# Summary of Presentations and Comments
# At the
# *Quadrennial Energy Review*

# Stakeholder Meeting #4: San Francisco, CA
# The Water-Energy Nexus
# June 19, 2014

## Opening Remarks

*NOTE: All speaker presentations are posted on the QER webpage at:* ***www.energy.gov/qer***


### Jonathan Pershing, U.S. Department of Energy (DOE), Office of Energy Policy and System Analysis

**Main Points:**

1. Thanks to everyone who has come today. Your comments are an important part of this process. It is the way we can get a hold of the expertise that is out there in the community and hear the issues facing communities throughout the country.
2. Today is one of a series of these sessions, specifically on the energy-water industry nexus.
3. I'd like to introduce our two speakers, Dr. John Holdren, from the White House Office of Science and Technology, and the Honorable Mike Connor from the Department of Interior.

## Dr. John P Holdren

**Main Points:**

1. President Obama's energy vision is one of affordable, clean, and reliable energy. This energy vision also protects the planet and fights global warming.
2. Energy policy should reflect an understanding that energy is closely linked to other technological and environmental issues.
3. The decision to undertake the QER was part of the formulation of the President's Climate Action Plan (June 25, 2013).
4. The QER process is built on 3 pillars: strong analysis (through its Secretariat), interactions with other federal agencies, and active engagement of external stakeholders.
5. The first year of the QER is focused on infrastructure issues pertaining to the transporting, transmitting and delivering energy.
6. There is extensive infrastructure across country supporting the energy industry. Major capital investments are required if we want to have a different system 30 years down the road. This will require us to start those changes today.
7. Energy-water interdependency is the main focus of presentations and discussions from today's meeting. There are four aspects that make this interaction particularly challenging:
    a. Global climate change is affecting temperatures, rainfall, snowfall, and evaporation patterns. These factors influence water availability in California and the American West.
    b. Regional growth and migration trends show that growth in the West (Southwest) will steadily increase in the years to come. This will put increased stress on the water network.
    c. New technologies in energy and water industries are shifting demands and patterns of transport for energy and water.
    d. Developments in policies in water rights and water in energy production have further complicated the issue.
8. There is a diverse collection of decision makers developing the policies and regulations surrounding this domain. While goals of these decision makers are often specific to the organization they represent, the results of decision makers cascade across all groups.
9. The Water-Energy Tech team just released a document addressing these issues: The Water-Energy Nexus: Challenge and Opportunities. See the report on the DOE webpage: http://www.energy.gov/downloads/water-energy-nexus-challenges-and-opportunities

## The Honorable Mike Connor, Deputy Secretary of the Interior

**Main points:**

1. This is an incredibly important topic. As witnessed last summer there are major water issues in the state of California and the Western United States at large.

2. We need to start planning now to make the changes that can last through shifting demands and other issues mentioned by Dr. Holdren so that we are better off 30 years from now than we are today.
3. Climate change poses a major issue in this realm. We know the risk that is posed to our water resources by climate change, and how this could affect energy services based on the climate assessment released last month.
4. The DOE report that was just published (cited above) is important to this discussion. The title itself highlights that there are both opportunities as well as challenges.
5. I would like to highlight what the U.S. Department of Interior (DOI) has done to address these issues:
    a. In 2010 Secretary Ken Salazar created a water and science leadership team that put together a program for water conservation as well as the interaction of energy and water issues.
    b. Secretary Salazar issued Order 3297, which recognized linkage between energy and water and instituted programs to review this linkage, and directed us to integrate policies associated with energy and water as much as possible.
    c. An outgrowth of this was the Water Smart Program. This includes the Water and Energy Efficiency Grant Program, which has invested over $100 million.
        i. It leverages local and state resources to implement water conservation programs and incentivizes the integration of energy efficiency or the inclusion of renewable resources.
        ii. This year's awards will go to 36 projects, with awards totaling over $18 million. These programs saved 67,000 acre-feet of water annually. They also added 6.1 MW of new renewable energy projects. It also decreases overall energy production costs.
    d. The Basin studies program does planning and assessments that are ongoing. It looks for cost-share partners to conduct river basin studies. The Colorado River basin study is a good example. There are strong concerns about the 3 million acre-feet imbalance between supply and demand. This will also impact hydroelectric power generation capacity on the Colorado River. These basin studies are being used to create a drought contingency plan.
        i. The contingency plan calls for the storage of an additional 1 million acre foot of water in Lake Mead.
        ii. By 2016 there is a 23% chance that there will be water shortages in lower Colorado River basin.
    e. Another notable project is the MOU in 2010 with the DOE and Army Corps of Engineers for a sustainable hydro program. This will expand capacity at existing units, and better optimize the use of our hydrogenation capacity.
    f. DOI is also retrofitting turbines at the Hoover Dam and other facilities so that they can generate same levels of energy at a lower head (less water). This program has resulted in 100MW of new generating capacity and we are looking to expand on this in the future.
    g. DOI is also focused on better assessments, understanding and collecting better data (USGS partnered with EIA) on water usage. Power plants are the

largest diverter of water and having better data on this usage will provide insight as to how their demand for water may change over time.

h. A final focus by DOI is on hydraulic fracturing (fracking). There is an ongoing regulatory initiative that hopefully will be completed by the end of this summer. The focus of this regulation is well bore integrity, water management, and chemical disclosure. We need this to build confidence in the practice and to protect communities and their drinking water resources.

## Questions and Answers to VIP Panel

### Name: Paul Wright
### Affiliation: Director, Berkeley Energy and Climate Institute

**Main Points**

- Voiced concerns regarding having adequate data and information about hydraulic fracturing, and wished for this information to be available to the public.
- Noted that the geographical topography of the United States is extremely varied, and more data, research and analysis will be required to fully address the energy-water nexus.

**Dr. Holdren:**

The Obama Administration shares your concerns about hydraulic fracturing that it be done in a safe and well regulated manner. There is an interagency task force looking into what the best regulatory practices for hydraulic fracturing should be.

**Mr. Connor:**

DOI is also a part of the hydraulic fracturing task force along with DOE and EPA. We agree. Good data and information is the key to make good decisions and build public trust. Communities in the areas of significant energy development value that economic opportunity, but they want to know that it is being done safely and responsibly, and that their communities are being protected. We hope to achieve that through good policies and regulatory processes.

# Panel I: An Increasing Urgency to Act on the Water Energy Nexus

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## Presenter Name: Peter Glick
## Affiliation: Pacific Institute

**Main Points:**

1. Although water and energy use are closely linked, the two are rarely integrated in policy. Substantial benefits can arise from linking them.
2. Climate change poses a major threat to both resources, and as demand grows the risk of conflict does as well.
3. Energy systems require water, and water systems require energy. Therefore, if water resources are limited, energy production may be limited as well. However, the water requirements for energy systems can be reduced. For example, swapping out traditional resources for renewables and once-through cooling dramatically decrease water withdrawals.
4. Water supply strategies have variable energy intensities with desalination at the high end and reclaimed waste water relatively low.
5. Both the energy systems and the water supply we choose have climate impacts. Any integrated policy should look to avoid the consequences of climate change we cannot manage and learn to manage those impacts we cannot avoid.
6. The water-energy nexus is poorly understood and should be integrated more thoroughly into policy. A failure to do so may lead to supply disruptions for both resources.
7. This topic can also be framed as a security issue. For instance fracking decreases the need for oil imports and possibly increasing national security, but the necessary data

and science behind it is unavailable. Water related resources themselves are quickly becoming the topic of ongoing conflicts.

8. In sum, there are strong links between water, energy, climate and security, and integrated policies should address those links. Integrated policies will take into account both resources, leverage efficiency savings, and can lead to fast, cost-effective greenhouse-gas emissions reductions.

## Presenter Name: Rob Oglesby
## Affiliation: Executive Director, California Energy Commission

**Main Points:**

1. Water and energy are inextricably linked; production of one requires substantial use of the other. The 2005 California Energy Commission's landmark finding that water related energy uses account for 19% of all electricity spurred coordinated action.
2. One of the main challenges in dealing with water and energy is that each has been siloed within the government. California has been addressing the need to collaborate through a variety of agency and stakeholder forums to advance understanding of the State's water-energy nexus, all with the goal of reducing carbon emissions.
3. The integrated policy efforts have provided a forum for state level executive leadership to meet and discuss the State's coordination regularly. They have also produced a Scoping Plan to reduce greenhouse gas emissions, conserve water, and make water use more efficient.
4. The RD&D Program under the California Energy Commission is developing strategies to achieve larger water saving and efficiencies in these areas: water supply and conveyance, water and wastewater treatment, water distribution, water end use, and water for energy.
5. The drought in California makes water efficiency an even greater imperative. Energy generation within the State was comprised of about 60% hydropower in the 1950's but has dropped to an average of 14%. There is a dramatic need to incorporate renewables that are not water intensive into the generation mix. The State is on target to reach its 20% renewables goal by 2020.
6. One of the most effective tools the State has used thus far is the Appliances Efficiency Program, which has decreased per capita water use throughout the State. Cumulative savings amount to over 43.1 million acre-feet as of 2013.

## Presenter Name: John Andrew
## Affiliation: Climate Change, California Department of Water Resources

**Main Points:**

1. The California Department of Water Resources is the owner and operator of the State's water resources; it also plans and manages the State Water Project.
2. California Water Plan Update was issued in 1957 and is updated about every 5 years. The 2013 issue will have 30 resource management strategies that local water agencies and stakeholders can use. The State is divided into 10 hydrological regions, which highlights the varying energy intensity required for those resources.

3. Energy intensity statewide is concentrated in end use, collection and disposal, which comprises about 80% of total energy use. Customers have greatest potential to decrease carbon impact. Overall, this is good news because the most effective policies are efficiency in end use.
4. The best opportunity within this policy area is collaboration; local water and energy utilities must coordinate. The biggest challenge is addressing how the water-energy nexus incorporates other issues such as public health, safety, and ecosystems restoration.

## Presenter Name: Adnan Mansour
## Affiliation: GE Water and Process Technologies

**Main Points:**

1. GE Power & Water is a $25 billion business at the intersection of water and energy. By using big data and analytics, GE not only treats drinking water, industrial water and wastewater, but it reduces the amount of energy needed to do so.
2. In an age of transformative innovation, three core elements are advancing the modern world: intelligent machines, advanced analytics, and people at work. This industrial Internet provides the process and infrastructure to transform water systems operational data into meaningful, actionable information to improve efficiency over time.
3. The cloud based platform, Water and Process Insight, a GE Predictivity Solution, provides better reliability, sustainability and usage over time. This means immediate responses to operational issues and proactive optimization. These tools can be translated across industries and public works.
4. GE is still at the infant stage of using big data and analytics to increase efficiency, but has had substantial success thus far. Looking forward, we are on the verge of a new level of productivity and predictability that will drive better management of energy consumption as it relates to water treatment.

## Presenter Name: Nathan Brack
## Affiliation: Western States Water Council

**Main Points:**

1. States have primary authority and responsibility for the appropriation, allocation, development, conservation and protection of the surface water and groundwater resources within their borders. This resource is and will continue to be critical for agriculture, renewable energy, hydraulic fracturing, and new power plants for increased populations.
2. The US Energy Information Administration projects a 56% increase in US natural gas production by 2040, much of which will take place in the West. As the extraction of energy resources from Western states increases, it will require a larger proportion of the total water used, or a reallocation of water resources.
3. One of the most important tools used to effectively manage water resources is accurate data on precipitation, temperature, soil moisture, snow depth, etc. A

number of federal programs provide this data to states, but over time a lack of capital investment in these programs has led to the discontinuance, disrepair or obsolescence of vital equipment needed to maintain data collection.

4. To address the lack of data needed to manage their water resources, the Council embarked on water availability data exchange. Collaboration has begun between the Western Governors' Association, DOE's National Laboratories, and WestFAST to develop a web-based water data exchange (WaDE) that allows for real-time access to Western state water allocation, supply, and demand data in a common format.
5. States are working for greater certainty to water rights. Outstanding water rights claims of Native American tribes and certain federal agencies have the potential to displace state-based water rights, causing uncertainty because these rights could be exercised at any time. Authorized settlements provide a path to greater certainty and fair allocation of resources.

## Presenter Name: Marcus Griswold
## Affiliation: National Resources Defense Council

**Main Points:**

1. 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.
2. In California, conveying water from the Colorado River to Southern California requires 2,000 kWh per acre foot of water and California's State Water Project is the largest single user of energy in California, consuming an average of 5 billion kWh/yr.
3. We stand at a fork in the road with the choice to either continue using water-intense fossil fuels, or to expand the use of energy efficient, low carbon sustainable systems.
4. Climate change will affect water availability for energy production. Warmer temperatures will increase demand for water, rising sea levels will contaminate fresh water resources, declining snow packs will store less water, and droughts will become more persistent.
5. Policy strategies should invest in energy and water efficiency and renewable energy generation. Switching to these resources reduces the impacts of energy use on ecosystems and local communities, while increasing their resilience to drought.
6. More work needs to be done to understand the amount of energy that can be saved through efficiencies applied to "embedded energy" in the water sector at the point of use.
7. The QER should work to resolve key challenges to low carbon, low water energy system including:
    a. Carbon capture and storage: This technology increases water consumption at coal-fired utilities 40% – 90%. Dry cooling systems may be an alternative.
    b. Concentrated solar panels: These systems require almost twice the water as coal-fired plants, and are generally located in arid, sunny states. Using dry-cooling technology or treated wastewater may be an alternative.

    c. Unconventional oil and gas development: This uses five times the water as conventional natural gas. This could be addressed through systematic energy water infrastructure planning.
8. There is a quantity versus quality issue. It is important to measure not only the total volume of water used, but the resulting volume of clean water. The QER should address this divide. Polluted water from carbon heavy energy generation is a large externality which is not currently addressed. The best option for any energy development process is one with closed loop water use – recycling water to the highest extent scientifically possible.
9. Planning now for anticipated energy and water infrastructure needs can curtail both energy and water use and reduce or eliminate any potential environmental impacts.

## Presenter Name: Honorable Catherine Sandoval
## Affiliation: California Public Utilities Commission

**Main Points:**

1. The California Public Utilities Commission will be finalizing a scoping memo, which will include:
    a. A water energy management tool: This tool will evaluate the embedded energy usage in various water resources throughout different regions.
    b. An overview of the water-energy nexus in multiple contexts: Water conveyance, water transfer, agricultural pumping, and residential and commercial landscaping all require special evaluation with respect to drought. This overview will also discuss how conservation can be brought to the next level.
    c. Inter and intra agency coordination: This will provide an overview of current collaborative efforts between and within state utilities.
2. There is a need to work with many stakeholders, specifically multi-family residential tenants and landlords.
3. The water-energy nexus is only the first two of many intertwined pieces. Communications must be included in this nexus. Communications encompass how information management systems, the Internet, and data management can be used to manage water and energy resources.
4. Development of the Internet of things should be used to understand use of water, and were lack of data means an inability to manage resources. This occurs often on tribal lands. These areas also have lack of access to both water, energy and communications resources.

## Panel Questions and Answers

*Q: What should the federal government be doing in the water-energy nexus space? Please give specific recommendations.*

**Commissioner Catherine J.K. Sandoval:**
Coordination with the U.S. Department of Interior and federal park lands to get broadband Internet. We need to have communications in order to address the water-energy nexus issues.

**Marcus Griswold:**
Move forward with proven technology – DOE needs to work with universities to get that technology up to speed and commercialized.

**Nathan Bracken:**
Increase funding for data and make it priority.

**Adnan Mansour:**
Big data and analytics, the community of national labs, universities and private sector need to collaborate.

**John Andrew:**
There is an opportunity to support local water-energy collaboratives. The federal government needs to act as a role model.

**Rob Oglesby:**
Increase funding resources to advance technology in water management.

**Peter Gleick:**
Integrate water and energy is the responsibility that federal government holds.

*Question for Peter Gleick and Adnan Mansour –How close are we to having a meaningful supply curve for water on the margin? Supply curves in energy have shown that a kilowatt-hour saved is just as good as or better than a new one created.*

**Peter Gleick:**
Some work has been done, "Waste not Want Not," was a supply curve done for residential water. Conservation and efficiency are the cheapest alternative, rather than creating new resources. Economic models of water and energy together can show that efficiency savings are worthwhile where they may not be when looked at individually.

**Adnan Mansour:**
Conservation, efficiency and reuse are big components. For example, grey water being treated for use in systems for cooling.

**Q:** *Regarding collaboration, is there a role for public private partnership (PPP) efforts that the federal government could provide?*

**Commissioner Catherine J.K. Sandoval:**
There is support for PPPs and community organizations in collaboration. We need to ask what the barriers are to development that the collaboration community wants to address. Water uses or energy uses face barriers regarding energy intensity. Also, we need to support research on storage.

*Q: We have heard that technology and big data should be made research priorities. What other technologies would you recommend that the government make a research priority?*

**Adnan Mansour:**
Reliable data is a key issue for priority research by the federal government. Also, advanced sensors are required for quantification. The federal role is encouraging R&D and funding priorities. The federal government should work in partnership to sponsor pilots and validation of technologies.

**Peter Gleick:**
We need to measure ground water extraction. This can be done through remote satellite systems or gravity sensing systems.

**Commissioner Catherine J.K. Sandoval:**
Water management sensor systems should be a priority. This is an opportunity to support communications as well in farming fields where there are gaps in communications or electricity. Regarding PPPs, John Deere is one of the best rural communications networks.

**Nathan Bracken:**
Remote sensing should be a priority, specifically thermal sensing. It is important to note that new research should not come at the expense of currently working technology.

**Rob Oglesby:**
Further funding for renewable energy resources that are not water intensive, such as hydroelectric power, should be a priority research issue.

**Dr. John Holdren:**
- In closing, thank you to all the panelists. Three themes stand out:
    - Integrated assessments and planning for water and energy systems
    - The need to provide better sensing and monitoring communication data
    - The need to better cooperate and collaborate

# Panel II: Integrating Water and Energy Operations, Policy and Planning: Lessons Learned and Remaining Challenges

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## Presenter Name: Frank Loge

## Affiliation: Center for Water-Energy Efficiency

**Main Points:**

1. There are four critical areas that need to be functional to drive changes in the water-energy nexus. These are policy, technology, business models and data and information.
2. You can focus on reducing energy use in the water sector by becoming more energy efficient. You can also save energy in the water sector by becoming more "water" efficient." To do this you need to understand what the energy intensity is in water use.
3. There is variation in the energy intensity within the year and across years. This significantly impacts the energy savings associated with water conservation initiatives.
4. The complexity of the data, which is multiple scales and in overlapping jurisdictions, makes innovation difficult in the water-energy space.
5. However there are opportunities to use analytics to achieve benefits both in water and energy efficiency. GIS, SCADA, energy and water meter data can be incorporated into a centralized platform to achieve this.
    a. Water benefits include:
        i. Water use benchmarking
        ii. Target conservation
        iii. Leak loss detection
        iv. Monitoring and verification
    b. Energy benefits include:
        i. Energy intensity reduction
        ii. Demand response
        iii. Peak shaving/shifting
        iv. Energy storage
        v. Monitoring and verification

6. The next step to achieve results is aligning water and energy data across a centralized platform. However there are barriers to overcome.
    a. There is not a common data platform.
    b. There are security and privacy concerns.
    c. A suite of analytics is needed.
    d. Funding is required (e.g., PGC).
    e. Continued stakeholder engagement is a must.
7. Expanding the water-smart program (federal funding) will assist with data issues and can help drive innovation.

## Presenter Name: Randal Howard
## Affiliation: Los Angeles Department of Water and Power

**Main Points:**

1. The Los Angeles Department of Water and Power (LADWP) is the largest municipal utility in the United States, serving 1.4 million customers.
2. Power System Overview:
    a. LADPW is a vertically integrated utility, which means it owns and operates generation, transmission and distribution facilities. It owns 26% of the transmission in the State of California.
    b. The LA Basin receives power generated from four large thermal generation stations, and imported power from the Western grid.
    c. LADWP has deployed a clustering strategy by developing renewables near large hydro facilities. For example, in the Pacific NW they installed 500MW of solar near Hoover Dam.
3. Water System Overview:
    a. The water system includes 338 miles of aqueduct from Mono basin, which flows by gravity. It also includes 233 miles from the Owens Valley to Los Angeles through two Los Angeles Aqueducts.
    b. The balance of water required (80% in 2014) is purchased from State Water Project of Colorado River or provided by local groundwater.
    c. A Los Angeles use about 215B gallons of water annually and the average resident uses about 155 gallons per day.
4. Power generation: The current 2013 resource mix is reliant on coal-fired generation. However a plan to decrease carbon emissions and integrate cleaner fuel sources will dramatically reduce carbon intensity by 2026.
5. LADPW's CO2 emissions are 21% below the 1990 level and expected to be 55% below the 1990 level by 2028.
6. LADWP is making progress toward meeting goals and mandates, guided by long-term integrated planning between water and power systems.
    a. Dispatch coordination has optimized energy and capacity production and minimized impact for filtration and water delivery.
    b. Implementing more cost effective approaches to integrate variable renewable energy using hydro generation and pumping.

    c. High level solar incentive program participation for water system facilities.
    d. Coordinated energy efficiency and water conservation programs for customers (both water and natural gas).
    e. Share common right-of-ways for both transmission of energy and water.
    f. Water system using transmission right of ways for storm water capture.
    g. Coordinated training and emergency response programs.
7. Some policies LADWP is proposing will help reach long term goals. These include:
    a. Facilitating increased voluntary water-energy partnerships.
    b. Enhancing voluntary water-energy regional data collection.
    c. Supporting more Save Water & Energy Outreach Campaign to customers.
    d. Developing more water conveyance storage jointly with energy production incorporated into the project.
8. However challenges remain in addressing the water-energy nexus.
    a. There is uncertainty surrounding environmental regulations that impact both water delivery and energy production.
    b. The FERC hydro relicensing process is a drain on resources.
    c. Drought conditions create additional stresses.
    d. There is a need for more R&D for smaller scale pump storage technology and dry cooling technology.
    e. Further complications arise with once-through cooling compliance since LADWP must also replace 9 generating units at 3 coastal power plants. No one unit can be taken off-line until its replacement is ready.

## Presenter Name: Keegan Moyer
## Affiliation: Western Electricity Coordinating Council

**Main Points:**

1. The Western Electricity Coordinating Council (WECC) is interested in energy-water issues because both load and water resources depend on water availability. The electrical load meets both agricultural and municipal demand for electricity, and water resources allow for hydroelectricity generation and cooling water for thermal facilities.
2. WECC is connecting water and energy through applied research, collaborations, case studies and scenario planning.
3. Scenario planning: transmission
    a. By forecasting plausible long term scenarios, WECC was able to evaluate possible impacts on transmission system.
    b. Forecasting requires the use of large data sets and includes water's impact on the transmission system.
4. Collaboration: During a recent meeting with the Western Governors' Association (WGA) and the Western States Water Council, water energy issues were not addressed adequately. Therefore, WECC is continuing collaborative efforts and gathering a more diverse set of viewpoints.

5. Applied Research: Though a DOE grant, WECC has been able to assess the impact of water on its transmission network.
6. Case Study and Scenario Planning: 10- year drought study for the WGA
    a. By examining the impact of higher temperature, WECC evaluated changes to the timing and quantity of precipitation and runoff.
    b. This study also looked at water basins and types of generation to determine the risk associated with a drought on the various types of generation.
7. Case study and scenario planning continued: 20-year tool to consider water constraints
    a. This study and forecast done by Argon and Sandia National Labs identifies water basins and the amount of water available in 10, 20 years as well as water use for electric generation.
    b. It considered water as a constraint. Regions could not add generation beyond the available water needed for that amount of generation.
8. The next step will be continued coordination between WECC, various government agencies, water resource groups, water and energy utilities, transmission owners, operators, and developers, NGOs, and tribes.

## Presenter Name: Eric Schmitt
## Affiliation: Vice President Operations, California Independent Systems Operator (CAISO)

**Main Points:**

1. Of the roughly 14,000 MW of capacity from nearly 400 hydroelectric plants in the State, the CAISO dispatches a little over 60 percent. Hydro generation has been 12-15% of the electricity brought to the marketplace.
2. CAISO has four major hydroelectric players:
    a. Pacific Gas and Electric, which has about 4,940 MW.
    b. Southern California Edison, which has about 1,195 MW.
    c. San Diego Gas and Electric, which has about 45 MW.
    d. California Department of Water Resources, which has about 2,300 MW.
3. There are various sizes and types of hydroelectric generation:
    a. Larger, dispatchable, reservoir-based power plants and project chains along major rivers.
    b. Pumped storage facilities (used in combination with other reservoir projects) in both rivers and aqueducts.
    c. Run-of-the-river smaller hydro.
    d. Smaller projects to capture power from water diverted for required deliveries for aqueducts or required fish life releases.
4. Dispatchable hydroelectric generation is ideal for integrating other variable energy resources, but it requires adequate water resources.
5. California's aqueducts are examples of historic water and energy pairing
    a. California's aqueduct system does consume a significant amount of energy pumping water across mountain ranges, but also generates a significant

amount of energy by capturing the energy in moving water as it exits the mountain ranges. This means the aqueduct can meet its own energy needs, and provide flexibility to electric operations as needed and vice versa.
    b. This piece of infrastructure allows CAISO to ramp-up/down supply and demand (quickly).
6. Drought Impacts
    a. There is less strain on hydroelectric generation during a drought since it does not consume water; it only lets water pass through its system. Therefore, there have not been reliability issues in 2014. If a drought leads to less storage in reservoirs over a long time (more than two years), this could lead to dramatic impacts on generation capacity.
    b. The current drought has not posed a problem for the overall system as the inclusion of renewable resources can replace lost hydro generation.
    c. Under changing profile of system – pumping of hydro resources during the day is now possible; before pumping would only be done at night when the cost of electricity was low.
7. Key take away: Increasing operational flexibility through integrated planning and an operational strategy has served both electric and water systems well and should be especially maximized in the future as the need for flexibility increases.

## Presenter Name: Alex Coate
## Affiliation: General Manager, East Bay Municipal Utility District

**Main Points:**

1. The East Bay Municipal Utility District (EBMUD) supplies drinking water to 1.3 million residents and waste water treatment for 650k customers.
2. EBMUD delivers an average of 161 million gallons of drinking water per day to East Bay residents and businesses. Next to labor, energy is the highest cost even with the use of gravity to move water and relatively low energy intensive water treatment processes.
3. Across California, the average amount of electricity used to deliver one million gallons of water is more than 7,000 kilowatt-hours. This has increased during the drought because of higher pumping and treatment costs; increases can be up to three times higher during a drought.
4. Addressing issues at the core of the energy water nexus helps EBMUD control costs and limit the need to develop new supplies.
5. EBMUD policies to minimize energy use:
    a. Aggressively promote water conservation practices that have optimized the system so that it runs as efficiently as possible.
    b. Conduct water efficiency research.
    c. Force new customers to meet high standards for internal and external water fixtures.
    d. Look to use lowest cost supplies. Shift pump operations to off peak hours – participate in demand response programs.

    e. Pumps vary in age and efficiency, so EBMUD uses the most efficient pumps first.
6. Next steps: Advance awareness, improve data collection and awareness, promote incentives for water conservation programs, and increase public private partnerships.

## Presenter Name: Randal Livingston
## Affiliation: Vice President, Power Generation, Pacific Gas and Electric
**Main Points:**

1. Pacific Gas and Electric owns and operates the largest hydroelectric system in California. It also has a series of combined cycle generation that uses dry cooling. This process uses about 3% of the water as wet cooling facilities.
2. Roughly 3% of the nation's dams have hydroelectric production. There is an opportunity for additional hydro generation here. The government should look at how the licensing and permitting process impacts the ability for these facilities to be built, while protecting the environment.
3. The transportation of water is not as efficient as the transportation of energy. Energy uses transmission wires to create the shortest path possible to the end user. Water, on the other hand, follows a much more meandering path. Water resources are sent from Northern California to Southern California and in San Francisco water is sent East, and is pumped up to San Joaquin Valley and then back down.
4. A high percentage of total water storage comes from snowpack. The impact of climate change on snowfall and snowpack is significant and needs to be analyzed.

## Presenter Name: Jim Herberg
## Affiliation: General Manager, Orange County Sanitation District
**Main Points:**

1. The Orange County Sanitation District operates a regional wastewater collection system and two wastewater treatment plants, which serve 2.5 million residents.
2. Water resource recovery facilities have 3 products:
    a. Clean water for recycling
    b. Renewable energy
    c. Biosolid products for agriculture
3. The plants can generate two thirds of the energy needed to run them and also produce hydrogen fuel from the fuel generated in treatment.
4. In partnership with the Orange County Water District, the facility recycles 70 million gallons of purified water per day to replenish the groundwater aquifer, which is enough to meet the needs of a population of over 600,000. This recycling facility is being increased to produce 100 million gallons per day.
5. Biosolids produced by the plant also add to water conservation. Crops that use biosolids require less water and increase production by over 30%.
6. Most of treatment plants use anaerobic treatment. You can generate 40% of your energy needs from this.

7. Smaller plants are held to the same standards as larger plants and those standards might prevent or stop generation from waste at these treatment plants.
8. Biosolids can help mitigate climate change and produce renewable energy.
9. The federal government must address the energy water nexus through meaningful collaboration among federal and local agencies.

## Panel Questions and Answers

*Q: Many speakers emphasized the importance of partnerships. What single thing can the federal government do to be a better partner?*

**Jim Herberger**

- Continue funding the Water Smart Program.

**Randal Livingston**

- Continue funding the Hydropower Research Program in DOE.

**Alex Coate**

- Continue funding anaerobic digestion techniques.

**Eric Schmitt**

- Technology initiatives are very important.

**Keegan Moyer**

- Funding the national labs. They are in a unique position to do research on both energy and water issues.

**Randal Howard**

- Put the resources on collaboration efforts to get this nexus moving forward.

**Frank Loge**

- Increase the focus on information technology.

**Q:** *What kind of market, financial or other incentives would help shape the water-energy nexus to get us to the innovative solutions that we need to get to?*

**Frank Loge**

- I do not think there should be incentives. There is a strong enough business case for companies to refocus or for new companies to come in and fill the space. The government needs to make the business case from the data.

**Alex Coate**

- Look to areas that might not have a strong business case over the next 20 years and help incentivize those areas.

**Randal Livingston**

- Incentives may not be the right way to get where we want. Speed up the permitting process could be beneficial. Permitting is a significant cost to the industry and by reducing or removing some of it the industry would benefit.

**Randal Howard**

- Having hydro capacity is very important as we move to renewable resource as a larger portion of the overall profile.

***Q:*** *The QER Task Force is grappling with what their role should be in this since so much is state and locally driven. What is your one recommendation to the QER Task Force; what should the federal government's role be in the energy water nexus?*

**Frank Loge**

- Help initiate the integration of energy water data so that advances, unknown to us now, can be made. Specifically help water and energy utilities understand how to integrate this data and understand that it is a priority.
- Continue funding Water Smart Program, perhaps with a 50% funding with the rest coming from private sector.

**Randal Howard**

- Continue funding hydropower research program for Power Market Administrations.

**Keegan Moyer**

- The federal government should provide a forum or the financial support for others to host a forum for power and water industries to come together.

**Eric Schmitt**

- The electric business is changing, and renewables integration has been the driver. All levels of participants in the water energy nexus, federal, state and on down, need to recognize this shift.

**Alex Coate**

- The government can advance awareness of the water energy nexus at all levels. The public does not know where their water comes from. They tend to take water and utilities for granted. The federal government needs to help everyone understand this is an important area that needs attention.

**Randal Livingston**

- While the majority of these issues are at the state and local level, the federal government can bring together various agencies do high level planning.

**Jim Herberger**

- For local utilities there is a lot of new technology to be dealing with, especially in the area of solids treatment and digestion and the ability to extract energy in different ways. There is a large amount of risk for small utilities to be taking on if a technology is not yet fully proven. To the extent that the federal government can partner or build partnerships to spread the risk around or provide funding that would make smaller utilities more willing to try advanced or unproven technologies.

*Q: How is climate change affecting your operations? To what extent are you addressing these affects, and sharing best practices among yourselves?*

**Jim Herberger**

- Wastewater treatment facilities are already discussing these impacts. Three issues arise:
    - Coastal locations of facilities are vulnerable to sea level rise.
    - Climate change will cause short, but high intensity storms and flooding.
    - Drought affects the reservoir which the treatment plant relies on for hydro power generation.

**Alex Coate**

- From an electricity operations perspective climate change will dramatically affect water resources like snowpack. We are trying to understand how this will affect electricity production.

**Randal Livingston**

- Looking at how climate change will affect hydroelectricity production.
- The system is built for variability within seasons, but storage will become increasingly important.

**Eric Schmitt**

- The drought has not had a significant effect on supply; it has led to a significant increase in fires. These fires, to the extent that they are a consequence of climate change, have the ability to do major harm to the transmission system.

**Keegan Moyer**

- At WECC we are organized to evaluate and study climate change scenarios based on two different perspectives, the direct impacts such as drought, and also the policy impacts built to thwart climate change. There is a need to study both of them.

**Randal Howard**

- The State of California has done a good job coordinating with many of the utilities. We are looking at changing reserves and storage of water due to the risk of wildfires. We are also increasing the amount of reclamation activities to increase the amount of water we have available.

**Frank Loge**

- California Water Plan updates, that occur every 5 years, based upon data collected from utilities. Quality of data received could be improved greatly and strategic planning could improve greatly.

# Public Comments

The public is allowed to sign up to provide comments, and each commenter is allowed five minutes in which to make them. Each commenter was asked to approach one of the standing microphones as their name was called, introduce themselves, their organizations and make their comments. On the stage representing the DOE were Johnathan Pershing, Principal Deputy Director of DOE's Office of Energy Policy and Systems Analysis (EPSA) and Deputy Assistant Secretary for Climate Change Policy and Technology, Matt McGovern, Special Advisor in EPSA and John Richards, Senior Advisor in EPSA.

The U.S. Department of Energy encourages everyone to file written comments at QERcomments@hq.doe.gov to ensure a wide variety of public input into the QER process.

**Public Commenter Name: Walter Robinson, Labors International Union**
**Commenter's Main Points:**

1. Desalination plants are built and manned by union workers. Continuing to use these plants should be a priority. Renewable energy projects, such as solar projects are also built by union workers. The union has a strong commitment to water energy nexus issues. Public private partnerships will provide much needed funding for projects to address these issues.

**Public Commenter Name: James Farrow, Energy Coalition**
**Commenter's Main Points:**

1. Water efficiency is a critical piece of the water energy nexus. While larger agencies can reduce energy demand, smaller agencies do not have the capacity or expertise. DOE should focus on training or a curriculum for water and waste water operators. There is a need for technological advancement on wastewater and storm water management. Storm water can be used as a resource, which could decrease ground water pumping. The water energy nexus should be expanded to include food, especially when we export so much, which means we are exporting our water resources. The DOE should increase funding for the Industrial Assessment Center.

**Public Commenter Name: Judith Eclay, California Public Utility Commission (CPUC)**
**Commenter's Main Points:**

1. The DOE reached out to CPUC through NARUC to cooperate on smart grid. They provided grants under the Economic Recovery Act of 2009 (Recovery Act) to cover additional work load. The California grant started in 2009, but Recovery Act grants are ending. It would be beneficial for DOE to continue to draw in the utilities and private water companies to increase coordination.
2. Regarding additional analytics that others requested today, additional information about renewables, specifically geothermal and its effect on water would be helpful. Additional analytics on combined heat and power for oil and advanced recovery would be helpful.
3. As we go forward in building desalination plants, in Carlsbad specifically, can they produce water in off peak times as a way to store embedded energy?
4. The Nuclear Regulatory Commission licensing process for nuclear plants should include licensing for non-once-through cooling.

# Meeting Conclusion

DOE's Dr. Jonathan Pershing expressed appreciation to everyone who took the time to present their views and participate in the process. He recognized the hard work of her staff, thanked the panelists and attendees, and the meeting adjourned.

To provide written comments to the process please see: QERComments@hq.doe.gov.