

**ENERGY-WATER ROADMAP  
TECHNOLOGY INNOVATIONS WORKSHOP  
PROCESS AND APPROACH**

The Technology Innovations Workshop associated with in the Energy-Water Research Roadmap development effort will be held May 9-11, 2006 in San Diego. This is the final workshop in a series of workshops that have been focused on the development of a research roadmap for the US Department of Energy in the Energy-Water Nexus area.

The science and technology research and development discussions in the Technology Innovations Workshop will be focused on addressing the regional and national energy-water interdependency needs identified in three Energy-Water Roadmap Regional Needs Assessment Workshops that were conducted from November 2005 through January 2006.

**Energy–Water Research Roadmap Development - Background and Process**

The roadmap development process was initiated late last year with a series of three Regional Needs Assessment Workshops that drew from a large cross section of people engaged in various aspects energy and water production, management and research. From these workshops a summary of research and technology needs were developed in the following eight categories:

- Water Resource Characterization
- Integrated Resource Planning and Decision Support Tools
- Oil and Gas Produced Water Treatment and Use
- Emerging and Renewable Energy Technologies
- Water Efficiency in Biomass and Biofuels Production
- Thermoelectric Power Generation
- Energy for Water
- Infrastructure Improvements for Energy-Water Efficiency

The summary results of each of the three Regional Needs workshops are presented on the Energy-Water Roadmap website at [www.sandia.gov/energy-water](http://www.sandia.gov/energy-water) .

Following the regional workshops, a Gaps Analysis workshop was held in early March 2006 where additional clarification on science and technology gaps was solicited from about 40 participants with established technical expertise in these eight categories. During this workshop an attempt was made to:

- a) further refine and clarify needs within the eight categories into subcategories;
- b) establish a sense of today's baseline or performance in each of these sub-categories;
- c) establish near-, mid- and long-term technology or performance goals;
- d) identify the stage of research effort required to reach these goals (e.g. basic research, advanced development, test and evaluation); and,
- e) identify the lead government agencies for possible execution of these efforts and the support required from DOE.

Following the Gaps Analysis workshop, additional consultations were held with the Energy-Water Executive Committee to further refine and focus the information assembled during the Gaps Analysis Workshop. Consolidation and some rearrangement of the various need areas were carried out and emphasis was given to those areas where the Department of Energy mission best fits the identified needs. The summary results of the Gaps Analysis Workshop are summarized on the Energy-Water Roadmap website at [www.sandia.gov/energy-water](http://www.sandia.gov/energy-water).

As a result of these consultations, the subject areas were focused into the following six energy-water needs categories and subcategories:

- Water Resource Characterization
  - Improved monitoring and characterization technologies
  - Enhanced data collection
  - Improved data management
  - Improved data and characterization of impaired water availability
- Integrated Energy-Water Resource Planning
  - Improved cooperative regional resource management planning framework and approaches to assess critical future energy and water demands
  - Advanced regional resource planning decision support tools
  - Climate variability modeling and validation
  - Regional policy, regulatory, and economic technology implementation drivers
  - Regional infrastructure changes to improve energy and water resource utilization efficiency
- Water Efficiency in Biofuels and Biomass Production
  - Improved thermo-chemical processes in biofuels production
  - Biofuels feedstock from impaired water or impaired lands – i.e algae and brackish or produced water
  - Improved biorefining for energy applications
  - Improved biomass to energy processing and assessment tools for watershed improvement analysis
- Thermoelectric Power Generation
  - System models to assess impacts of alternative cooling approaches
  - Improvements in dry and hybrid cooling technologies
  - Environmental and materials issues associated with impaired water use in cooling
  - Advancements in water intake designs to reduce ecological impacts
- Emerging and Renewable Energy Sources
  - Assess water contamination issues with oil and gas sand/shale development
  - Assess and develop kinetic energy hydropower
  - Technology and model development to support distributed power generation to reduce water use and increase energy efficiency

- Water Treatment and Impaired Water Use
  - Science-based ecological and environmental water quantity and quality requirements
  - Improved energy efficiency of impaired and produced water use and reuse
  - Improved energy efficiency of water transportation and distribution
  - Improved efficiency of water treatment and water storage

### **Technology Innovation Workshop Process**

The goal of the final Technology Innovation Workshop is to develop specific research activities that could be implemented for each sub-category noted above in each of these six general subject areas. The proposed research activities identified in the workshop will include:

- a description of the research and development efforts needed,
- the expected impact on the overall energy-water problem,
- the expected execution time (e.g. near, mid or far term) and duration of the effort,
- rough-order cost estimates of funding needed,
- possible constraints and challenges,
- cooperative opportunities, and
- candidate groups, organizations, industry, institutions, as well as state and federal agencies that should or could be involved with the research.

This final workshop will rely on input from technical experts in each of the six categories from industry, government, national labs and universities to develop the specific research pathways for each sub-category. The workshop will be facilitated through a series of day-long structured discussions and interactions for each category. The over-arching goal is to identify specific science and technology research and development priorities that will enhance and accelerate improvements in energy and water use efficiency and improve long-term energy reliability and cost-effectiveness, and overall economic security and prosperity.

In the Technology Innovations Workshop we are interested identifying detailed research and development opportunities required to help meet current or emerging Energy-Water issues. Included will be:

- Ideas that cover all phases of technology development and implementation pathway.
  - Included are research, development, demonstration, test and evaluation, and implementation suggestions and ideas.
- Ideas that cover all elements needed to insure an improved strategy or approach can be effectively implemented.
  - Included are improved processes, new technologies, better decision models, improved sensors, improved science for policies and regulations, etc.
  - Additionally, all technical, policy, economic, and ecological and environmental research and development concepts that support and insure that good approaches can be implemented will be considered.

While the Energy Water Roadmap will be focused on efforts for DOE, the Roadmap research and development priorities should consider and address science and technology issues where DOE efforts could support other agency effort such as DOI, NOAA, USDA, EPA, etc. to improve energy–water sustainability and energy reliability.

The final stage in the roadmap development process will occur over the next several months and will involve the collation and integration of all the information gleaned from the various workshops. These data will be used to draft a final research roadmap for delivery to the Department of Energy in August 2006.