

NETL Water-Energy Workshop
Water Management for Fossil Energy Systems
August 20 2014, Baltimore, Maryland

Breakout Session A

Facilitator: David Stopek Recorder: Jordan Kislear

Each of the sessions provided a review of areas where R&D funds can best be utilized over the near term. The order of discussion was based on prioritization of the categories to be used by each of the Brainstorming Groups. Each group participant received two red stickers. Participants used these to vote for their area of greatest interest for prioritizing discussion among the categories listed below. This ensured that sufficient time would be available to capture discussion on the areas of greatest interest to that group.

The order of discussion was based on prioritization of the categories from the Brainstorming Groups:

- | | |
|--|---------------------------|
| 1. Cooling Systems: | Total Votes = 7 |
| a. <i>(Wet and Dry)</i> | |
| b. <i>Incremental & Step Change Improvements</i> | |
| 2. Water Treatment and Reuse: | Total Votes = 6 |
| a. <i>Economic Pathways for Zero Liquid Discharge</i> | |
| 3. Process Efficiency and Heat Utilization: | Total Votes = 2 |
| a. <i>Pathways for produce more power per unit of water withdrawn, consumed, and treated</i> | |
| 4. Data, Modeling and Analysis: | Total Votes = 1 |
| a. <i>Tools to enable regional and plant level decision making</i> | |
| 5. Other topics | Total Votes = none |

At the conclusion of the session, several members of Group A felt strongly that the R&D needs discussed should be prioritized to reflect their relative importance of being able to make a timely impact on the reduction of water use for the generation of electricity. Group A decided to prioritize the results of the discussion. These votes are show for each bullet in the discussion summary of Group A.

Cooling Systems:

- Once-through cooling systems are critically important to water conservation in that they minimize consumption and have a better efficiency than systems with cooling towers. Technologies that promote the continued use of once-through cooling are needed. **Votes = 5**
 - Note that power plants using ocean water for cooling cannot easily be converted to cooling towers. There are no solutions pending for this issue.
- Use of degraded waters for cooling tower makeup is important to reduce the strain on groundwater
 - Sources include
 - Saline waters (sea water/brackish water)
 - Produced waters
 - Treated FGD Waters
 - Municipal Waters
 - Issues include:
 - Corrosion
 - Scaling
 - Ability to cycle up tower circulation rates
 - Bacterial issues with Municipal Waters
- EPRI & NSF have an extensive research initiative in progress as do ARPA-E. The results from this research will be available before a new round of NETL funding may be available. NETL Funding may be more valuable if positioned to support a **DEMO** program in the 2015-2017 time window. This program should be structured in a manner similar to the successful Mercury Control test program. Early demonstration of technologies at that time could be “game changing” if they can be applied prior to making decisions for new water permits needed in the 2017 – 2022 time window. **Votes = 6**
- Use of Waste Heat to produce chilled water was mentioned. There was little enthusiasm for this topic. Uses such as combustion turbine inlet air cooling are known. Ability to recover water from a cooling tower plume sounded like a perpetual motion machine in that more cooling water would then be needed.
- Better designs for cooling towers is always of value. This includes documentation of improved packing materials, better contactors, anything to improve efficiency, reduce corrosion and micro-organism based fouling, etc.

Water Treatment and Reuse:

- Technical decisions needed by 2016 and 2017 to impact permit applications and technology selections. Therefore **DEMO** assistance would be useful (See above)
- Current zero-liquid-discharge (ZLD) technologies could use improvement. Nearly all still require blowdown of an aqueous solution that is loaded with salts (mostly chlorides) that do not crystalize with the other materials that are very difficult for disposal other than deep well injection.

- Need to conduct more research on the issues of landfill practice on Barrier Stability and Leachate.
- Work is needed for solidification and stabilization of solid wastes.
 - Development of good recipes
 - Long term impact on liners
 - Imperviousness to breakdown with time
- Research into value added product and market development from wastes
 - Fly Ash
 - Bottom Ash
 - FGD Gypsum
 - Strategic mineral recovery from waste waters

Process Efficiency and Heat Utilization

- Don't take any fuel off the table. A diverse fuel utilization portfolio is critical to long term vitality of the energy supply stability.
- Look to produced waters as a source of supply? **Votes =1**

Data, Modeling and Analysis

- Existing data analysis tools are meeting industry needs.
- The concept of a Water Atlas can be very beneficial to all segments of the industry. *(There were extensive questions and comments on the value of the Water Atlas during the Opening Remarks by S. Maley. Many of the participants were interested in gaining access to raw regional data for use with various needs and applications.)*
- There is a need for new and improved "on-line" sensor technologies for Se, Hg, As, NO₂⁻, NO₃⁻ in particular and for Organics, Cu, Br⁻, B, and Cl⁻ as well. Current lab measurements do not adequately capture the variability of waters with time, are expensive to gather, and labor intensive to process. *(During the research results discussion on Thursday, there is a strong correlation between Br⁻ in FGD water with high concentrations of Se in the waste waters.)*

Other Topics

- Development of integrated advanced power plant design with optimization of cooling systems
- Lessons learned from concentrated solar cycle design could play a role in thermal plant design
- Advanced Materials are an enabling technology for all areas of development and can play a critical role in developing lower cost approaches to all technology development in treatment and cooling systems. **Vote=1**
- NETL should look at International Collaboration to identify work done around the world and help with technology transfer to the US market.
- Advanced generation technologies are on "the radar". NETL should continue to look at how these new technologies can be developed with lower water utilization foot prints. **Vote=2**

- It is unclear how and when distributed generation will begin to make a significant impact on overall power generation from central power plants. Therefore it is hard at this time to predict its impact on water use for electric power.
- Energy storage has value to the power supply infrastructure. Efforts in developing technologies should continue. **Vote=1**

Attendees:

Stopek, David (Facilitator)	LTI/NETL
Rawls, Patricia	USDOE - NETL
Reidpath, Maria	USDOE - NETL
Arellano, Kimberly	Access Intelligence
Eklund, A. Gwen	URS
Kelley, Jennifer	Headwaters Resources
Mantello, Michele	Lockheed Martin
Renew, Jay	Southern Research Institute
Smolenski, John V	Tampa Electric Comp.
Wedig, Christopher	CB&I
Wilson, Jeff	Southern Company Services
Richardson, Mandi	URS
Offen, George	EPRI
Kislear, Jordan	DOE - HQ