

Eastern Region Energy-Water Needs Assessment Workshop Real Time Notes

Group E Breakout Session Notes—Facilitator Marie Garcia, Note Taker Terry Wilson

Name	Ref	Company	Notes/area of interest/specialty
Stine, James	JS	NRECA	Represents 60 coop generators 900 companies that distribute energy. Movement based upon not for profit customer owned systems. Return funds if they pay too much. Used to work at Constellation Energy IOU. Environmental management groups for both IOU and NRECA .
Kumm, William	WK	Arctic Energies Ltd.	Physicist. Government, fuel cells and solar energy at sea.
Genoa, Paul	PG	Nuclear Energy Institute	Participated in the afternoon, not the am.
Baldwin, Samuel		EERE-DOE	Chief tech officer. Asked by undersecretary to coordinate programs
Renner, Robert		AwwaRF	
Woodward, Nicholas		Office of Science- DOE	
Panchal, Chandrakant	CP	ANL	
Vesay, Anthony C. Col	Vesay	USACE	Ground water ==keeping water off of people
Rude, Mark	MR	SW Kansas Groundwater Management	
Hook, Jim	JH	University of Georgia	Hydrology and soils and the irrigation side. Water planning. What and how the state is using water
Thomas, Sherri	Sherri	UNM Law School	Utton Center. Representing Tribal rights and Indigenous rights, Federal lands Conservation and Economic development
McGavran, Ed (Ted)	TM	McGavran Engineering	North Carolina engineering consulting business large utility transmission, siting nuclear plants wants to contribute from the industry side
Hennig, Charles (Chuck)	CH	USBureau of Reclamation	Research and Development Office
Kelly, Suzanne	SK	EPA	Headquarters, office of ground water and drinking water. Deal with de-sal and concentrate management
Hopkins, Omar		Development Alternatives, Inc.	Consultant in DC. International focus. Active in the water sector
Liu, Sissi	Liu	SENTECH, Inc.	Clean Technology investment consulting, new technology and application of Renewables in the water area.
Sale, Michael	MS	ORNL	Charter member of the team. Hydropower research on climate change, energy systems, impact on environment
Mike Connor	M	US Senate, Bingaman	Showed up and took path of least resistance

Problem Area Energy Supply
Energy Supply

Our job is to discuss top problems identified from the energy side and top problems from the water side.

Reference the handout in the folder. Please look at questions and begin to answer the primary water related concerns impacting Energy Supply.

General Warm-up discussion

- Resource allocation issue referencing the environmental economic idea of Tragedy of the Commons. Water is a free resource that everyone wants to use and then it gets all used up. Part of the dynamic here is to change it from a free resource to a controlled resource. [You] do this through a market system. Until a market system operates in a balanced manner, there will be unequal allocation.
- [Regarding] resource allocation, people will use resources at will until they pay for it. There has to be a consistent market which allocates resources to the most efficient use. Markets are inherently unstable.
- [I question] the notion of water for energy supply; 71% surface of earth [is] covered with water. You don't pay anyone to use it. Capture energy by the sun -- process it by solar. 97% of the earth's water is in the ocean. Salt water. Only 3% is not ocean water. Change the venue from terrestrial processes to global process.
- Why haven't we thought about the ocean?
- Because of philosophical reasons. We crossed oceans to migrate but we ignore it as a potential energy resource.
- Is there an economic aspect to looking at the ocean?
- Foreign energy comes in by sea. We have a strange attitude about the ocean. The point is, [we should] consider the ocean. [This] eliminates the problem of cooling towers on land. How does this happen?
- Water quality, salinity of the water and economic constraints associated with ocean water impact our ability to use ocean water.
- [He] is saying we shouldn't limit ourselves to what we are used to. Market mechanisms lose the economic aspects. How do we bring clean carbon emissions to water and energy?

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Understand the social impacts, cost them and understand where the costs are to address them.

- The function of a regulatory agency is to quantify it and reflect it back in the cost of doing business.

- [The] ability of markets [is] to identify efficient solutions (considering equity, fairness and social justice issues). This needs to be discussed. Merit Goods such as education, public health vaccinations... We must be cognizant of these other issues.

- The social issues may be forced on us by government regulations. All of this will greatly affect the market. We haven't had to look at ocean because the terrestrial resources have been readily available.

- [It's a matter of] public awareness. Industry water is available in the tap. One refinery came down to the point the local population shut it down because of the salt going into the river. The water issue is not as much in the public awareness as energy. The value of water to the public [is] usage. [My] interaction with the production side of energy is that water is very tight. No oil industry company can put [a] refinery where there is water. Where do we put the new energy sources? [Consider] new sources of energy from Coal gasification. Where do we put Coal gasification plants? In places where there is water, or [we] pipe it in. [There] exists an imbalance between water supply and where the energy plants are located.

- [The] impact at a local level of where you put these plants [is] on the local labor force, and [it causes] an impact to the economy. Expand the energy supply more locally. It will shift the impact on an economic basis.

- Solutions will not be the same across the nation. Technology needs to be more focused on regional needs. One solution will not fit the entire country.

- Fairness and equity [are at] issue. What is fair to one is not fair to the other, and we must be very cognizant of the fairness and equity factors. [There] must be some federal regulatory template. *He would like to see how we deal with transmission and RTA.* Set the rules so the market can respond.

- Here is a real time example: As cooling technology has developed, water usage has been less. Generating plants often locate where transmission and gas lines are, rather than where water is. Re-use effluent from sewer treatment for cooling water. [They are] located [near the] lower income population. Where the plant was located was in a lower immigrant population [resulting in a] social issue impact.

- Put a power plant in a blighted area and there are some economic opportunities reaped.

- Two time frames here: Power plants and increasing efficiency... In the long run can we look at more renewable energy and technologies that would improve the efficiency of current technology so we don't become pigeon holed?

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- LNG and gasification process- liquefying gas for transporting. And water front issues to those in coastal regions. Go to the beach

- CP petroleum industry spending lots of money on the LNG fuel cell tied together for the future. *He can provide numbers for this.* Driven by the market. Coal gasification is part of the future. 20-30 years down the road Renewables and nuclear hydrogen will need to be in the picture. How we use transport and store this is a big question.

Let's fit this is into the matrix.

- [The] problem is how the question is asked.

- We define this the way we want.

Problem 1 What are the major Energy problems over the next ten years for Extraction?

- Coal is running out. What happens when it does (the impact on the landscape, the labor force and local economy)? What happens when the big companies decide to leave?

- This impacts the water because water goes from the river to mine usage. Consider the road usage.

- The impact is water quality. The big water impact [involves] quality. Residual water... and the clean up of water quality... In the west water is such a scarce resource, the regional needs must be considered. Man -made lakes, company leaves and then there is no one left to continue with the maintenance.

- How do you do it efficiently and deliver it to market and consider environmental concerns? How [do you] balance the cost benefit for preserving environmental aspects verses conserving resources? Make the market work efficiently.

- Problem of produced waters. Coal bed methane byproduct is poor quality produced water. Further exploration will [involve] negative and positive water quality issues. [With] huge water resource, how can we turn that into a beneficial use and have a win-win situation for users and producers? [This is a] near term problem and long term opportunity.

- We are not running out of coal in the eastern region. Coal production could increase because of the market.

- The questions are really what are the challenges facing energy production.

The issues are so intertwined that they are hard to separate.

- [An example of a] near-term problem under extraction [is] acid mined drainage from deep coal mines rather than surface mines. This is a legacy problem from coal mining companies. Now we are stuck with the mess. Passive technologies exist to try to deal with this, wetland. [You end up with] wiped out streams and yellow color. Can this be turned into a resource that can be actually used?

Reference Pennsylvania Department of Mines, Frosburg University.

- Research and development side of the equation [is] a long term issue for extraction. More R&D needed.

- What is the trend in these problems? The trends that revolve around liability and risk are of concern. [This] applies to all of the problems. Risk factor will impact cost factor.

- In the 25 year frame of reference this will increase.

- The push to get energy out of the ground in the west has opened people's eyes.

Problem 2 - Fuel Production

- The role of water on fuel production: Hydrogen has been mentioned a little bit. Where the water comes from is a potential constraint for hydrogen production.

- But then if you take the water out of the ocean, it isn't so much of a problem.

Refinery capacity of the country is centered at the base of the Mississippi River for transportation concerns. Much of the water used is transported via canals for transportation. The loss of the river delta and the protection it affords to the inland regions is a problem for the region.

Examples of a mine in Montana were given. Build a power plant next to it. Centralize [the] location of extraction production and exportation. [There's your] Solution.

[They use] coal gasification movement to reduce CO2 emissions. How intensive is the coal gasification process for water usage? [We can] research opportunities to examine this question. [There is a] major water issue for coal gasification. Water re-use technology will be an issue.

There is a report CP can reference. He will forward reference information. He doesn't have it on hand.

- Refineries need water to mix with crude oil

- It takes] 65-90 gallons of water to process one barrel of oil. Future refinery needs will be impacted by this. CP will send references.

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- Energy concerns from beginning to end user --Biomass does face a constraint because it is agriculturally based. Step back and look at the beginning rather than the end user.
- [There are] arid energy crops that don't require much water. [The need is for] agricultural researchers to do R&D on crops.
- [We can examine the] potential [of] using biotechnology to produce energy. But then there are issues of GMO (genetically modified) don't know the long term for the GMO crops.
- Risk factors that are involved with pricing stability of oil preclude anyone from taking a long term risk. Urban media issues of water for energy. Don't let whatever you are spilling get into the water. [This is] short and long term. As a fuel producer you must deal with the regulation, and this is critical.

CP: Biomass focus to double or triple production to meet target in the energy bill, more corn production and the water requirement for the growth of the crop will be difficult to reach the target. **Reference will be provided by CP.** 10 -15 gallons of water per gallon of ethanol for just the processing itself, not considering the water needs for growing the crops. How about using the crops more completely? Use the full advantage of the crop and convert to fuel. [It is] more efficient using crops that are grown.

Inland water ways in the nation -not enough water resource for the product to get out through the locks and dams. The company cannot get out onto the water way, the barges can't get there. Water based transportation for fuel, the infrastructure for water based transportation. The dredging out of the canals as well as the dam water being diverted to other uses is denying water that was originally intended for transportation.

Problem 3 Electricity Production

Clear issue in Southeast USA is a combo of a drought and hot temperatures, existing generating plants that use once-through systems. Not enough water and the water is too warm to accommodate the electricity generation

- 90% of electricity is produced by running water through a turbine. Take water from a water resource, burn something, compress it and send it out the other end. [We] must find another way to make that turbine turn.
- Electric producers in western states are being asked to stop using once through process. Not just in the west but in the Hudson River. [This has to do with] federal and local requirements for closed loop processes.
- Regional regulators are pushing to get away from once through processing. The main connection between water and power generation is a cooling issue. The water is clean and boils and condenses over and over again. The big water issue is to have a big heat sink to cool off the steam to get it back out into the environment. Liquid water is an excellent sponge to cool off the heat.

- We have a perfect heat sink, the Ocean.
- [The issue is] the right quantity of water **and** the right quality of water. The water coming in needs to be of a certain quality. [So the problem is the] effects of water quality regulations on the permissions for water usage and the expense associated with treating the water to the level the regulations require.
- [The] consequence of cooling technology is increasing consumptive use. [We're back to] re-using water in the cooling tower. Evaporated water is higher in the cooling tower over the once through. They both have impacts to the goal you are trying to reach - temperature of water verses greater consumptive use. Close loop increases consumption of higher quality water.
- [There are] new competing uses for available water. [Consider] new recreational uses for reservoir originally built for cooling tower. Energy isn't always the first priority for available water.
- [What about] drinking water – the competition between energy and drinking water
- At first hydropower plant authorized for energy, but is now [dealing] with recreational use. Fishing, fisheries, all competing demands are not in agreement.
- Net water availability minus what you have to leave for nature and recreation use. This is a changing dynamic.

70% of dollar an IOU customer pays for electricity goes to power production. **EPRI has this information.**

- [There is a] direct relationship between the cost of producing power and the amount of water a power plant is allowed to use. Using less water increases the cost of producing electricity.

Researchers are linking the cost of producing electricity to the impact of health. Journal of Health benefits of low cost energy and economic case study. Reference article hand out.
November 2005 Waste Management Association

Renewable Sources 4

Thinking of new ways to use what we have. Think of non-traditional ways to the available resources.

- The ocean is a large heat sink.

Hydropower

Solar

Wind

Ocean

How can we catch the energy from waves and currents? [The answer is to] use the Ocean's energy. As long as we have a sun and an ocean, we won't use it up.

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- [What about] using renewable energy in remote areas for energy provision?

What are the water related problems to producing energy from renewable resources?

- ...Renewables that require fresh water and those that don't require fresh water. Using low water intensive

- Energy sources that require water input is the issue of water and energy conservation. Any ability to manage energy demand will have a direct link to water use.

- Biomass is related to renewable. So the same issues related to biomass issues can fall under there.

- Geothermal has its own water problems, environmental as well as thermal – cooling issues as well.

- ... wind and oceans – offshore wind farms constrained by water due to Marine biology and ecological problems.

- Hydropower has been constrained by water problems because of environmental concern and societal values, i.e. protecting fish.

- Countries like China facing huge Transboundary problems between countries. Biomass has ecological impact on the local and indigenous plant life, etc.

Problem Area: Water Afternoon Session

What kinds of water resource issues impact the eastern region?

- Issues related to urban use, agricultural use, recreational use, and energy production use. Then there is the issue of the kind of water.

What are the concerns to capture?

- One of the problems is difficult to think about the future when there aren't any set of common assumptions. Suppose we only used traditional technologies. One set. But then perhaps where we shift from traditional technology to other and the world issue. *She is struggling with the problem questions because there isn't a commonality of assumptions.*

Are there any other comments?

- [There is] no common set of assumptions because it limits the thought process to do that. This is brainstorming session and we don't want to put constraints on this process.

- [First determine] what are the driving factors of the future and then go from there to address the problems. Then you can look at what the world would look like in the future.

- There is no person in the group like [NAME] associated with potable water community. *He has questions related to urban use* –is it potable use but desalination is one way to get it.

- For the eastern region it is a fact that growth is pushing to the south. Water resources have become tight and desalination is a process important to a place like Florida. Reverse osmosis is a source of water treatment. [This] can become a critical issue.

- Basic water use may change, gray water usage—used to irrigate landscape. Today most people drink bottled water. Will there be dynamic changes where not all water is treated to drinkable standards. How much potable water is really required?

The point is How do you match the quality of water to its intended use.

- You shouldn't use potable water to wash cars. Non-potable water [has] usage for broader applications.

- How about distributed water purification ala distributed generation?

- [This is] assuming everyone is economically able to bear the cost.

- Ultimately, new developments will install dual lines and whatever else.

- [You're suggesting] retrofitting existing water use.

Dual systems still need to be treated to some acceptable standard. The water industry is moving towards promoting conservation. Re-use where appropriate in the home.

- What are the primary issues to the impacts on surface water from urban or municipal use?
- If large cities dump sewage into bay, [then you have] an inadequate infrastructure to hold up storm water. Surface water impact is storm water runoff and sewage treatment plants.
- Water needs to be pumped from one location to another. How municipalities are designed from an infrastructure perspective [is a] planning issue.
- Energy is needed for the plants to treat storm runoff and to transport the treated water.
- How do you retrofit cities to address this?
- [Provide] protection of the capture area for the water. East gets a lot of rain. If we can get that water into the ground as opposed to run off the system [then you have a fix].

Water Harvesting

- The east has an excess water problem. We have paved over so much the water gets lost. Little effort to protect the main watershed captures areas.
 - [What about] opportunities to increase supply through storage and treatment? [The] need is for additional supplies and need for more storage.
- [We] need to look at alternative supplies of water whether reallocation, treatment, or through additional storage.
- Part of the answer [includes] water market mechanisms and water transfer. In the West, market mechanisms take care of supply issues.
 - [This] focuses attention farmers, who can sell water for more money than they get for their crops.
 - [We have] constantly changing market dynamics of water supply and demand. Energy demand is a problem [even if] there is a development of new water supplies.
 - Who owns the water?
 - How much water is being used? No one really knows. Here we can use water when we want.
 - Is there a true cost of water? People are not paying attention. It isn't valued in the same way—it doesn't promote efficient use because of value [or the lack of value].
 - Take the water offshore and use solar energy to treat the ocean water.
 - What about ground water as it applies to urban use?
 - Recharge. [We are] not properly recharging wells in the east. Not sure why.

CH referenced a book **Water Follies**—Inability to Sustain ground water. [When the] well goes dry, then you go deeper and deeper and it costs more.

- Sustainable yield –define it and determine what it is exactly.

Contaminated wells and brackish water. Common problem for coastal areas. Degradation of ground water and how that occurs.

- Salt intrusion in coastal and inland aquifers is a concern.

- Unregulated manufactures [who] take water from a state resource like Lake X and sell it are causing problems in ground water.

- Do we know enough about our ground water resources to determine what problems exist? **USGS has history lesson for 50 to 60 years.** Still many unknowns and coastal regions are very dynamic

- Aquifer storage and recovery itself is a problem with quality and how effectively it is managed. Pumping surface water back into the aquifer and the pumping it back out again. In the east it is pumped in and then pumped out. Regulated everywhere but a question of how much damage you will do. Florida uses this process to hold back salt water intrusion. Georgia does not allow any aquifer recovery of any type.

- Surface water and ground water are connected. Surface water flows impact one another. **Water Follies**, is a good book that talks about this issue.

- Pollution MTBE [is] getting into the groundwater. What about water pollution leaking underground? [It] takes a long time for problem leaking into groundwater to be remediated compared to surface.

- [There are] many issues that we don't understand (for example, the impact—pharmaceuticals).

Lots of different things are getting into the system and we don't know the impact of this long or short term.

- We do know the more treatment needed the more energy needed/used.

Economic Development/diversification on urban use of water

- Economic development has been a contributor of the storm water run off problem. The more you pave the world, the more you have more surface from which you need to collect water contributing to contamination, erosion flooding., pollution, and development. [Development] itself causes contamination, flushing all down to the sea concern for run off.

- You got to have development.

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- But in order to sustain development, many planning departments are looking at how they are going to look at the future demands of the state. Many states are regulating this.
- Economic development and diversification is water intensive. It will just put increased demand on water.

6 What are the environmental problems impacting urban use?

- Urban development displaces [the] environment.
- Recreational fishermen are very concerned about the fish in the bay.
- Urban development is very water intensive, but this is based upon the assumption there isn't a better way of doing this. What about renewable for the solution?

Tomorrow we will get to this solution.

7 Surface water issues as applied to ag use / forestry

- TMDL [is the] total maximum daily load. This is the limit you can have on runoff. Agricultural activities lead to increase nutrient loading in surface water. This is an urban concern as well as ag issue because it runs off golf courses as well as back yards.
- Sediment is the other side of this because it alters streams significantly... Fills in the lakes and channels and canals for shipping...
- [If you] get enough red clay running off of a construction site, then it makes a huge impact.
- Agricultural includes animal farm run-off.
- Take for instance the hog herds in Eastern North Carolina. The runoff creates huge problems - feedlot problems.
- Additives to livestock feed stores become very specific problems from agriculture.
- Some people like China think of US as one big feedlot for them.

[The] expectation is to continue our large US agricultural activity to feed the world.

- We should be more production centered then.
- This is not a good characterization of the US Agricultural market. US is moving more toward service industries instead of the world's agricultural center.
- How much agricultural activity/demand will we have in the future? The footprint is smaller but denser. Maybe in the future there will be more farming but in less area.
- Do more with less land.

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- Hundred years ago we had more agriculture to feed horses that were our main source of transportation. Now the feed is for recreational use of horses.
- A large part of agriculture is to support livestock.
- In the next 25 years there is likely to be changes in the way agriculture is done. [We're looking at] the industrialization of agriculture.
- Well how about agriculture for fuel?
- Agriculture and groundwater - TMDL applies to urban use.
- [There are] risk factors involved in bringing a crop to market. It now requires a large operation to bring crop to the market and to pay for it. More complex, larger farm means greater risk factors.
- [A place like] Wal-Mart has the greatest impact on the size of how products are sold.
- Groundwater tables [are] used for irrigation.
- As long as the water is free and the farmer feels it is his, then there is no limit.

Ground water is a free good, common pool resource.

Economic development and diversification as applied to agricultural use

- Development for other uses puts pressure on agricultural use. There is no big growth in agricultural land.
- There is more production per unit of land.
- Urban use of water is still higher on a per acre basis than agricultural use.
- Who regulates the use of this water? Anyone can drop a well down to the ground, but whose water is it? Who has the regulatory responsibility?
- Is water treated as an underground right, like mineral rights?
- No, you are permitted use but you don't own it.
- This varies from state to state. Whoever can drop the well gets the water (like Texas for example). In Colorado you have to get a permit and show no impact.
- Water rights issues are in conflict.

In the east ground water law has not been tested very well as it has in Texas.

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- In the executive branch, who regulates --state ---federal--?
- Surface water and navigable water falls under federal purview.
- It's hard to get a handle on it because every state has their competing priorities.
- There is no one overall water authority for the nation. No single centralized planning czar for water.

Environment as it applies to agricultural use

- Endangered species and water quality laws are impacting the practices allowed on land. One example [involves] keeping cattle away from water.
- Agricultural impacts on the surface and ground water impact the environment surrounding the agricultural use.
- ...corn growth from Mexico into the gulf...

CH Almost everything spelled out as issues and needs can be found in [publications of the National Academy of Sciences](#), or [Office and Science and Technology reports that discuss many of these questions already](#). Countless sessions such as this –I have a huge sense of déjà vu listening to all of this.

- What are the benefits to the environment for agriculture? Is that something to consider? The agricultural sector is the largest open capture area for water.

We may address this tomorrow when we talk about solutions.

Problem 8 - *What are the surface water issues are as applied to energy production?*

We agreed to change this to fuel extraction instead of energy production.
So, what is the surface water issued as applied from fuel production?

- Transportation is a whole other category, like number 11 on the matrix.
- Maintaining the ability of the water to supply transportation usage...
- One river system was going to be shut down because of maintenance issue.
- Low level waste disposal site –can't get it up river because there isn't enough water to move it.
- This gets into the competing uses issues.
- Any fuel production that involves mining has impact on surface water quality.
- Refining and production are competing demands on water for refining and fuel production.

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- Water simply [is] not available.
- Is ground water used in petroleum extraction? Yes, the North Slope of Alaska. That's sea water not surface water.
- As we transport the raw product we use surface water. That introduces the whole gamut of issues from oil spills to the ability of a [power] plant to operate.

Ground water issues as applied to fuel extraction

- [Given] the large portion of energy from foreign sources, more and more will be taken from non-terrestrial sources.
- ...Foreign imports impacting on water quality...relationship between water and surface water...
- Where does waste disposal fit into this? Let's change it to fuel extraction and waste disposal.
- The impact of deep well injection for processing, such as petrochemical plants.—[there is] no regulation at this point.
- A lot of what we are saying under the top part of Number 8 applies to the bottom part of number 8.
- What is the cost impact of competing ground water usage? Is this another “big picture” issue?
- Cont'd 8. Economic Development and diversification issues as related to fuel extraction and waste
- Old coal mines filled with poor quality water are being viewed as a resource for economic development for power production. What is the life cycle of fuel production?
- Economic development of an area could have negative as well as positive impacts. Fuel extraction development enables economic development.
- Fuel extraction competes with resources necessary for economic development.
- Clearly gulf coast production inhibits as well as encourages development.
- ...diversification and economic development down the road...Finite economic benefits...
- Often times the different stages bring a new set of problems.
- Hopefully we learn the lessons from other stages.
- More and more we will get the refined product from outside (the US). Our economic future means more and more will come from elsewhere. Hopefully we won't see this with water as well.

Environment from fuel production

- Produced water issues fit.

Problem 9 Electricity generation

Issues related to surface water as it applies to electricity generation

- ...waste water treatment pressures... Water supply from tap to toilet 19 – 20 % of energy produced goes to production for water consumption. Utility companies spend a substantial amount of money moving water around. Transportation and transmission issues come into play.
- End to end, the amount is great.
- Impact of the use of cooling towers, increased chemical burn
- Degraded surface water quality from the cooling towers concentrating salt
- Increased chemical loading. Treatment for the zebra muscles, radioactive concentration, thermal discharge...
- In terms of hydropower generation, the fluctuation of water levels is due to water releases. Causes changed in the hydrology of the ground water and the –water reverses flow couple times a day like a tide.
- Shed water quality [is] impacted by water operations
- If you dam up, then river evaporation increases.
- Ground water from electricity production
- Some contamination issues, under ground tanks that leak.
- [What are] the impacts of geothermal plants? Are there any? May not be significant...
- Is most of geothermal closed loop or pumping from ground water? (no real expert in the group)

Problem number 10.

- Electricity generation can be a positive factor in development recreational uses and economic development. The other side is the interruption of the flow of animals and species that cannot live in deep water.
- Plus building of dams displaces people.
- If you put a Nuclear power plant next to a body of water for cooling you create an economic impact.
- In some cases electricity generation enables diversification

Break

Prioritization

Our job is to identify what are the top three energy problems for the regions as they relate to water and then top three problems as they relate to energy

The value of water resonated with [NAME]-- *there isn't a clear value on water-- it isn't clear who owns and controls it. It isn't a transparent market.*

-There fore there is no clear way to directly link it to a market system. Is that a clear problem?

-Yes.

- There is a value of energy because we pay for electricity.

- We are three or four years from a public debate. There is no sense of urgency so it isn't in the public eye.

- No czar for water issues.

- No mechanism for allocating scarce water resources among competing users.

Risk and liability issues.

Lack of public awareness of water issues.

- The three points are true for all water, not just ground water. Can these be addressed with needs and can we hook to an S&T solution?

- These are medium term problems.

Let's identify two other problem statements, staying on water.

- Do they end up the same in the west and Midwest? In the short term a mechanism for allocation of resources during drought is needed.

- [What of] economic shutdowns during drought situations?

- [Compare] if you shut down agriculture and you lose all resources for the whole year. Unlike manufacturers where they just don't make as much product.

- Emerging competing uses place pressure. [This is a] medium to long term problem.

What we do with water now is much more energy intensive.

- It's demand side and supply side management —the problem is insufficient understanding of tools for managing water demands for electricity generation in a socially acceptable way.

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- The relationship between surface and ground water issues...What you do to one impacts the other.
- The value of water isn't just that the public needs to be aware of it, but is it the problem of the public? How about the suppliers?
- The demand comes from the public.
- A considerable amount of energy we generate is to transport/move water around.
- Do we believe there is an adequate supply of water?
- The amount of fresh water depends on region/state.
- We talked a lot about transmission, water quality, risk liability, competing uses, interconnection of ground and surface.
- As water quality is degraded we will need more energy to treat that water for designated uses, whether it is drinking water, for agricultural use or various other uses.
- Liability and risk are increasing, as applied to all problems. There is a risk to stakeholders of not having the water and energy available to meet needs. Long term

Is treating ground water resource a concern?

- ...Multi-jurisdictional and competing authorities on water and energy... There are so many regulations and laws, it gets confusing to anyone trying to compete.

Ongoing degradation of water quality

- [There is an] inability to match water quality with its intended uses.

End of Day One

Day Two

James Stine
Vesay
Genoa
McGavran
Hook
CP
William Kumm
Sussi Liu
Sherri Thomas

Today we identify needs

Energy Needs

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As water quality degrades

- Database of water usage on a National Regional State Municipal level.

- PG quality of water database as some is potable and some in not. A good model for that is (USDA) RUS (Rural Utility Service and is at Sandia with Larry Moore) and the database of peak demands. Very good model but applies to energy not water.

What are the parameters of the database?

- It should go back about 5 to 10 years, but focus on going forward with data that means something... That they know what to give you.

PG You want to back far enough to establish the trends. Basic information must be somewhere. That information does exist from the USGS. They are responsible for maintaining this data. Is it somewhere someone can look for it?

-What is not there is the energy side of the database.

- Could you merge USGS data with the muni data? Would it have any meaning? Many munis and states have their own data. There needs to be integration and standardization in reporting and calibration to get a picture of the water flow and the water demand, electricity availability and demand moving forward.

- We need to get it coordinated. The data is there. But it is [a matter of] coordinating the data. The important thing is the trending. The data does not address trends.

-USGS data ... is it accurate as far as actual usage?

- That's probably true. Raw water data but there should be financial information about the value of the water today so that the investment aspect can be measured.

Group E

Eastern Region Energy-Water Needs Assessment Workshop Real Time Notes

- If you were a future policy maker in a region and your job was to approve projects, what is it (data) that you would need to make the decision? You would need to know energy demand, cost options for water. The info all exists but it is all buried.
- Financial information? Shouldn't that data include social issues?
- That would be too broad
- Separate data.
- In Smallville, NC there is a plant value, book value of the plant. If you had that info you could get a trend on where the direction is going.
- There is a push for this but takes a lot of money to update.
- In this local database, what are the existing resources and liabilities associated with these resources and factor them in. Somehow you need to know what all these resources are. The bottom line is what is the best choice to move forward? What is the demand going forward, what are the costs and other implications of the various options and what is the resource at hand and what will it cost to reach that resource?
- Water re-use activities, the whole issue of desalination goes to the people of the coast. It tends to be a coastal issue.
- Current population trends show people moving to places where there is less water and away from coastal region
- In energy, water availability must go into the beginning of the planning. It is not in the energy plan. It must be included in the economic planning
- More data needed, more modeling needed. Market potentials for where Renewables can be used for the energy for water.
- Why are we jumping to Renewables? Do you mean life-cycle costs?
- We should look for more opportunities that are less water intensive and less dependent on the grid.
- Renewable has a role in the long term. Put that as a separate item.

1 Need an integrated database with certain kinds of information to be included. Near term.

Fine tuning of the model
Near term is the inventory
The mid term is the model

Eastern Region Energy-Water Needs Assessment Workshop Real Time Notes

- The long term is to apply the model competently and confidently and have it available to the users. [There] must be an effort to standardize integration of energy and water data with economic and social information and evaluation.

[This type data] must be available to the public and wider on a wide basis for planning purposes.
On-line tool

Designed up front for the user-can plug in own numbers and determine best course of action.

PG The second step is to have some modeling capability that allows using this database.

Do models exist? Do they have to be developed?

There are some: **NEMS, MARKAL** Energy constraints are not part of the model

There is **another model in New England** that gives the opportunity to change many scenarios.
Not sure if water as an input.

-Take the models that exist and use what you can. Elements of many models should be integrated. How could you not include water in the planning process?

- Some of the environmental and social costs should be included.

- How can you do this? This model would need to be very analytical...and factual.

(Disagreement as to if social and environmental issue should be included)

USGS says that there are 2 main challenges for water:

1. Flow requirements for the environmental flow requirements. How much water is available for what is needed in nature?
2. The interaction between ground water and surface water. What is a sustainable level?

- These science issues need to be included in the overall decision making process.

- The human environment is part of the natural environment. Then the social issue should be included.

- The problem is there is no doubt social issues have an impact, but the hard data must be separated from the social aspects.

- Two models can exist concurrently; one looks at the social aspects/value judgments and one looks at the technical hard data side.

- In the MI area they are asked to identify if there are environmental and social impacts. Go look and determined to what degree folks have been disadvantaged by not having flood control. It will be considered separately.

Eastern Region Energy-Water Needs Assessment Workshop Real Time Notes

It's still energy for water. We are considering energy opportunities. Yes the environment is considered.

- When this data set is developed, the ability to extrapolate this information is what we are asking for.
- Maybe we need to define how we integrate.
- One set is strictly hard data and the other set of data is soft.
- Regardless, at the end of the day policy judgments will be overlaid
- Coastal issues surf quality [with] all the pollution washing up on the beach. The ocean [can serve] as a resource
- Focus on technology aspects. And the EPA is the watchdog. Goal gasification CO2 sequestration
- Problem area is water quality is degrading
- Two to three years ago there was the effort to build plants. All had the basic assumption that water was available. The attitude was when we get there we will get the water somehow. Water was never considered in site considerations. We will "always" have the water assumption. Meanwhile water allocation discussions went on elsewhere and never considered future water needs of something like a plant. This is why the data is critical --similar situations in other states, Consider the time spent on site models for plants. In Florida they took all the steps to find the data. But at the same time Corp of Engineers planned a water use that was never communicated. There is a lack of communications among the stakeholders in the planning process that involve the use of water

Need to be an integrated planning effort between stakeholders.

- JS on the east coast the **river basin commission delta associations** maintain a strong control over flows and usage. [In this] example, the cooling tower on a river required several changes. You must be careful because it isn't as consistently applied--lack of integration across the board.
- We keep hearing about the trend is all new power is natural gas. But that is not the only course --political emphasis has been on natural gas.
- DOE tends to think maybe too top down
- The discussions and planning is taking place now: 2014-2015 is when our decisions today will be implemented
- A lot of what we are talking about here is centralized planning and control. Don't forget that markets functioning without constraint serve that kind of function. They function to have that communication without that central planning process. Let's not forget the allocation management modeling.

- The data source would influence the market, but not suggesting that there be a czar. The market is where the social issues will be played out. Taxation will also work out the issue in the market.
- Some people don't trust the market because they aren't perfect and sometimes don't work well. In the east we have an opportunity in the water arena to do better than the western part of the country because we don't have an over allocated situation the west has. We need to work together to get more effective markets.
- But we do see market failure often times.

#2 Liability and risk-- no science and technology need

- This need is there and it is a need DOE needs to recognize that it has cost, especially the legal aspect of it. Need to be an awareness of the considerable costs and that's all we can say—it isn't a science or technology issue.
- We need to work on market value.

#3 Risk to energy generators

Energy Efficiency and water efficiency issues

The need is properly managing the demand by making sure you are efficient

Need other sources of energy to be used more efficiently. Increasing supplies. Using grey water, etc.

Need more accurate life cycle cost/impact of energy production and water management.

Short term -- existing energy and water production

Long term -- future predictions or future options for water and energy production and predicted life-cycle costs.

Pilot demos-- should be based on life-cycle ranking and driving fundamental research. Very little data exists .What is the optimal solution to my problem?

Need to look at co-producing energy and water

No attention paid to the true energy cost of making water

- There is not a function that makes you think of water and energy as a nexus problem. That in effect results in us fighting with each other. The way to lift ourselves out of this (referenced **to his paper**). **WK stood up and spoke about his paper**. We must get DOE to be more creative. Rethinking the approach and beyond the current technologies. Move to something with zero impact.
- The future should be looking of co production of power and water. Hydrogen We are not looking in the direction of co-producing energy and water.
- Where is the benchmarking going on?

JS USGS has project sustainable water resources where EPRI is involved in the big picture.

- How about the global view?

CP the UN has world reports that he can provide references. There was a UN conference.

PG non-potable water is the largest killer in the world. How much of this information as we move forward and translate to the rest of the world.

- Reports are available on the web.

- Example: the drip irrigation system came from Israel.

The gap is insufficient knowledge of practices outside the US to manage resources. Benchmark water usage levels and problems in other countries.

- DOE technology transfer

The gap is the partnership between the government-- organizations and industries are not on the same page. **Cooperation between public and private sectors is not good. It isn't profitable from the private industry perspective.**

We have to be careful not to be stuck in our current paradigm.

CP cost share demo to develop the technology then the industry will pick up. Just writing a report as DOE frequently does, does not encourage industry to pick up the ball and run with it.

Need cost share of pilot projects.

New projects have been funded but creative funding opportunities, creative financing options are needed. Creative thinking about funding opportunities.

We are so far away from accurate decisions because we don't know the value. We must consider the life cycle costs

Available funding is limited. Projects must be picked.

#4 Multijurisdictional

Need to research and catalog to organize and categorize within each region. Where are the redundancies? Where are the conflicts within jurisdictions?

Jurisdictional boundaries, authorities and boundaries in every region on a national basis and in consideration of international water laws.

After cataloged, identify constraints and competing authorities.

Licensing issues regarding data availability and laws and regs, and other documents

-DOE hasn't collected data about the ocean resource such as how close can we do this. Should this be under the database issue?

Need to collect data about the ocean treasure work more closely with NOAA to keep data available.

Water problems

A lot of what we have covered applies to water as well as energy. So you could just say Ditto

- The mechanism of the market proposes: gaps - lots of examples of market mechanisms functioning. A lack of knowledge of the value of market mechanisms for management allocation solving water and energy problems. We have seen market mechanisms come out of air pollutions and stack emissions. Use the market to help us get to where we want to go. There are markets already functioning out west. Are there advantages and strengths to be gained by applying market mechanism? Are there benefits?

Applies to problem 1 2 and three: We need knowledge of the value of market mechanisms for management allocation solving water and energy problems. Is there an application of market mechanisms to water in the East as there are in the west?

There was an experiment in GA with ground water markets in ground water to pay farmers not to pump from the ground water.

This is not a government intervention, but free market.

The example of Coca Cola taking water and bottling it and selling it. What mechanisms are the market mechanisms? There are water resources out there that are being developed but we don't know if they are being developed properly or not to optimize resource to benefit regions.

- Clearly what we have identified here at the workshop are non-science obstacles and policy issues.

We don't know who has authority and what value is placed upon it. The knowledge gap—who is the keeper of the database?

How to ensure every jurisdiction is standardized. Congress needs to be the driver.

Where is the Pixie dust to get this database???

- The information is available but the tendency is to think there is less data collection. There is a push for more private data collection and then sold where there is a market for it. A real challenge is how to get that data that costs so much to gather. It is a big job to catalog what is out there in the private sector. None of it gets into the public sector

- Real time example of the Nuclear industry is reporting to NRC but the data is not used .
The gap is pixie dust (cash)

Identify information needs as to what is valuable to entities; there will be other entities that will provide it.

- What goes on now is the taking of government information, repackage it and then sell to someone else. There are a number of informal markets that have been established, such as farmer to farmer but also those with ag permits and plant owners on an informal basis.

Need to eliminate institutional blockages for informal marketing of water.

The participant has looked at FLA and the water capturing. The water is completely regulated and their mechanism for value is obtained from water withdrawn. They have a process for weighing money obtained for one request and the loss of downstream value. This is complex. This is a reference to setting minimum flows and levels, including valuing the water for uses other than natural systems.

Need specific information such as has been done in Florida Document existing case studies interstate and intrastate where jurisdictional uses are addressed.

How do you provide that information?

PG Example: he was shocked to receive from his area (Loudoun VA) a brochure that explained the water management district and how they got their water. Outreach trying to improve public awareness.

#4 Water

Need is to increase public and institutional outreach of water/energy nexus issues
Personal value of water efficiency or water conservation a la Energy Star.

#5 Mechanisms

CP: What is the impact to put the resource?
What we put for 1,2,3 applies to #5.

We need to know minimum sustainable resource. How do you know when you are going to start restricting activities?

Need Criteria for defining when you are in a drought. Understanding of marketing and regulatory mechanisms for allocation water. How do different jurisdictions define drought and how do they address it? This is the place to start to optimize the best way of allocation.
Need to capture information on how different jurisdictions do this. If the information exists then the gap is that the end user doesn't know it's out there.

-The experts need to be pulled into this. A representative is one person commenting on this speaking for thousands of companies!!

- What about pricing on demand of electricity. Need information on prices verses demand. There is a difference in energy and power. Power you need right now. Energy is over time. Shift the pricing to put in the component of demand, then it allocates based upon demand.

The difference in pricing between water and electricity is a transmission issue.

- In a municipal water system, it is completely funded by the electric side of the house. The water is completely subsidized by the electric system. The reason is because it takes a long time for a water project to pay for itself. Electric project pays for itself fairly quickly. It is a service. It is easier to recover the cost of an electric facility over the water facility. It takes more money to put in an underground water pipe than an overhead line.

- Is it a pricing issue? Water is considered a right to most people so artificial pricing is reflected in this.

Two ways to perceive the management of water shortage: one way is to reduce demand, and the other way is to increase supply.

6 Insufficient Tool

Need to find the better ways of both increasing supplies and better ways for managing demand.

What is the real cost of water and what is the subsidized cost of water?

DOE should do research on innovative way for increasing water supply and for managing water demand. Conservation is the key.

Need to explore opportunities to use demand side electricity management and apply to water management.

Need to identify the true cost of water from electricity Problem 1 and 6.

#7 Considerable amount of energy used

- **Need new technology for post- use water treatment**

- Other energy sources that would be considered off grid that would be cost competitive

Study the demand and energy use of electricity required to move water to the end users and how manipulation of water use can result in less use of energy.

Need to Document the most efficient water use operations. And correlate with the electric use and supply.

#8 On-going degradation of water quality for intended use

What are the top water degradation mechanisms?

Need Identify the best practices to mitigate the mechanisms?

Need to interface with the EPA on what is water quality?

There is a gap in the knowledge of water quality and quantity for intended uses and what is the cost benefit of increased water quality

Document and identify innovative technologies that allow matching of water quality with its intended use both nationally and internationally.

Benchmark water quality and cost to provide that associated water quality.

- Who is going to do all of this? This report will go to Congress and they can create the policy environment to address the ability to do this.
- Some of this can crosscut at a higher level.
- DOE has done best practices in the energy area. It depends on the relationship with DOE to the industry.
- The benchmarking is going on now, the industry has said, yes but it doesn't want to share information that will help competitors. Plants have a great deal of detail but don't want to share.
- Related to public awareness, there is a lack of an indicator that relates shortage with something personal. For example in power there is a relation to number of trees saved, etc. There could be an example of saving xx number gallons of water.

Solutions

Cross cutting set of solutions for water and energy which is the integration of needs

Basic thing we need to do to address a number of our needs

The needs we identified applied to several problems

1. Information gathering for database necessary to perform life-cycle analysis

Develop a comprehensive model for life cycle costs and benchmarks that includes historical data and future forecasts.

Develop data necessary to perform life cycle analysis

Validate model with regional benchmark data

Establish model a priority of technology management

Making model interactive on the web.

2. Create a database and catalog all jurisdictional authorities permits, regulations and permissions granted that pertain to water

3. Develop and rank order promising technologies to increase supplies or manage demand (including international sources)

4. Develop pilot projects to test technologies : Cost sharing, Water energy efficient use, Desalination, Low water power production, Renewables

(At this point the group applied crosscutting solutions numbered in red next to the “needs” identified on the flipcharts.)

5. Explore the benefit of applying market mechanisms to address conflicts between water uses for energy production and other uses. A think piece.

6. Establish outreach to the public regarding water issues. Create a consumer oriented water/energy consumption calculator available on the web—interactive

7. Encourage creation of start-up programs to develop entrepreneurial activities SMBIR

8. Identify and promote projects that encourage symbiotic water/energy production conservation (including international sources)

9. Create and identify new funding sources for implementing large scale projects

10. Identify water quality specifications for specific needs and applications and cost-benefit analysis and explore cascading water uses.

What about Two kinds of models – one for policy and one for consumer

- Does Public knowledge has to come by itself. Not something DOE does as a matter of course.

- How to increase cooperation between public and private institutions requires its own solutions reference MIT and the renewable energy competition

- Now we use Hydro as storage energy supply is there a co-benefit with water?

Are there solutions that improve both our water and energy production distribution? What we are doing now is parasitic and we need symbiotic relationship between water/energy production?

- Matching funds and financing mechanisms that are available and could be used.

Industry is interested in protecting its rights. Funding sources are already known. Whether agree or not, it's number 9.

Drop EPA

Group E