawatts or so.

And the breakout is, with the four big players, Pacific Gas & Electric has the most resources, almost 5,000 -- and this is installed capacity or potential -- about 5,000 megawatts. Southern California Edison about 1,200, San Diego about 45 megawatts. And then we heard from CDWR earlier and they have about 2,000 or so megawatts.

So those megawatts are available to us. There's various types in terms of their characteristics. The large reservoirs can give us longer run times on hydro and some flexibility. Pump storage can give us the maximum flexibility. You'll hear me use the word "flexibility" quite a bit. I think that should be the takeaway, because the portfolio of energy use, supply, and consumption is changing dramatically. I'll talk about that a little bit later.

But the need for resources that can start quickly, that can ramp significantly is mounting; and it's really at our doorstep. We're living those needs, those characteristic needs. So hydro resources are more valuable today than they've ever been from a pure energy point of view.

We heard from, again, California Department of Water as they talked about their aqueduct system. And I just want to highlight that, because for decades, again, it's provided us with this sort of flexibility. While it consumes a lot of energy, it generates a lot of energy. And there's multiple generation opportunities across that 700 miles or so of aqueducts as it moves water south and then up over the mountains 2,000 feet and then of course into the southern part of California. And it gives us an opportunity to really tune the system realtime. Sometimes we need more supply. Sometimes we need more demand. And that particular piece of infrastructure has provided a lot of value in that regard.

In emergency response these kinds of resources prove to be critical. And indeed in our analysis we build in assumptions about how these resources would react if we need supply quickly or demand quickly. So important resources.

Let me talk quickly about the drought. And this is really a near-term perspective, not a five-year or ten-year perspective. We're in a long-standing drought. But for this year the bulk electric system in California, we don't anticipate any reliability issues. The drought does have an impact in our modeling. We've de-rated hydroelectricity by about 1,300 megawatts in a typical scenario. In an extreme scenario, which is what we call a one in ten or a ten percent chance of extreme weather conditions and so on, it's derated at about 1,600 or 1,700 megawatts. But even with that, our reserve margins are adequate. One of the main reasons for that is our renewable resources have increased dramatically, particularly solar. And it's helped to offset some of that hydro loss during this drought period.

Again, flexibility. In many of the ideas we've already heard, I think our grid -- and there's a graphic in my handout you can take a look at -- we refer to it these days as the "duck chart." And what the duck chart does is it takes a typical, let's say, spring day when our lows on the system are low. And it analyzes net load conditions, so that, if you backed out the wind that you would expect during that period and the solar during that period, it gives you a load curve. The message from that is we have very steep down-ramps in the morning and very steep up-ramps in the afternoon, because the sun comes up, we use that energy. Conventional resources need to back off. They go into sort of an idle load, if you will, and then they need to ramp back up in the afternoon when the sun goes down.

So opportunities for flexibility as those steep ramps get steeper and steeper are essential. Hydro plays a role in that. Demand response plays a role in that. Energy efficiency plays a role in that. Renewables. So the mix in our peaking in our use of resources is absolutely changing.

And so as the water folks begin to look at either infrastructure improvements or mitigations or even new infrastructure, they should absolutely consider this changing profile.

The availability of electricity -- for the first time in really the history of some of these hydro plants they're actually pumping during the day. So they were designed to pump at night when electricity was plentiful and cheaper and then generate during the day when we need the load. But under the changing profile of our system, we actually have an opportunity for over-gen situations where pumping with hydro resources can help. So if you're designing or modifying a water-treatment facility and you recognize these changes in availability of energy, then you can design in technologies and storage capabilities and flexibility in your process to really capitalize on the availability and cost of energy going forward.

So that's my key message. I'd be happy to take any questions. Thank you.

MS. WELSH: Thank you very much.

Okay. Our next speaker is Mr. Livingston.

MR. COATE: Alex Coate.

MS. WELSH: Alex Coate. Okay. I'm sorry. I cannot see the name plates, so I'm going by the agenda, which is all messed up. So pardon me. I apologize. Mr. Coate, please.

MR. COATE: No problem.

Well, thank you for the opportunity to address this energy review task force. My name's Alex Coate and I'm the general manager of the East Bay Municipal Utility District. We're headquartered in Oakland, just across the Bay. And we supply drinking water to 1.3 million residents in the East Bay and the greater parts of Alameda and Contra Costa County; and we provide wastewater-treatment services to 650,000 customers with our wastewater-treatment plant at the foot of the Bay Bridge.

We deliver an average of about 161 million gallons per day of water -- drinking water -- to businesses and residents in the East Bay. And, next to labor, energy is our highest cost. And it's our highest cost even though we have a well-designed system that optimizes the use of gravity to move water from the Sierras to the East Bay. And that system also has a very high-quality source of water that allows us to sort of pass all the state and federal drinking water regulations with some very low energy-intensive treatment processes.

And across California the average amount of electricity used to deliver a million gallons of water is on the order of 7,000-kilowatt hours. And in normal water years, East Bay MUD uses about 1,250-kilowatt hours, or about 80 percent less than the average California utility. Part of that is the way the system is designed. It's gravity-fed all the way from the Sierras to the Bay. And part of that is what I'm going to talk about.

East Bay MUD's been focused on energy and water issues and the nexus between those for many years in order to do us right, which is to control costs and to reduce the amount of new supplies that we need to develop and in so doing meet our board's policies in the areas of sustainability and energy. To minimize energy use, we promote aggressively water conservation and optimize our operations to conserve energy. Our board adopted a water-conservation master plan. We started doing that in the late '80s and we had a plan that went to 2020. More recently we have a plan that guides our conservation efforts to 2040. And the plan includes both supply-side and demand-side measures. And on the demand side, the measures improve water efficiency through rebates and other incentives, education, outreach, market support, and regulatory programs. We also have long-standing partnerships with water-agency peers and investor-owned utilities, such as PG&E to my left. East Bay MUD's been involved in water-energy-efficiency research, as you heard from Dr. Loge; and program implementation at the consumer level.

We try to make new development water-smart from the start. We require new water-service customers to meet rigorous indoor and outdoor water-efficiency standards for plumbing fixtures, appliances, landscaping and commercial operations. And our efforts address not only conservation savings but energy-resource efficiencies.

As Dr. Loge mentioned, we have a very complicated system. It has five water-treatment plants in the service area. Each one is capable of treating a different quality of water. We have 4,200 miles of water-distribution pipeline. That's enough to go all the way from here to D.C. and then back to Chicago. We have more than a 130 water-distribution pumping plants, because there's a lot of topography in the area and some steep hills, so we've got to move it up and let it go down.

And so we optimize our operations to try to minimize what it costs us to move that water around. We try to use the lowest-cost water-treatment plants where possible, meaning that we use Mokelumne supplies, which are purer than local supplies which have local runoff to the degree that we can. We shift our pump operations to off-peak hours and we've been participating for a long time in demand-response programs to get off the grid when the cost and demand is high and get back on in the off hours. And we have pumps of varying ages and efficiency; and we try to use the most efficient ones first. And, of course, we invest in energy-efficiency improvements.

So there was some discussion earlier about energy curves. We call it loading order for water supplies. And while obviously we're driven to use the lowest-cost supplies first to draw on conservation as much as possible, discussion around dictated loading orders, which would drive us or reduce the flexibility that we have, need to be sensitive to the fact that we have very complicated systems and not all our water can even reach all the parts of our service area. And so it's important to consider that we have site-specific, geographically based constraints that need to address water quality, reliability, the kind of infrastructure that we have, and our operations.

We are working very hard to produce as much renewable energy as we can. We have hydro, bio-gas production at our wastewater facilities and solar power production. We are producing hydro at a couple of facilities up in the Sierras on our reservoirs; and we've been doing that for about 80 years and we produce about 185,000 megawatt hours of electricity annually, which comes over a period of just three or four months primarily. But in total that's more than all of the power that we use to move the water over the course of a year in the service area.

On the wastewater side of the house, we have a fairly state-of-the-art facility where we collect all sort of food wastes; and that allows us to generate more than 55,000-megawatt hours of energy.

So in closing, I would say that there are several areas we'd like to get the Department of Energy to focus on -- advancing awareness, improving data collection and metrics, promoting incentives for water-energy efficiency programs, and expanding public funding for public and private partnerships. And in particular -- and I think maybe Mr. Herberg will be able to talk about it -- we'd like to see investments in wastewater treatment methods and technologies.

Wastewater has the opportunity to -- it's the end of the hydrologic cycle and it has the opportunity to generate a fair amount of energy to contribute to the grid.

So thank you again for allowing me to share our experiences.

MS. WELSH: Thank you.

Now, Mr. Livingston.

MR. LIVINGSTON: Good morning. Thank you for the opportunity to address the task force. My name is Randy Livingston. I'm vice-president of power generation for Pacific Gas & Electric. And I'm an East Bay MUD customer.

PG&E is one of the largest combined natural gas and electric utilities in the country. We're headquartered here in San Francisco and we provide natural gas and electric service to approximately 15 million people through a 70,000-square-mile service area. We also own and operate the nation's largest investor-owned hydroelectric system, covering 17 river basins stretching over 500 miles.

Along with our hydro system, we have a series of modern, efficient combined-cycle and reciprocating-engine plants to support customers. And those are all air-cooled facilities so they use about three percent of the amount of water that a more conventional plant would use.

So we have pretty firsthand knowledge. We have hydro systems that's been around for, in many cases, a hundred years and has experienced many of the droughts of the past, some worse than what's happening now. Also experienced some very robust years of rainfall and been able to try and operate and still provide customers through that.

So really nowhere is the energy-water nexus kind of more realized than inside of a hydro plant where the -- you might call it the water-energy-gravity nexus that really happens within there. But it's, I think, an important part of the overall consideration of what the task force is looking at.

Roughly three percent of this nation's dams have hydroelectric production on them. I think there's great opportunity to look at how the energy that falling water is used and really look at opportunities for smaller hydro on some of the conveyance and other facilities to capture some additional energy.

I think part of what needs to be looked at that is how that licensing of those facilities and the permitting of those facilities goes forward in a way that both addresses the environmental needs but also is not such an impediment to entry that facilities cannot be built because of the high cost versus the smaller plants.

As I think about the water-energy nexus in our -- in the western states in the '30s through the '50s, the whole grid was interconnected in a way that electrons now flow generally from their point of production to their point of use in the most direct path they see. And certainly not so with water in this state. We pump water from all the way -- or bring water all the way -- from the very north to the very southern part of the state. In the Bay Area we see the east-west and we even flow water all the way up the San Joaquin only to pump it back to the same place where it came from. So trying to think of the efficiency of water use and finding ways to better integrate savings. It's very -- as was pointed out -- very heavily dependent upon where you are in the state for the potential water and energy savings that you're going to get. And I think that programs that are designed need to look at that.

I think within the electric industry for the investor-owned utilities in this state, the California Public Utility Commission, as we're looking at improving energy efficiency, had the foresight to de-link returns from overall production or overall consumptive use. And

I think that's one of the struggles, that a lot of these systems are fixed-cost heavy. Consumption is fixed-cost heavy. And having rates that are all based on incremental use creates a challenge in terms of incenting conservation in the way that it's happened in the electric industry.

I think there's been many points that are covered that I all agree with completely. I think some of the things that the task force may want to consider as we look at the western system is a very high percentage in certain years of our total storage for water comes in snow and really understanding the impacts of climate change and snowpack as it affects water-supply issues. Certainly within the hydro systems, they're not consumptive use. They do, though, feed at different gravity elevations, consumptive end-users in many cases with our hydro systems that provide the flexibility that Eric was talking about. Those are higher on the hill and generally feeding the large state and federal rim dams that are the primary source of consumptive use in the state; and we need to understand the interrelations. Storage in, for instance, PG&E's system, our total storage of the entire hydro system that we have would really fit completely in New Melones reservoir. So overall water storage is relatively small. The total useable storage is actually much less.

I think just a couple of other things is, you know, just in the western states, endangered species -- salmon, steelhead, delta smelt -- all have a big impact on the energy-water nexus and how we look going forward.

So thank you for the opportunity to address the task force.

MS. WELSH: Thank you.

Mr. Herberg.

MR. HERBERG: Thank you. I'm Jim Herberg, the general manager of the Orange County Sanitation District. And I'm thankful for the opportunity to participate today.

A little bit about our agency, the Orange County Sanitation District. We operate regional wastewater collection and treatment facilities serving two and a half million people in central and northern Orange County. When we talk about treatment plants, today in our industry we call them water-resource-recovery facilities, which I think is much more accurate to describe what we do. At our facilities we really produce three products. We produce clean water for recycling. We produce energy. And we produce biosolids for agriculture.

We generate about 11 megawatts of electrical power. That's enough to meet two-thirds of the needs of our treatment plants' energy demand. We also have a project going on right now that's just closing off. It's a three-year pilot project. It's a public-private partnership with help from the Department of Energy, FuelCell Energy, the National Fuel Cell Research Center, Air Products Corporation, the California Air Resources Board, where we are generating hydrogen fuel from the bio-gas in our treatment plant, actually fueling hydro vehicles. We have a fuel dispenser at our plant. We're near a freeway. And that has been a successful pilot project that is just winding down right now.

Also, on the water side, in partnership with the Orange County Water District, we're currently recycling 70 million gallons of purified water per day to replenish our groundwater aquifer. And this is enough new water to meet the needs of a population of over 600,000 people.

Biosolids. That is beneficially reused as well by conversion to compost and for land application. And when you land-apply with biosolids, you reduce the use of water for crops that are needed and increase the production by over 30 percent. Again, the term "water-resource-recovery facility," I think, is more accurate than "sewage-treatment plant."

How can we fit in to help the goals of the State of California and the nation? Well, wastewater utilities produce renewable energy that can help meet climate-change goals. The wastewater community through its statewide association of California, the California Association of Sanitation Agencies, has actively engaged its partners within the state to fulfill some of the goals to mitigate climate-change impacts. Providing 33 percent of the state's energy needs from renewable sources, reducing carbon-dioxide-equivalent emissions to 1990 levels, reducing carbon intensity of transportation fuel used in the state by 10 percent, and recycling 75 percent of solid waste generated in the state are all things that we can work toward in the wastewater industry. Most of our wastewater-treatment plants use the anaerobic-digestion process which produces bio-methane, as I mentioned earlier. The majority of the wastewater-resource-recovery facilities generate between 40 and 70 percent of their energy needs on-site from this.

Alex mentioned the East Bay Municipal Utility District's process, where they're actually bringing in waste -- organic waste -- and adding them to the digestors. That generates even more greenpower as well.

It can also -- in addition to the hydrogen example that I gave, the methane produced in the anaerobic digestion process, or at least a portion of it can be converted to a low-carbon intensity transportation fuel.

In California, there is a problem though that has come up where some of the smaller plants are required to meet the same stringent air-emissions standards in the South Coast Air Basin in Southern California as the larger plants. These controls are expensive, especially for small and medium-size facilities. And there's a concern that some of these smaller plants might forego generating power with their bio-methane and have to flare it off because of the expense of meeting those requirements. I think this is a place where a grant funding would be an opportunity to help with that.

Water recycling can save energy and help reduce greenhouse-gas emissions. In California we've heard that there's an estimate that 20 percent of the state's electricity demand is used for the transport, treatment, recycling, heating, consumption, and disposal of water supplies. Water recycling can reduce this demand, as we've illustrated with the groundwater-replenishment system in Orange County. The production of water -- recycled water -- that goes through microfiltration, reverse osmosis, and ultraviolet light treatment only requires about 1,500 kilowatts per acre foot of produced water. Now, when you look at Southern California, that's contrasted with 3,000 kilowatt hours per acre-foot of water to move water from the State Water Project down to Southern California. So it's actually less energy-intensive than importing water.

And, finally, biosolids usage can help mitigate climate change. We use it in agricultural and horticultural settings. And by avoiding the use of fossil-fuel-intensive inorganic fertilizer, roughly about a quarter of a gallon of fossil fuels required to produce a pound of in organic nitrogen fertilizer. When we use biosolids, we offset that need.

And, finally, in closing, if we've learned anything from our varied efforts here to leverage the embedded energy and resources in water and wastewater-treatment processes, it's the partnerships that matter. We couldn't have done what we did with the hydrogen fueling station without the technical and financial collaboration of the federal government and the private sector. Similarly, our partner agency, the Orange County Water District, was successful moving forward with the country's most advanced water-recycling program with significant support from the U.S. Bureau of Reclamation. All of our shared experiences show that the federal government must address energy and water nexus through meaningful collaboration among federal and local agencies; and we stand by ready to help.

MS. WELSH: Terrific. Thanks.

I'm going to let Dr. Holdren ask the first question.

DR. HOLDREN: Well, thank you.

This was certainly a set of presentations from people who know something about the on-the-ground realities of infrastructure in both the energy and the water domains and in many cases their interactions. Again, I took a lot of notes.

The single question I'd like to ask is everybody's been emphasizing the importance of partnerships. That was a theme in the previous panel. It's been a theme in this one. I'd be interested in your thoughts about what single thing the federal government could do to be a better partner for you in the energy and water space. One -- one thought each for what we could do from the federal government side to be more useful and effective for you as a partner. Just run down the table, starting at the end.

MR. HERBERG: One thought would be to continue funding with the WaterSmart program.

DR. HOLDREN: Okay.

MR. LIVINGSTON: Continue funding the hydropower research program in DOE.

MR. COATE: Continue investing in research and, in particular, research in new anaerobic digestion techniques.

MR. SCHMITT: I think technology initiatives are very important.

MR. MOYER: I think, again, on the funding line, focused on the national labs and their unique position, I think, to analyze both water and energy issues.

MR. HOWARD: I'm going to agree with everybody there, but I would say put the resources on some of the permitting aspects. We still struggle with the timelines related to the federal permitting to support some of the efforts in trying to get this nexus moving forward.

DR. LOGE: And I'd say increase focus on information technology within the WaterSmart program.

DR. HOLDREN: Terrific. It was great. Thank you very much.

MS. WELSH: Let's continue along that, 'cause

I'm wanting more from you. You all were invited here because you're the innovative-solution guys on the ground. Several of you talked about incentives. And the task force would like to look at what kind of market or financial or other incentives would help shape the energy-water nexus to bring us to the innovative solutions that we need to get to.

So do any of you have comments on what the appropriate incentives should be from the federal government in this space?

Dr. Loge.

DR. LOGE: I'll start. You know, I don't really -- I don't think there should be incentives. I think there's a strong enough business case for having companies either start up or refocus their current efforts or have startup companies start focusing in this space. I think the big challenge is making the information available to these entities so they understand what the business case is.

And someone said in the prior panel you can't manage what you don't understand. I completely agree with that. Right now we have a tremendous amount of data, but we don't understand what it means. I mean businesses don't understand what that data means, such that they can't then invest in this market.

MR. COATE: I'd say we regularly evaluate renewable and alternative energy approaches -- ways to save energy. And, you know, we do a business analysis. We look at a 20-year life-cycle cost. And there are lots of things out there like in-conduit hydro, other things, where it doesn't pay back in 20 years, but it makes sense to do. So it would be helpful if the federal government were providing incentives that help us bite down and get into those things. And in so doing that provides experiential basis for improving those systems and maybe bringing the cost down over the course of time.

MR. LIVINGSTON: If I was to -- I would agree that I don't think incentives are necessarily the right way to get to the end point we want. We want these technologies to stand up on their own. But this is a very heavy permitting and up-front cost business, both water and energy. And trying to find ways to have some of the small developments be able to make it through that process and to be able to interconnect to any local distribution or transmission in a more facilitated, quicker process, especially the early adopters, I think would be a faster, better, cheaper way of getting there. Obviously, we need to, through that whole process, preserve the important environmental reviews that go through that, but do that in a way that can help streamline for some of the early adopters.

MR. HOWARD: I think one of the things that we have determined is some of the energy produced from hydroelectric facilities is no longer as valuable as it used to be, but the capacity is extremely valuable, meaning to ability to back up as we're moving to this greater renewables world in meeting our reliability requirements, having that hydro capacity. I think the Department of Energy really could assist, instead of financial incentives, some of the incentives they could offer related to their hydro facilities to support more of the efforts to back up the intermittency issues would provide significant value and help us transform more of our resources into renewables if we had that ability.

MS. WELSH: Okay. So I asked this of the second [sic] panel. And I'm going to ask it of you all as well. The task force is grappling with what their role should be in this, because so much of this is state and locally driven. What is your one recommendation to the QER task force on what the federal government's role should be in the energy-water nexus that we haven't already talked about?

So I'll start here and -- Dr. Loge. And then we'll go down the table. What's your one recommendation?

DR. LOGE: I sound like a broken record, but I really do feel strongly about this. It's to help initiate the integration of water and energy data together so that then all sorts of thing can happen, many of which we probably don't even understand right now because it hasn't been done. But once that -- once that information gets integrated together, I think, you know, the business case will be made for many, many activities in this sector. And it could be driven largely by state, local governments and the private sector in partnership with these entities.

MS. WELSH: So are you -- just to dig a little deeper -- are you recommending R&D into data analytics? Are you recommending funding to academia to do the data? What specifically when you say "integrating data"?

DR. LOGE: So I think much, if not all, of the IT infrastructure and architecture exists to already do this. I think what the big -- right now water utilities energy utilities don't understand how to integrate their data together very well; and they don't understand the value of doing that. So I think -- I think anything you could do to help them initiate that conversation --

MS. WELSH: Okay. Thank you.

DR. LOGE: -- and that's why I keep coming back to the WaterSmart program. One way to help initiate that is if you offset the cost by 50 percent and then they each come to the table with 25 percent of the overall cost. Now suddenly you're -- at least, I'm assuming that you're developing more of a case for water and energy utilities to start to work together. I think once they start doing that, they will understand the value of continuing do that.

MS. WELSH: Thank you. Thank you.

Mr. Howard.

MR. HOWARD: So I'm going to go back to, I think, the federal facilities, the power-generation facilities of the federal government and just the integration to work with the other utilities on more of this energy-water nexus and especially those hydro facilities that are available through the federal government.

MS. WELSH: So you're referring specifically to the power-marketing administrations? Yeah. Okay.

MR. MOYER: I suppose my recommendation -- we've heard the need for data and remote sensing -- these things. Mine's going to be slightly different. My recommendation for the role of the federal government to play in supporting this issue in the West is around providing a forum, or at least the financial support for others to provide a forum, to bring the appropriate parties together from both the electric and water perspectives, because frankly right now there isn't a place where that's supported. And I'm not just talking about the electric utilities and the municipalities. There's the tribes, the nongovernmental organizations, those that need support in order to participate. We've had success at WECC in doing that in transmission planning, giving people a seat at the table that don't typically get one, and I think there's an opportunity to have that when you talk about the water-energy nexus as well.

MS. WELSH: I know that the Department of Energy is quite sensitive to bringing opportunities for those who can't afford it and have done it in many other forums, so we'll make sure they hear.

MR. SCHMITT: My thoughts center on renewables integration. And most of you know that in California we have a 33-percent RPS requirement by 2020. We're well on our way to that. We'll absolutely make a 33 percent renewables penetration. In fact, on some spring days we've seen north of 30 percent renewables penetration. Now, that's not on average.

So I say that again because the business is changing, right? The electric business is changing.

And renewables penetration is one of the main factors changing it. But demand-response, energy, efficiency, storage -- all those things together -- require all of us -- the federal government, the state agencies to understand this shift. So to the extent that there's silos either in regulatory space or policy space between water and electricity, we need to at a minimum appreciate the shift. Business as usual for the last hundred years is over. It's over in the electric space. And so that's going to drive things in a way that we've never seen before. So that's what I would suggest that we do.

MS. WELSH: Excellent.

Mr. Coate.

MR. COATE: So this is going to sound rather simple. But I think an area that the government can assist in is to really advance awareness of the water-energy nexus at all levels. We're pretty well aware of it here in this room. But our surveys indicate that many of our customers don't even know where their water comes from. They take infrastructure and utilities for granted. And so to the degree that the federal government can bring, as others have suggested, the right people to the table, they also need to help everybody understand that this is an important area that we ought to be paying attention to.

So thank you.

MS. WELSH: I think my colleagues would agree that one of the roles of federal government is their convening power. And so we take that to heart and we'll take it back to the right folks.

DR. HOLDREN: Great.

MR. LIVINGSTON: I agree that a lot of this issue is heavy in the state and local jurisdiction or use. But I think in participating on things like some of the DOE peer-review forums, I think the federal government can bring together the different federal agencies that have a very targeted role in all this to help look at a bigger role that they together can impact often. Certain agencies might be a single-resource look. And none of these issues are single-resource look. And the more that they can bring together, how can we get hydropower production off of the Corps or Bureau of Rec dam that might not exist? Or how can we look at the release of water from a facility in terms of how it can help the issues Eric's talking about? As far as cycling and not just a pressure-reduction valve on the back end of the facility, we can really enhance that view of the world and probably break through some of the problems.

MS. WELSH: Well, and not to toot our own horn, but this QER process involves about 14 to 15 federal agencies. So hopefully we're doing that within this process, at least partially.

DR. HOLDREN: Excellent.

MR. HERBERG: I was going to talk about breaking down silos, but I would be the third person to do that. So short of that, I'll say that, you know, for utility -- and a local utility in particular -- there's a lot of new technology coming up in the area of solids treatment or digestion and the ability to extract energy in different ways. And with a lot of new technologies coming out, it's a big risk for a local agency to take something on that's not fully proven. So to the extent that the federal government can help partner with us and build partnerships to spread some of that risk around to provide some funding, we would be more willing to try new technologies.

MS. WELSH: Terrific.

Thank you all. Let me turn it over to close our session and maybe ask a final question to Dr. Holdren.

DR. HOLDREN: Well, thank you. I do have sort of a combination of a question and a comment. The QER has, as one of its major focuses in this year where it's looking at infrastructure, the question of how climate change is impacting and will continue to impact going forward our various energy infrastructures and related infrastructures. And that is also, of course, a theme of a separate interagency council which I co-chair with the CEQ chair and the head of Homeland Security and the National Security Council, which is the Interagency Council on Climate Change Preparedness and Resilience.

I'm just wondering to what extent you folks in your responsibilities are already looking explicitly at the ways in which climate change is influencing or is likely to influence your operation and your infrastructure going forward. And to what extent, given that you're already doing some of that, are you also engaged with each other in sharing notes and sharing best practices and how to address that particular challenge?

MR. HERBERG: I know that in the wastewater industry there already are groups together talking about climate change and the impacts. And just to tell you about three ones that come to mind real quickly is a lot of us have facilities in coastal areas, low-lying areas that -- critical infrastructure near sea level. Obviously, sea-level rise is a concern.

With change in climate, if we have stronger storms over shorter periods of time, higher intensity but less frequent on water and wastewater area flooding and being inundated with water during these short high-intensity storms is something that we're looking at as well.

And if we have a really hot summer this year with low reservoir levels we'll be monitoring the Cal ISO Website very closely because we need the power.

MR. COATE: And a from a water agency perspective in California in this dry year, I can say that we've been engaged in climate change, as it's critically important to us to understand it for many years now. And we're obviously that it impacts snowpack. It impacts demand. And the sea-level rise impacts the low-lying facilities; and it also impacts facilities in the Delta that are critical to moving water from east to west. So we've done lots of work to try to increase our reliability, but -- and we are participating at the federal level as well. But additional efforts in those areas to help us understand the impacts on hydro generation would definitely be helpful.

MR. LIVINGSTON: Certainly -- certainly within our organization we're continuing to look at climate change, its impact on hydroelectric production, and so on. We have -- we have a system, fortunately, that's designed for pretty big annual variability. So for some time to come, while there's a directional change that we definitely see, the change is within our normal -- within the seasonal variability. I think it's also, just in terms of what we look at in terms of snow versus rainfall versus storage, the storage of water is something that is going to become increasingly important.

MR. SCHMITT: While I mentioned earlier that, at least in the near term, the drought is not having significant impacts on supply, there's one area in our business that is very acute. And that is around fires, especially here in California, and the threat that those fires have on transmission systems. So without regard for our reserve calculations and analysis and so on, we all know that it's an ever-present danger. They can flare up quickly and they can cause problems on the system. So, indeed, these conditions are a consequence of climate change. And they are with us today in real time.

MR. MOYER: At WECC we're sort of organized to evaluate and study and develop climate-change-oriented scenarios sort of based on two different perspectives, at least the way that I see it. It's the direct impacts from climate change. Those are those drought-type scenarios that may influence weather. And we're putting together the tools and models to look at those. But then there's also the sort of policy impacts, those policies being driven to thwart climate change and evaluate in those policies as well. So we kind of see it as the direct impacts and the indirect impacts of that issue and the need to study both of them.

MR. HOWARD: So I think being in California, the state has done a good job coordinating with many of the utilities. I would echo some of our greater concerns with fire during climate-change conditions. We've looked at that. We're changing what might our reserves need to be to keep our system backed up because of the contingencies related to a transmission-line-type outage. Because of fires, we're making substantial capital investment in more reclaimed-type activities to ensure that we're capturing as much water as possible that does fall and reusing that water and then looking aggressively at how we can do storage, because we're seeing those impacts of the storms will be of greater intensity, maybe less frequency. We need to capture it when we can and make sure that we have a place to store it going forward, so we have been putting together integrated plans to do so.

DR. LOGE: I don't run a utility, so I can't answer your question from that perspective. But very broadly speaking, the California Water Plan updates that the State of California puts out every five years, they are based on data that they collect from water utilities. And then California Department of Water Resources in turn uses that update to do strategic water-resources planning within the State of California. If you talk to people who are part of that process -- and, again, I don't work for DWR -- I'm not speaking for them, but this is the impression I get -- is that the quality of data is -- it could be improved greatly. And if the data were improved, it would help California DWR make more strategic plans for water-resources management in the State of California.

So drought -- you know, it's the ups and downs and the peaks are getting more pronounced with climate change. But with better data, they can do better strategic planning to anticipate what's going to happen with those peaks.

DR. HOLDREN: Great. Well, thank you very much. It's been a very informative panel.

One further plea I would make. I think going forward, all the way across the country, our states and our cities are going to need increasing analytical help in thinking about how to address the wider problems of infrastructure and climate change that they're going to be facing. I think, for example, when you look at the new EPA-proposed regulations for existing power plants, there's a large amount of flexibility for states to figure out how they're going to deal with that. There are a number of different ingredients that can be brought to bear. This is a plea from me for your engagement, all of you, with the state planners who will be figuring out how California can best do that.

My sense is that California is ahead of most other states in the degree of engagement that already exists between the folks who run the energy and water infrastructure and the state authorities. But I would just urge you to continue to be attentive to that interaction to that particular partnership. And I would say that, with respect to cities, what we know and what we emphasize in the national climate assessment and in the climate action plan is that measures for preparedness and resilience and adaptation mostly take place at the local level because impacts are by their nature local and diverse across different localities.

And, again, I think our cities, our mayors, our city planners are going to need all the help they can get going forward from entities like yours. So, again, I would just urge you to continue to do even more of what I know you've already been doing, which is to interact very closely with city officials as well.

MS. WELSH: So with that, let's give this panel a great big round of applause.

[Pause]

MS. WELSH: Well, now we come to the important part of the meeting; and that is hearing from the public. As I reiterated several times today, the QER task force led by the White House and DOE as the executive secretariat is extremely interested in hearing from individuals and organizations.

We only have three people who signed up to speak today, unfortunately. But I want to encourage everyone who is in the room and who is watching us by live stream to submit written comments. We do read every single one of them. They are assessed and considered and will be part of the analysis that goes into this first year's report.

But for today I want to ask our first speaker Juana -- am I pronouncing your name right -- Tietze.

Juana, are you here? Okay.

We will move on. That person did not wait till the end.

Walter Robinson.

MR. ROBINSON: Thank you. Thank you for this opportunity for letting me speak on this environmental issue. I come from one of the stakeholders that you're probably surprised that I'm here. And I'm with the Laborers International Union of North America, which I'll refer to as LIUNA moving forward.

And along with building and highway construction, our core work includes energy and the water sector. Our members work in conveyance and treatment of water as well as the building of water-management systems. They also work on all facets of energy infrastructure from oil, natural gas pipelines, nuclear and renewable energies.

LIUNA's interest in water and energy includes alternative water-source projects, including desalination plants. Here in California there's one in construction in Carlsbad and one that may be on the way in Huntington Beach.

With the ongoing drought and climate change, fresh water has become a precious commodity. Conserving water is important, but converting salt water and reusing water are also essential to continue provisions of the water supply, even our energy production. Plus, renewable energies can be used for salt-water desalination, either by producing thermal energy required to drive the phased-change process or producing electricity required to drive the membrane process.

As for renewable energy projects, LIUNA members recently played an essential part in the Orchard Solar Forum Project in Imperial County. The Imperial County project -- the solar project -- Imperial Irrigation District now receives the energy's off-take.

We also benefit from hydropower both in construction and in the maintenance process. But due to the drought, less watter may be available to generate hydroelectricity. LIUNA, therefore, understands the interdependency of energy and water on practical levels.

Further, we are acutely aware of additional impact climate change and other competing demands is having, increasingly limiting our resources. While we anticipate continued priorities and varied approaches to addressing the water-energy nexus issues going forward, we would like to make it clear our need for a commitment to the allocation of water and energy infrastructure funds necessary to effectively resolve its issues. Specifically, private partner. We recognize and are receptive to the growing role of private financing -- specifically, private/public partnerships and providing additional funding for much-needed projects. When structured properly, they can be very beneficial. With members in both energy and in the water sector, LIUNA clearly has a stake in this nation's continued ability to provide clean, affordable energy and water. We believe our skilled workforce and our commitment to this country's infrastructure needs are part of the solution and ensure the success of our nation.

I thank you for the time.

MS. WELSH: Thank you.

James Farrow, your five minutes, please.

MR. FARROW: Good afternoon. Yeah. Thank so much for the opportunity. My name is James Farrow. I'm with The Energy Coalition. I just wanted to say thank you for being here and for putting this together. I appreciate the efforts on behalf of the Department of Energy to hold this Quadrennial Energy Review. And while I wasn't exactly familiar with what the process for the energy review was going forward, I was sort of notified of this recently of this meeting. So I will provide formal written comments on behalf of my organization as well as the Southern California Regional Energy Network --

MS. WELSH: Great.

MR. FARROW: I work on behalf of the water and wastewater agencies in Southern California to help them with energy projects. At the same time I do work on the water-energy nexus trying to identify the embedded energy in our water supply and how water-efficiency measures can actually result in energy efficiency.

A couple of comments I wanted to make today based on the conversation we had, was that I do believe, like many folks from Orange County Sanitation District and East Bay MUD have demonstrated, some of these larger agencies are very capable of reducing their energy demand through a long-term process. The other, smaller agencies out there just physically do not have the capacity or the technical expertise to really approach energy management as these two exemplary agencies have over the past decades.

So I would encourage the Department of Energy to really focus on training for an energy curriculum, if you will, for training of the water and wastewater operators. Really think about making energy integral into what they are learning as they go through their career advancement developing skills to operate our complicated wastewater facilities, or water-treatment facilities.

At the same time I think we need to really focus on bringing new technologies from other sectors into the water and wastewater space. These plants that I work with, specifically in Southern California, were designed in the 1970s and operate much the same -- many of them operate much the same -- as when they were designed. The technological advancements in other sectors are available to the wastewater facilities and water agencies.

Finally, I think there's not quite enough emphasis on stormwater management and how we as a society could look at stormwater as a resource to help reduce our reliance on other sources of water, at the same time to reduce energy demand in groundwater pumping. A lot more to come on that from my behalf.

And I think the only other thing that wasn't really mentioned today was the food nexus here to the water-energy-carbon nexus. We do export lots and lots of food; and essentially it's virtual water marketing where we're exporting our water resources in many cases that don't make economic sense if we look at it holistically as a country and as a state in California.

So I just want to say one final piece. I would encourage the Department of Energy to extend funding for the Industrial Assessment Center. I find the partnership that has been helped -- I've been helped to form this partnership through my colleagues at the EPA Region 9, who have helped me to work with the IAC to do -- to fund some of the audits with the water agencies that I'm working with. I think that kind of partnership right there needs to really be extended and just should be commended for building that kind of program that water agencies can take advantage of. So thank you for that, folks.

Appreciate your time and good luck.

MS. WELSH: We look forward to receiving your written comments as well.

Judith Iklé.

MS. IKLÉ: Hello. I'm Judith Iklé and I work for the California Public Utilities Commission. And I also didn't prepare remarks on behalf of my organization. Of course, Commissioner Sandoval participated; and we may, you know, submit something else in the future.

I just wanted to talk in terms of our experience working with DOE on the smart grid. DOE actually reached out through NARUC to provide grants to public utilities commissions to help them deal with the additional workload associated with the smart grid under ARRA. Our grant was started in 2009. And, of course, all of these ARRA grants are ending as well as the work at TEPPC that was also ARRA-funded.

So in terms of considering whether in order to draw in the utility commissions, which in our case we regulate most of the energy production in this state -- over 80 percent of the energy consumers' electricity, but also 14 percent of the private water companies -- whether you can consider providing support to public utilities commissions who are going to take on this additional work and break down our silos and that sort of thing.

Just in terms of some reaction to what I heard today in terms of analytical questions for us relying -- in terms of looking at renewables, the question of geothermal and its impact on water is something that we would love some analytical support on in terms of fact-finding when we consider these projects. The role of our agency is not in permitting these, but is in approving the power-purchase agreement which finances these projects.

Also, in combined heat and power, the impacts -- a lot of the combined heat and power is enhanced oil recovery and just the water footprint of that; and additional analytics on that is useful. We again have a combined heat-and-power settlement that we're implementing and we have combined heat-and-power goals. We're also looking at, in the context of the climate action plan, what role combined heat and power should play in the future in the state. So that would be appreciated.

As we go forward in building actual desal plants in the state, the first one is, as the previous speaker mentioned, is in Carlsbad -- I guess I'm interested -- and I'm not sure, kind of discussing this with other experts -- if we can have desal plants actually produce water in off-peak times and use that as a means of storing the embedded energy. So right now the contract that's being negotiated between San Diego Gas and Electric and the desal plant doesn't provide a lot of flexibility in terms of making that an effective demand-response resource. And I guess if our future is more desal plants, it would be great to see whether just providing more storage of the water itself could serve this role to make them more flexible in terms of the grid demand.

Another thing is the NRC and options to develop non-once-through cooling options for the nuclear plants in the relicensing process.

And I guess I'll stop there. Thanks.

MS. WELSH: Thanks very much.

That's the conclusion of public comments, much to our dismay. We wanted to hear from more of you. But we will hope to see those in writing.

Before we close let me turn it over to

Dr. Pershing to give a few closing comments.

MR. PERSHING: I don't know if anybody else who has not had a chance to sign up would like to offer some comments. We're certainly interested in what people might have to say. If you'd like to say few words, you're certainly welcome to do that. I don't want to cut things off if there are others who might want to make some comments or suggestions. I don't want to push you, but we are certainly interested in them. And as Peggy said, we very much welcome the written materials that you might submit as well.

So without curtailing the discussion, I wanted mostly to do two things. One is to thank all of you for coming. I think that what we're embarked on is an exercise which I think will have potentially significant value, not narrowly only in this water-and-energy connection, where we have heard much of the panels' focus today, but in a larger review of our energy system, which is I think, as many of the panelists have said and as we certainly observe from inside the Department of Energy, is a system in flux. We have new technologies. We have new demands. We have new pressures. They come from an increase in population, an increase in the challenges like climate change, but also from new technologies that make it different to operate than we used to do.

But those come with opportunity as well. There's certainly opportunity for the business community. There's opportunity for jobs. We certainly heard from one of our labor colleagues, some that we're going to very much pick up in other parts of the report as well, the question around the energy sector and jobs play out quite substantially and significantly. I think the role of the federal government in all of this, both as a catalyst for change as well as a convenor and a connector and those who are actively working on the ground is something that we're also seeking to evaluate.

So please stay tuned. Please send us back additional input, additional thoughts. I think Peggy said -- or one of us said earlier in the meeting -- we're doing a series of meetings around the country. This one happened to be focused on water which really is topical right now in this part of the word, but there are other pieces that are certainly relevant to all of you who focus on the energy system. Questions around how we manage our electricity and how that is changing with intermittent supply. Questions around the new gas boom and what happens there. Discussions around oil and its distribution as well as its availability. This year, I think as Dr. Holdren started off by saying, we're looking at transmission and distribution and storage, but it's not a one-year process. Next year we hope to look at both generation and production as well as end-use. So comments and ideas in this larger framework of the energy sector are very, very welcome.

Let me conclude by again thanking you. Please do send material forward to us. We look forward to seeing it. As Peggy said, we will be looking at everyone's comments. We've already received quite a goodly number. They are very constructive. Enormous wealth of ideas are available out there. Certainly, we at the department and even in the interagency process have no lock on the really substantial work that's going on. And we get much, much additional insight from these kinds of dialogues.

So, again, thank you for coming. We look afford to being in touch. And we'll, in the other direction, pass information on to you.

MS. WELSH: And this meeting is adjourned. Thank you, everyone.

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CERTIFICATION OF TRANSCRIPT OF PROCEEDING

I, Freddie Reppond, a stenographic reporter, do hereby certify that the pages of this transcript prepared by me comprise a full, true, and correct transcript of the testimony and proceedings held in the above-captioned matter on June 9th, 2014.

EXECUTED this 1st day of July, 2014.

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Freddie Reppond

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