Table 1 Group B Team Members

Kevin DeGroat	McNeil		January 10	January 11
Terry Sullivan	BNL		X	X
Craig Forster	Univ Utah		X	X
Ron Smith	BOR		X	X
Cliff Barrett	CREDA	Hydropower	X	X
Brad Warren	Western Area Power Admin.	Hydropower	X	X
Mike Parker	Exxon Mobil		X	
John Koeller	CA Urban Water council	Urban water	X	X
Dan Macuga	LANL		X	X
Richard Skaggs	PNNL		X	X
Sarah Baldwin		Renewable	X	
Terry Morlan	Northwest Power and Conservation	Electricity planning	X	
Norm Whittlesey	WSU	Irrigation	X	X
Gary Johnson	U. of Idaho		X	X
Sara Pletcher	NETL	Water reuse	X	X
Joe O Hagan	CEC		X	X
Barbara Conklin	USEPA		X	X
Cody Allred	Pacifi Corp	Utility water resource management	X	X
Lynn Takeachi	Kennedy/Jenks consultants		X	X
Ken Shannon	Northern Arizona University.		X	X
John Braden	U of Illinois.	Exec Committee	X	X
Rajan Gupta	LANL		X	X
Karl Wood	NMSU		X	X
Sharon O'Toole				X
Jim McMahon	LBNL		X	X

Water for Energy Supply

EXTRACTION

- Produced water management is an increasing problem.

- Impact on water quality. Produced water usually high TDS and poor quality. The more you extract, the lower the water quality in general.

- Conventional produced water and coal bed methane water. Exponential increase in coal bed methane water, which is sodium bicarbonate. Conventional produced waters have higher hydrocarbons and TSS. Coal-bed methane water has much higher potential for reuse.

10000- 20000 TDS in conventional produced water. 10 – 10 TDS in coal-bed methane water. Permits needed know for coal-bed methane water.

- Communication problem. Water utilities do not know about produced water. "Yuk factor" Supply reliability issues. Urban areas want water to provide housing. If the produced water will end in 20 years, it does not support long-term population.

- Multiple water systems (potable and gray water) being considered.

- Time variability of water sources. Will become more crucial in the future as resources are consumed and new sources become available.

- Municipalities are risk averse for water reliability.

- more thought on long term planning and resource uses. What is a resource today may not be available tomorrow.

- Steam flood injection, oil shale recovery are water interest.

- Oil shale water consumption varies by an order of magnitude depending on the technology that you apply. The water use ranges from low to high. Little progress in oil shale recovery in the last twenty years. With oil prices coming back, it may come back. It will take a lot of effort and confidence that the prices will remain high before oil companies invest in oil shale recovery.

- water used during cracking, drilling, and flooding to produce oils. Can not have sulfate reducing bacteria. May use irrigation water for these uses because it is clean. In some fields, they are using more water than they are producing.

- When coal-bed methane comes on it will produce a lot of water, but it is not collocated with population centers. Transport costs are high.

- depletion issues related to fish and wildlife.

- off shore drilling rigs pump water to on-shore fields that are becoming filled. This can curtail the drilling. (No place for produced water).   Economic driver for reuse of produced water.

- Salinity problems in central valley changing practices for use of water.

- Not aware of any facility that discharges water from off-shore and is being turned down. Exxon facilities discharge all water off-shore after treatment on shore. On-shore production is having problems with on-shore disposal.

- Oil companies are selling produced water to AG industry.

Fuel Production

Transportation for coal slurry. Peabody at Window Rock.
These plants are shutting down.

Refineries

- Waste water streams from refineries. Treatment required.

- Refineries often use recycled water. Trend is to grow more   Not a major problem.

Biofuels

– biofuels, water for irrigation and conversion requires aqueous phase catalytic process that uses water. Growing problem in northwest. Desire to use agricultural waste products for biofuels.

– principle driver for biofuels is displacing oil.

- Studies show that energy balance for biofuels (90 – 110%) energy gain. So it may lose energy if not done properly.

- biofuels will lead to only 1 – 2% of US oil needs. It will be limited by water requirements.

– anaerobic digestion from methane. Dairies, feedlots, hog farms.
Publicly owned treatment methods.

– biohydrogen. Long-term if ever.

– trade-off. If you use biohydrogen, it will reduce methane production.

– no hydrogen infrastructure. This makes use difficult. We have infrastructure to use methane.

Electricity Production

WATER CONSUMPTION FOR THERMOELECTRIC GENERATION.

– are dry cooling techniques cheaper than renewables? Very site-specific. Difficult to generalize. Oil and gas prices are likely to increase substantially in the next decade.

– water quality. Reuse of blowdown and makeup water is limited to a few cycles due to scaling on heat exchange tubes. Requires more treatment to increase the number of cycles of concentration.

– California going to zero liquid discharge from power plants. Water treatment is required.
– People starting to realize the value of produced water.
– large capital and operating cost for zero liquid discharge.
– California is willing to pay extra costs for ZLD.
– air emissions on power plants effects water consumption (wet vs. dry scrubbing). Trade-offs in water use and efficiency in removing SO_2. Will supply references on costs of ZLD and costs of scrubbing.

– retrofit of existing facility for dry cooling could cost 10% more than wet cooling.

HYDROPOWER

– Hydropower. Three major issues. Droughts, resource allocation and environmental concerns. 20% loss of power production due to environmental concerns. They have the turbines to generate more power but are not allowed to use them.

– Environmental issues (salmon) limit hydropower production in Northwest.

- In west many dams are constrained by the amount of water that can be run through the turbines. Hydropower regulatory issues: Endangered species act, NEPA process.

Competition a huge issue – Ag, recreation, salmon, power.

Regulations reduce flexibility to use hydropower.

Efficient use of Hydropower is a growing, immediate concern. Competition and regulatory limits will increase.

Air emissions
– NOx treatment often uses a lot of water in coal-fired power plants.
Question of impacts of future emissions limits on water consumption.

Nuclear
- Concern about water consumption due to increased nuclear power plant production. Nuclear uses more water than coal-fired power plants per unit of electricity.

– 20 years supply of Uranium if all power is nuclear. Will need advance cycle nuclear power plants (mixed oxides).

Siting - Distributed versus Centralized Power

- Distributed versus centralized power production. This will impact on future siting needs. More flexibility in siting with smaller plants, but economies of scale for larger plants. Need to reexamine if this remains true.

– Same applies to hydro. Do we want big dams, or a series of small dams?

– optimization problem. You need to move energy or water.

– hydropower. Relicensing of existing dams is an issue.

– How does a utility acquire the water needed to meet future load growth? Drainages are overly appropriated and need to acquire water rights from agriculture. Continuing to convert Ag water to industrial water will work short term, but not long term.

- Data to monitor and measure water use now to optimize most efficient use of water.

– Katrina eliminated reserves of power equipment and transformers.

– This is a general problem of a constrained system. Any fluctuations will have major impacts.

- Climate change may impact electric generation in the Northwest. The variability may impact snow melt and make water unavailable when it is needed. May change consumption patterns.

RENEWABLES

Water for renewable energy production.

Photovoltaics

- Photovoltaics. Manufacturers not in US. Water use is not an issue.
– We should develop capability to manufacture Photovoltaics in the US.
- Energy will become more and more a value added commodity. This will become a $40B /day market. Cleaning of PV cells could be done upstream and use water for irrigation.

– No contingent markets for water. No way to smooth out variations in hydropower flow.

Biomass

– New Mexico will harvest 1000's of acres of Pinyon Pine and Juniper forests. There is a concern that they will greatly impact water quality. Immediate and increasing.

– biomass is the big issue in water use for renewables. Irrigation for growth of biomass. Use of byproducts for methane production is a different issue.

Urban uses/growth to reduce water. Green roofs reduce fertilizer/pesticide use.

– Biomass byproducts have alternative competing uses.

Geothermal

– Increase in geothermal plants. Water quality/reinjection/cooling.

Geothermal is limited in use. < 1%. Currently almost all hydrothermal.

- New Mexico State uses geothermal water for ½ it's heating. Must reinject this water and it is expensive.

Industrial scale versus small scale will drive the market for geothermal.

– Water rights overlay everything; however, this is a particular problem for produced waters. Regulations in place will not change quickly.

Topics

1. Extraction
2. Nuclear
3. **Produced Water 12**
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8 **Acquire water for load growth 10**
9 **Fossil fuel thermal plant 7**
10 coal slurry
11 refinery waste water streams
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17 Data Monitoring
18 Constrained system
19 Climate change
20 PV & Wind

Urban Problems

Water treatment

– Push to energy intensive treatment processes. Ozone, UV. Desalination, membrane process. Driven by population growth and regulations.

- Inland desal an issue. Arsenic in water is a problem.

– emerging contaminants (MTBE, 1-4 dioxin, perchlorate)

– concentrate disposal is a tremendous challenge inland. Many of the salts are not sodium chloride.

– Water treatment is an economic development problem.

– regressive water rates. Impacts low income people greatly.

– can treat waste water to potable water

– perception and marketing issues. For example, people buy bottled water even though it is no better than tap water.

- Competing uses for water is a huge problem. Urban/agricultural/energy production

Inefficiency in water use. No incentives to users or builders (housing company).

Water conservation deals with programs that limit water use. Water efficiency deals with achievement of the same end goal using less water. Need to focus on water efficiency.

- Integrated resource planning (treat both supply and demand sides).

Conservation – rate structures/water meters/improved technology.

- Large Gap in Adoption of new technologies. No incentives, risk averse.

- Lack of capital to develop and demonstrate new technologies. Building codes and standards inhibit/prohibit use of new technologies. Static problem.

– storm water runoff. Landscaping in urban areas. Covenants in landscaping (e.g. must use Kentucky blue grass).

– money not available to implement new technologies. Not self-sufficient.

– no political will to put in rate structures. Political will varies with the rainfall.

– incentive based systems work better than codes/regulations.

– archaic state laws. Every person in NM is allowed to drill a well for drinking water. 7000 new wells per year in NM. No integrated planning or control over wells. Groundwater issue.

Individual solutions.

– Private versus public solutions. Individual RO units and filters. Clear willingness to pay.

– Voluntary versus involuntary costs. System wide, it is viewed as a tax. On the individual side, the person sees money spent for clean water.

– bottled water consumes more resources. Producing plastic, transportation.

– bottled water regulated by FDA. Public water regulated by EPA.

Agriculture Uses

– true costs of water are not reflected in costs. Example lettuce grown in Arizona use 8 – 50 inches of water.

- What is the true cost of water? No adequate message. There are resource implications of growth and supplying new energy. (Engineers, materials, etc.)

– Ag owns most of the water in the west. The rights for this water are based on 1890 technologies. Laws are not dealing with improvements in technology over the last 100 years. Rights were intended to be sufficient to irrigate a piece of land with the crops of the day. We need to do a better job of defining water duty and enforcing rights that disallow water spreading.

– Water rights principle is use it or lose it. No incentive for efficiency in surface water. Water rights have place and purpose of use tied in to them. It is difficult to transfer water rights.

– Water rights in surface waters are often re-used. Suggests water is over allocated.

Crop selection. Can less water intensive crops be grown? Yes, but can not tell the farmer what to produce. No true costs of water. So water intensive crops are subsidized.

- Water quality impacts – pesticide and fertilizer use. Selenium.
– New York worked with farmers to reduce amount of effluents into the groundwater.
– rice paddies form habitat for wildlife (e.g. birds). This newly created habitat may preclude changes in water use.
- How do you assign true cost of groundwater? Now the cost is electricity. No charge for the water itself.
- Number of papers on the true cost of water (AWWA).

- San Joaquin valley classic example of problem with draining irrigated soils (Selenium issue, saline issue). Need drainage ditch to collect water from irrigation? How to optimize re-use of drainage water is a big site-specific problem. Need to treat residuals.

– flood irrigation practices and impacts compared to traditional irrigation.

– transfer of irrigation waters to power needs and other needs. This may impact the hydrologic regime such as groundwater recharge.

– This would also change the ecology of the area (vegetation and wildlife).
– climate change will impact agriculture. Need to get ahead of this if we can.

Other

Active metal mining in Nevada adds water to streams and will decrease when mining stops. It will be a pit when mining stops and store water. Example of change in hydrologic cycle. Berkeley pit in Butte Montana is an example of heavy metals filling in the pit and contaminating other aquifers.

Energy Production

– energy production threatens water quality. Past practices for produced water have led to contamination problems. Farm alliances worried about coal-bed methane water.

– many power plants have reservoirs that they use for cooling needs.

Withdrawal versus consumption versus other uses for power production water.

– EPA once through cooling will depend on EPA's regulations (316 J). First set was struck down and new regs are pending.

– fish and wildlife protection can impact water for energy production.

– tribal cultural uses of water.

Environmental and Recreational Use

– California banning recreational use of drinking water reservoirs. MTBE from boat engines and microbial limits.

– ESA, NEPA, CWA and regulation of water quality.

- Demands for instream flows due to ESA and NEPA impacts operation of hydroplants.

– CWA impacts disposal and discharge. (CWA regulates discharges.)

CWA benefits can also benefit water treatment (less treatment necessary).

- CWA may impact inter basin transfers.

– temperature impacts on water quality.

– Lake Levels needed to be at certain elevation for boat races in Lake Havasu. This has impacted hydropower generation

Problems:
1) Treating water for urban uses. Energy intensive
2) Water rates regressive.
3) Private versus public approach. Bottled water growth. RO systems
4) Urban vs. Ag sharing shortages.
5) Inefficiency lack of incentives
6) Diff between efficiency and conservation.
7) Integrated resource planning
8) Gap in financing and adoption of new technologies
9) Urban sprawl Stormwater run-off and contamination
10) Landscaping in arid areas.
11) Archaic state laws (urban/ag)
12) True costs of water not reflected in Ag use.
13) Resource allocation withdrawal versus consumption.
14) Hydropower increased instream uses. (Resource allocation).
15)
16)
17)
18) Increasing bans on recreational use in CA.
19) ESA, NEPA, CWA acts and constraints on discharges.
20) Lake and reservoir levels for recreational use.
21) Impacts on Hydrologic systems due to changes in water use.
22) Climate change
23) Produced waters from mines and impacts on surface waters and flows.

Summary

Problem Area 1:

1) Extraction-Produced Water Management Issues
   Coal bed methane
2) Acquisition of water for future energy demands
3) Hydropower

Problem Area 2:
1) True cost and valuation of water
2) Urban inefficiency and lack of incentives to conserve
3) Environmental/ recreational uses
   CWA/SDWA/NEPA/ES&A.

- Oil 10 barrels of water per barrel of oil produced. Cost and treating of this water. Oil produces 5 million barrels per day. Thus, there is 50 million barrels per day. This is not a lot of water. It is distributed throughout the US.

EXTRACTION-PRODUCED WATER

Production water from oil wells – brackish. Would require extensive treatment. Very limited reuse potential.

Coal bed methane waters. Also distributed and in remote areas. Rapid pumping at start. Slows down over time. www.Allconsulting.com has information on amount of coal bed methane. Also, www.BRNL.com. Coal bed methane overlaps in the same areas as water shortages.

Geothermal – reinjection problem. Use of wastewater for reservoir support in geothermal.

ACQUISITION OF WATER FOR DEMAND GROWTH

Need water, fuel and transmission.

Coal plants will be sited where water and fuel are available and transmit electricity to population centers. For example, transmission of electricity from coal regions (Wyoming) to population centers (CA, AZ, and NM).

Gas is alive and well but depends on infrastructure.

More efficient uses of water for thermal production.

Carbon sequestration requires saline aquifer near the plant or place to inject it.

Perception of time is different between oil companies (quick turnaround) and government agencies (slow turnaround).

Coal gasification may use less water than conventional plants. Large environmental benefits to gasification but costs more.

Side effects of gas production (Hydrogen sulfide production).

Agricultural relationships to water rights.

HYDROPOWER

Stream flow requirements are out of synch with ideal electricity production. Stream flow low in hot summer when demand is highest.

How to share shortfalls.

Regulatory issues (NEPA).

Competition with other uses (Ag, recreational).

Distributed (small) versus centralized (large).

Environmental impact of dams is a key issue on whether to remove dams or not.

TRUE COST AND VALUATION

Not reflected in Ag use. Cost of groundwater is the cost of electricity.

Property rights/ownership. Can a market be created?

Water rights based on antiquated laws (1890's).

Water transfer may take several years and difficult to do.

Crop selection. How would this change if water valued differently.

Subsidized water promotes use of crops that may not be appropriate for the region. This leads to increased pesticide/fertilizer use and resulting water quality issues.

Disposal of residuals from irrigation.

Can not have market based solutions if you do not value water appropriately or vice/versa. Market creates value of water and encourages efficiencies.

Current valuation system may restrict technology choices (e.g. not cost efficient).

URBAN INEFFICIENCY

ENVIRONMENTAL RECREATIONAL USES

Jan 11

Needs for Produced Water Management

- Quantify the problem. Volume/ characteristics (TDS, hydrocarbons, etc.) Location information in relation to other infrastructure (transmission lines, fuel sources).

- Need water amount over time. Initially high water production that deceases over time.

- Need energy efficient cost effective way to treat produced water. RO expensive. Ion exchange need to change beds frequently. Electrodialysis not developed to full scale.

– Energy costs for treatment is $0.1 – $0.5 per barrel of water.

Need research to determine which crops grow well in the produced waters.

– CBM waters 1000 – 2000 TDS. Need to get below 800 for agricultural.

- Controversy about disposal with Indian tribes and local population. Need public outreach.

– Need to set up a process to address the problem. This would include teams to study this problem. Current answer is not available.

– Re-injection is not the entire solution.

– Each state has different laws and results will be site specific. Need a series of published case studies of successful management of produced waters.

– Rancher from Wyoming. 1800 permits issued by July 2006 in Wyoming. This is an immediate problem. Placing the water in the worst quality aquifers. It would be better Reinjection is not the answer. It may work in some cases but not all.

– Need state by state list of regulatory issues (regulatory roadmap). Process would include the following stakeholders: tribal representatives, state, local, and municipal governments, states water quality, property owners, state water right owners, state mineral rights, department of interior, corp of engineers, lawyers, BOR, environmental groups, potential water users. This would address ownership, rights, etc.

Need to find an extraction method that removes less water. Is there a technology that will increase methane production will reduce water extraction.

– hydrological studies of coal seams to focus drilling through areas of lower flow.

– This needs to be done on an accelerated schedule. Wells are being drilled now. This is an immediate problem and an accelerated schedule is needed to deal with the problem.

Need to have a treatment system for a cluster of wells (50 – 100 wells).

– Need to integrate produced water into watershed management.

– Produced water spread out over several agencies DOE, DOI, BOR, EPA, etc. Federal coordination needs to be improved to provide a coherent approach.

– Need one stop permitting to facilitate the process.

– 15000 barrels of water per day for five wells. They estimate by the end of 2007, they will be up to 60000 barrels per day. 1 barrel = 42 gallons. 1 acre feet per day approximately 750000 gallons per day.

– discharge limits for total mass of dissolved solids. Disposal wells not successful in the past at that volume.

- Coal bed methane is facilitated by biological activity. Could we reinject the water to produce more methane? Research need.

- unlikely. Most of the methane produced when coal was formed.

Need to assess collocation of power plants near produced water plants. 125Mw plant needs about 1.5 million gpm.

– CBM gas sometimes has CO_2 in excess of pipeline gas requirements.

CO_2 reduces BTU in gas. Less efficient in fuels.

Needs for Utility Acquisition of Water for Future Demands

- Efficiency is critical to decrease the amount of water to cool thermal systems and the need to reduce water demands. Must address supply and demand.

– Water efficiency by other users (Ag – flood irrigation to more efficient).

– water transfer markets are not efficient. Done on a case by case basis. Competition for water resources will always be a problem.

– Potential buyers need to understand the public and institutional time frames needed. Water transfer rights require many years to effect.

- Need more efficient market to trade water.

Need incentives to promote water conservation.

– have been attempts at water brokerage firms. Current activities in Montana and Arizona.

– Need integrated analysis of the siting, the energy, and water needs.

- CBM water will last 20 – 70 years before the wells run dry. Can not rely on CBM water forever.

Needs for Hydropower

- Need to assess impacts of climate change including water quality, water availability, seasonal timing, and variability on hydropower operation.

- Need information on biological needs of fish and wildlife.(ESA).

- Need to understand the impacts of changes in the ecosystem on wildlife. This will help optimize the selection of mitigation needs. Need generic information on the costs of different mitigation based on types of stream, geomorphology, etc.

- Need to address societal concerns about natural systems as opposed to man-made systems (natural salmon versus hatchery salmon).

Need to agree upon definitions. What is sustainable, recoverable, what to restore a system to.

– Need to assess impacts of water use changes. For example changing from agricultural uses to urban uses.

Needs- Valuation of Water

–Life cycle analysis of costs (production, treatment, disposal). Would be time-dependent to account for growing cycle.

- facilitated trading. Market determines value.

– Need to distinguish between market costs and intrinsic value. For example, the value of water to the semiconductor industry is high, they can not live without it. However, water companies can not discriminate among customers.

Willingness to pay is not addressed.

Need valuation of different “quality” water.

Need to include value of water to wildlife in valuation.

Value of environmental benefits.

Need to value water in Ag uses.

Cost of conveying water is primarily born by power users not water users.

Need measures of what are the subsidies and do they make sense (not all subsidies are bad).

Research on whether the current policies promote efficient water use.

– federal policies are inconsistent and will remain so.

– value is time and quantity dependent.

Needs for Incentives to Conserve, Urban Inefficiencies

– Need tiered pricing structure for water. Higher costs to big users. This can not punish the poor.

Need Water Star program for water.

– there are codes for water conservation – low flush toilets, low water use utilities.

– Need to provide incentives to builders to make more efficient homes.

– time between development and adoption of technologies is too large.

Need for increased grey water recycling within the house. There are code issues to deal with on this issue.

Need to improve regulations that inhibit the use of recycled water in residences.

– Need improved land use planning to account for water consumption.

Land use planning
- Local issues
- Plan review for water use like there is for energy.
- Incentives to builders for low impact communities.
- Water usage of landscaping. Xeriscaping.
- Amount of concrete and impact on run-off.

Lack of reinvestment in the aging infrastructure.

Use of solar power to reduce energy consumption (and water use to produce the energy). Can use solar water heating as well. There are barriers to implementation.

Needs for Environmental Regulations and Laws

- Regulatory roadmaps. Federal and state. Determine all interactions.

– Oil and gas regulations differ from each state. Need roadmap for them.

Need for increased coordination. Inconsistencies between different agencies.

Regulations often impede technological solutions.

- Technology needs to provide analysis and decision support tools that integrate the impacts of all aspects that are impacted.

Need to identify antiquated laws for reevaluation.

Needs for Bioenergy

Needs for economic evaluation of bioenergy. Life cycle analysis. Will be very specific and difficult to generalize. Multiple feedstocks (wood wastes, anaerobic digestion, farms, etc.)

Gas production, feedlots, barns.

Need: Research on collocation opportunities

Examine produced water potential for growing crops for biofuels.

Look for opportunities that do not compete with food production. Aquaculture (tilapia).

Greenhouse plants

Aquatic energy plants. Algae production as feedstock for biofuels.

Need: Assess impacts of regulations on the use of biofuels.

Need good marketing scheme to get the information out to the industry that is going to use bioenergy.

Solar ponds can be used for aquaculture that will extend the growing season.

Need: Research on genetic engineering of plants to optimize growth under conditions expected near the well fields.

Need: Bioenergy and watershed management analysis.

Need to consider invasive species.

Research need – can we use the waste heat from the water extracted from the ground? Water comes out of the ground at 120F.

Solar powered telemetry at oil fields.

Need for comprehensive national energy policy that deals with water.

Summary

Produced Water Extraction

1) Information needs on volume /characteristics/costs.
2) Research on potential uses of produced water
3) Information sharing (case studies)
4) Legal institutional infrastructure issues. Regulatory roadmap.

Utility Acquisition for Future Demand

5) Analytical tool to look at efficiency trade-offs and technology options.
6) Market framework

Hydropower

7) Impacts of climate change
8) Biological characterization of impacts of hydropower on vegetation and wildlife.

Valuation of Water

9) Integrated infrastructure analysis
10) Research on value of environmental resources (cultural, tribal issues)
11) Analyze water distortions and trade-offs.

Urban

12) Tiered pricing structure
13) Landuse with water impacts.

Bioenergy

14) Integrated analysis of economics, resource uses, etc.

Summary

Produced water

- **Quantify produced water re coal bed methane (7)**
- **Research and characterize technology solutions to disposal/use of produced water (6)**
- Public process for implementing solutions (2)
- Regulatory road map (1)

Water for increased electricity demand

- Analysis of tradeoffs between water efficiency and thermal efficiency (3)
- **Need market framework for potential water transfers (14)**

Hydropower

- Analysis of impacts of climate change and climate variability (2)
- **Research on impacts on water systems, impacts on ecosystems (7)**

Valuation of water

– Integrated analysis of market cost and intrinsic value (0)
– Research on value of externalities (environmental, cultural) (1)
– Characterize market distortions, subsidies, tradeoffs (security)

Urban

– Information, incentives and programs to motivate builders and consumers to conserve and increase efficiency and incorporate renewables (1)

Assess and characterize bioenergy (9)

Solutions

Produced water from CBM.

Develop other uses for the produced water. Greenhouses, agriculture,

Typical solutions: Reinject, evaporate, land application, treat,

Use crops that can handle salinity

Centralized collection and treatment.

$1 -$7 per barrel to move water. Co-locate power plant to reduce these costs.

Integrated solutions not easy to sell.

S&T roadmap to look at beneficial reuse program for produced water. Holistic approach that considers treatment, land use, collocation of power plants, Ag reuse etc.

Water acquisition for future demands

Water Star program similar to Energy Star.
Federal Water Efficiency Standards for Applications.

Effective tiered pricing. It can be time-dependent, higher in summer when water demands are greater.

Metering system for charging and feedback to users.

Involve government in transporting produced water to where it is needed. (BOR canals)

Get ranking /measures of costs/technology options. Capital costs, O&M costs, lifetimes, discount rates.

Continued effort to increase the efficiencies of Ag use for water. Water Star for Ag water uses.

Need to adjudicate water rights to determine how much water is there and actually available.

Junior right holders are first in line for excess water. Difficult to transfer out of the basin without satisfying Junior right holders.

Value water to provide incentives to use water more efficiently.

Siting of new plants. Co-locate new plants with retired plants (all infrastructure is their) and use more efficient water use technologies.

More efficient thermal plants – combined cycle plants.

Regulatory Roadmap

Develop one for water/energy issues. Include various agencies to develop this roadmap.

Streamline permitting processes (BLM, EPA, etc) . In 2005 Energy Policy.

White House level summit needed to call for this roadmap.

Consider several smaller roadmaps: CBM, Hydropower, etc.

BOR has a reasonable roadmap for produced waters.

Statewide/Regional/technical topics.

For CBM you can look at issues on a watershed basis. Can start small and increase regionally. Need to get local stakeholders in the room. CBM – nobody currently owns the water in some states. State owns the water in NM and Utah.

Roadmap has to be focused on implementation. These are the difficult issues.

Hydropower impacts on ecosystems

Evaluate ways to minimize man's impact on habitat.

Protect the environment while producing power.

ASTM standard to evaluate environmental impacts of different generation technologies. Coal has air impacts, wind has visual and bird impacts, hydro has ecological impacts.

Develop better information and analysis tools.

Develop advanced storage technologies to store energy for later use. Often have to spill water at times when energy is not needed.

Bioenergy

Research on plant genetic studies to optimize biofuels.

Private funding into types and quantity of oil produced by corn, soy, and peanuts.

Water use in feedstocks and conversion facilities.
Develop crops that replace high water use crops.

Develop bioagents to clean water. Good for organics. (Bioremediation of waters).
- Genetically modify alfalfa to take up NaCl. It grows as well as natural alfalfa. Can get up to 7 cuttings per year. UC Davis.

Biopower production and cooling water (produced water). Thinning of forests could be used for power production. Currently burned in place.