1/10/06
Group F Facilitator Jack Whittier
Note taker: D. French
Breakout Session 1 Problem Area: Energy Supply

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- Blain Ipson, IPSC
- Bill Miller, Pacific Power & Gas
- Don Mustard, BP America
- Bruce Johnson, Tucson Water
- George Sherk, Utton Center
- Tom Gede, CWAG
- Tom Trout, USDA-ARS
- Kerry Howe, Univ. of New Mexico
- Gail Achterman, OR State U
- Jane Blair, Bureau of Reclamation
- Lin Harmon-Walker, Lewis & Clark Law School
- Bailey Green, LBNL
- Mark Squillace, Univ. of Colorado
- John Tracy, Univ. of Idaho, Univ. of Idaho
- Bailey Green, LBNL
- Troy Willardson

Extraction

- Problems Bp extraction of natural gas, problem is produced water sodium bicarbonate,

Treat with reverse osmosis, 22 re-injection well into ground, 60,000 barrels of water per day.

- Small impact to the Colorado river basin due to produced water
- Extraction from 2 to 3,000 ft. with re-injection to 5,000 ft, but re-inject to same type water quality
- Before drill well BP must test 2 wells for water quality around main well to ensure water quality b/c people are concerned about water quality.
- Loss of production of water wells located at 2-300 ft, but BP does not impact shallow well quality
- CBM
  - Water quality, sodium Bicarbonate
  - Re-injection is current solution
  - Issue of assurance to surrounding landowners
  - No recharge issues to maintain head on total water system
  - Law suit has been filed on impact to watershed
- Re-injection controlled by Oil and Gas Commission
- Re-use of produced water for beneficial use for crops b/c
  - Whose water is produced water, who owns the water? Water ownership
  - Treated produced water becomes an issue b/c waste if not treated
  - Cumulative the produced water becomes a state policy issue in a broad outlook
  - In OR and WA power is produced by natural gas or coal, natural gas from Canada
    - Mining and extraction in surface extraction has impact on GW and aquifers
- Issues
  - Water quality – during extraction process, crosscutting or fracturing aquifers
  - Impact on aquifer - quality and quantity – extraction of produced water
  - Ownership of produced water
- Same problem with Gold mines in NV where water is extracted and put into river
- Big issue: Produced water from any extraction, coal, CBM, gold/silver
- Issue: reveg of coal takes lots of water
- Issue: Inconsistency of state law is not a major issue with BP because BP just deals with it

- Issue: Inconsistency in state laws of who owns the produced water or maybe in the application of the state law
- Issue of produced water
  - Who owns it, LT and ST problem
  - What can you do with it
  - Rename the water from waste to water avail for use (change in name of water) therefore different
  - 1.80 per barrel to treat by RO compared to 1.10 per barrel to re-inject by BP, but may treat b/c of public perception, does not include value of water. Transference of water. 25 years of water production from CBM production, but quantity will decrease over the years.
  - BP hears that view, quality of water, quality of life b/c of extraction wells
- **Extraction impact or issues**
  - Aquifer impact
    - Who is causing the issue, b/c lack of good data to know impacts of extraction process on water table
    - Regulatory claims
      - Regulatory cost to energy production and is a community concern about such extraction (regulatory cost imposed by law plus community public perception costs) Extraction process issues need to be transparent.
    - Local/political impacts (in TX GW is absolute ownership)
    - Funding limitation for data on modeling and actual acquisition of water
    - All water users have an impact on water availability, needs more education, but needs to be done on community level to get people's attention.
  - Produced water, who owns it? And who get ownership when, who can sell the water
  - Quality/Quantity, underground mining, GW impact
  - Cumulative effects of lg. Number of producers or extraction processors
    - Impact on water quality and quantity
  - Public perception
    - Community
    - State

- Extraction of Uranium
  - Different water issues
- Indians lease water thus produced water can also be leased
- Re-injection in WY and UT same issue of who owns it?
- WY does not do a good job of management of produced water
  - Powder river basin water quantity is up b/c of produced water from all the small wells
- Constraint
  - Availability of good data regarding aquifer impact issues
  - BP painted with brush that they are impacting the aquifer and real issue is that state/county allow withdrawals but really do not know.

- **FUEL PRODUCTION**

- Oil shale
  - Will probably consume lg amt of water
  - Uncertainty if it will be developed
  - Where to move fuel and how
- Coal gasification
  - Will probably consume lg amt of water
  - Uncertainty if it will be developed
  - Clean coal
  - Where to move fuel and how

Electric Power Production

- Decommissioning of hydro power plants b/c of env.
  - Concerns total reduction of power production
  - Better usage for water (public water supply or recreation) rather than power production
- Need better data and operational management of hydro power generation
- Need better forecasting b/c of uncertainties
- ESA causes problems on flow compliance
- Water rights not fully adjudicated and where hydro rights lie
- Hydro cycle will change b/c of climate change b/c lower water quantity and different timing
- Co-generation – huge ability to generate power in current water distribution (under 5 MW)
  - Legal and regulatory issues and permitting costs
  - Connection into grid
- Power paid for irrigation
  - Do not have $ to keep projects going on hydro
  - Cost of rehab hydro production
  - Aging and redesign necessary to keep current or increase hydro power
  - Climate variability may cause catastrophic failure of hydro system

Other

- Value of water
  - Opportunity/time cost
  - Real cost of water actually varies quite quickly, but not as quickly as energy costs; however, such quick changing of water costs is not acknowledged
  - Lack of info in understandable format
  - Temporal & spatial value of water
    - Peak pricing
    - Spatial issue, not fully understood
    - Water intensity of water energy generation technologies
- Movement of water, interbasin transfers (Florida water case)
  - Water quality in water transfers under NPDS regulated systems

Thermal Generation:

- Siting of new facilities
  - Real water impacts
  - Public perception of water impacts
- Recovery of cooling water
  - Costs
  - Technology limitations

Renewables

- Same as extraction
- Quantification of water resources needed or energy resource (cost of pumping, etc.)
- Bio-based
  - Is it a wise use of water per unit of generation in the west (energy water balance and certainty)
- CO2 costs are not captured in power production thus true cost of solar may be viable
  - Undo market price cost of CO2
- Other pollutants are not captured in cost of water, external costs need to be captured to make comparison between renewable energy and current energy (thermal) production (level the playing field to make comparisons)

Urban Water Use:

- Broad growth policy problem,
  - Recharge issue
  - Sustainability of GW
  - Increased energy cost for extraction
  - Increased scarcity
  - Inadequate regulation of GW
    - Race to the bottom, aquifer management
- Lack of legal and regulatory protection of GW
- Lack of sustainable GW management
- Lack of recognition of surface and GW interconnectivity
- Lack of Jurisdictional management
  - Fragmented water districts, lack of coordination except for Las Vegas
  - State law in UT encourages fragmentation of water systems
- Need for regional planning, implementation with land use and water
- **Political pressure to accept short-term gain vs. long-term cost**
- Linkage between tertiary treatment and energy cost
- Lack of total environmental and energy costing of energy production and water usage
- Lack of projected physical water supply analysis
- Laws in reallocation of water, high transaction costs
  - Do not have an efficient reallocation system for water usage
- Effect of climate change on urban demand, earlier spring and later fall (8% increase in length of summer)
- Future energy demands for water storage (dams and recharging GW)
- Infrastructure is aging
  - Original design requirements, need to be redesigned
  - Post of 9/11 infrastructure vulnerabilities are readily exposed
- Leakage of public water systems
  - Regulatory burdened leakage in AZ is limited to 10%
- Urban pricing issue
  - Lack of price signals for all sectors
  - Is it really an issue of pricing structure?
    - Is it a planning structure that will cause a decrease of water instead of pricing

Agriculture:

- Energy costs associated with irrigation
- Understanding water balance issues

Conservation:

- Not enough attention on conservation
- Value of conserved water
- Do not want to address conservation as a beneficial use
- Link to infrastructure
  - Transmission velocity of sewage needs to be maintained for current water treatment systems
  - Lack of analytical methodology to recognize sequential savings (total systems engineering analysis not done)
  - Waste water treatment improvements is an area for substantial energy savings

- Effluent discharges are in some places in AZ are the only actual water source for that stream, thus, if decrease in discharges then loss of that water resource.
- Effluent discharge to river vs. potable water supply
- Demand hardening of water systems

1/1106 (Day 2)

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Breakout Session 1 Problem Area: Energy Supply

- Always Policy implications to technical solutions
- Group A, needed equivalent to DOE Energy Star program such as Water Star program
- Group B, imbedded infrastructure, a better statement for capturing overall infrastructure systems
- Group C, lack of modern conveyance systems instead of leaking piping systems
- Group D, outmoded paradigm of original and current energy distribution systems, distributed energy system may be the better model
- Group D, match water quality and quality demand (end use). Failure to match water quality with end use.
- **Brittleness of regulations**, inability to be flexible to meet demands. May be a problem of inability to state actual cost of water

- Biomass power generations systems
- A more diversified power generation system where appropriate
- Current exclusive power generation should move toward a more diversified power generation system, thus, current system maybe not be sustainable and need to move away from that paradigm
- Distributed power generation systems **Complement** current power production paradigm
- MS more efficient use of reclaimed power for cleaning up water

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Energy Extraction – Water quality impacts

- Better aquatic toxicology
- Better local water quality baseline, set up monitoring systems for quality baseline
- Assessment of all impacted strata to understand the issues more fully
- Companies needs financial incentives to treat water to higher standard
- Problem is the incentive is for mining company look to reuse of the water rather than re-inject (produced water is not productive – what do you need to make it productive), Resolve the issues of:
  - Cost
    - Treatment level to meet maximum beneficial use

  - Legal rights issues
    - Need regulations that match water quality with end use (appropriate level of treatment)
    - Who owns produced water, best if mining company
    - Need to clarify ownership, such as producer is owner
    - **Need for legal/regulatory reform to promote maximum beneficial use (clarify ownership of produced water)**

- NEEDS
  - Baseline
  - Monitoring
  - Treatment

Environmental Accounting

- Need a method of full cost environmental accounting
  - Need data,
    - fully cycle costing,
    - water intensity for power production,
    - treatment standards,
    - collection,
    - transportation,
    - treatment for waste water,
    - **methods for evaluation of authorized pollutants (Mark S)**,
    - extraction costs (gals/KWhr),
    - energy intensity (KWhr/gal) of water uses,
    - Other metrics, e.g.,
      - Gal/KWhr
      - KWhr/gal
      - Gal/tons of CO2
    - water quality
    - Risk analysis
      - **Need ability to put a cost on pollutants (Mark S) see above**
      - Need models to help define the various risks
    - **Price of water is different than value of water, need value of water vis-à-vis the full cost accounting**
    - NEED better standardize methodologies for decision support systems

Value of Water

- Need to match water rights to hydrographics so you can translate old right to current day and year to year (hydrographic collection in terms of temporal and spatial) (such as done in Colorado)
- Need index of reliability for water right (opportunity cost analysis)
  - Need list of water rights per drainage in an accessible format (databases need to be revised to make such databases usable)
  - Need to flow characteristics over time (need predictive models for water availability)
  - Need a set of standards or protocol or std methodology for assessment (**This is where National Labs would be useful b/c of computing abilities and data management abilities**) for:
    - **Need to quantify federal reserve rights** (e.g., tribal rights)
    - **Need to quantify regulatory rights (TMDLs)**

- **Energy Problems -- Combining bullets #3 and #6 from Group F Energy Problems**
  - #3 Electrical production – aging infrastructure
  - #6 Electrical production – regulatory and licensing requirements, lack of transmission capability and grid acceptance impede the development of distributed small scale hydro
  - Major federal power production facilities are beyond their life expectancies
  - Macro level system of data production for power usage/production (probably does not take into account water)
  - Subsidies and credits assumptions are not agreed upon
  - DG distributive generation, water not taken into account

Aging Infrastructure (embedded) [Also applies to Water]

- Asset management
- Condition of asset
- Current need
- Projected future needs
  - Look at alternatives
    - Look at cost impact of each alt w/ respect to water use
    - Need improved integrated decision support systems
- Gap analysis
- Allocation of cost per needs
- Need load flow analysis for DG on a regional basis (water component needs to be included)

Water Needs

- Needs on 2 and 6 already discussed
- #4 Increase demand and increased scarcity
- #5 reallocation systems
- Need to talk about #1 and #3
- #1 Need mechanism for regional (water sheds) planning, coordination, implementation and management across jurisdictions
- NEED to define on initial scale of hydrographic neighborhoods (problem sheds) (lack of land use planning based on water availability (both temporal and spatial)
- NEED model that integrates both land and water use. Need analytical tools to run this analysis. This need should be correlated to water rights, transmission systems, irrigation, municipal water supplies, opportunity costs, population assessment, etc.
- Gauging systems
  - NEED -- Integrated measurement and monitoring system
- Need uniform standards (data standards) or base for common starting points for the various water planning analyzes

Conservation (water)

- Similar to Energy Star
- **Focus on water duty problem (Mark S)**
  - Need to inform water consumers
- Savings by design
- New water comes out of conservation (not just reduce return flows)
- **NEED full definition of the water saved**
  - **Need Ability to determine and quantify water saved (value)**
  - **Need Better water efficiency metrics**
  - **Need to Reduce transaction costs between willing buyer and willing sellers**
- **NEED incentives/subsides for recycling water**
- **NEED severance tax on water lost by not recycling**

Group F Problem Statements/Needs/Solutions

E1 & W1 Problem statement

- Lack of environmental accounting methods to allow comparative analysis of various water and energy technologies

E1 & W1 Needs

Environmental Accounting

- Need better stds methodologies for decision support systems to capture full value of water

E1 & W1 Solutions

- Develop, test, evaluate standardized methodologies for decision support to capture full environmental accounting
  - NBS, ASTM, NBII, ASHRAE (look at Std producing organizations)
  - DOE put together consortium, steering committee to direct actions
    - Educational function/outreach to various college programs

- Develop methods to include water intensity in energy planning/decision making and energy intensity in water planning /decision making

- Develop standards /methodologies for water appraisals
  - Economists, etc.
  - Borrow from real estate appraisals

- Develop reliability index and std protocols for determining water right(s) reliability
  - What is the percentage of time that right will be available
  - What is the availability, when, and how much (temporal and spatial)
  - What are the opportunity costs (replacement costs)

- Done by hydrologists/ water rights experts, biologist, chemists

- Users – anyone who wants to buy water rights

- Database development
  - What is required for index
  - Need real time flow monitoring system

E2 Problem stmt

Water produced from energy extraction is used beneficially

E2 Needs

- Regulations that match water quality w/ end use
- Need for legal/regulatory reform to promote maximum beneficial use
- Need to clarify ownership of produced water

E2 Solutions

- Identify markets for degraded / produced water
  - Quality
  - Quantity
  - Duration
  - Location

- Reduce treatment costs for treatment of produced water
  - Re-filtration cost reduction for R/O
  - Improved membrane efficiencies

- Pilot programs to test produced water reuse

E3 & W3 Problem Stmt
- Current dependence on centralized energy generation may be unsustainable and needs to be complimented by distributed generation

Need E3 & W3
- Aging infrastructure (Imbedded)/DG
- Asset mgmt
- Condition of asset
- Current needs
- Projected future need
  - Compare alternative include water use
- Gap analysis
- Include water in DG strategic value analysis on a regional basis
  - Refine methodology

E3 & W3 Solutions
- Develop new systems analysis tools for energy/water sustainability
  - Developed by labs and universities
  - Users – waste water treatment, electric/water utilities
- Pilot Projects for regions (local scale first the move to larger projects)
  - Model
  - Data
  - Identify limitations
- Develop decision support tools to support integration of mixed systems (DG to centralized)

Water W1
Problem stmt
Lack of information or understanding of the value of water in terms of true cost, opportunity cost and spatial and temporal variations in value.

Need W1
- Need for reliability index for specific water rights
  - Need standardized protocol
- Need predicative model for long term value of water
- Need quantified Federal/Tribal reserved rights
- Need to quantify regulatory, e.g., ESA, CWA
- Need real time monitoring data

Problem stmt W2
Lack of regional (water shed) planning, coordination, implementation and management across jurisdictions and ownerships to integrate land use and water supply

Needs W2
(Number 1 & 3 combined)
Mechanism for regional planning (watershed)
- Need to define scale of hydrographic neighborhoods
- Need analytical tools that incorporate water/land
  - Model to integrate land and water
  - Tucson example –
    - Demand forecasting
    - Need for uniform stds
- Gauging systems
  - Integrated measurement and monitoring system
- Need for data stds to inform water planning

Solution W1 & W2
- New technologies for measuring/monitoring
  - Gauging stations currently $50K, and $15K to operate

- Develop common data stds land use and water use for integrated land, land use and water supply planning and management
  - Data mapping

- Develop protocols for integrated land, water, and wastewater

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Problem stmt W3 & E
- Failure to pay attention to water conservation (supply curves of water)

Needs W3 & E
- Need full definition of the value of water saved
  - Determine and quantify value
  - Better water efficiency metrics
- Need incentives/subsides for recycled water (example – treated water to ocean)
- Need severance Texas water "lost" to ocean

Solution W3 & E
- Replace aging water meters