

<b>NEED AREA: Regional Integrated Resource Planning and Associated Models/Studies</b>				
	Today's performance	Near-term Goals	Mid-term Goals	Long-term Goals
Cooperative planning framework and approach	Some planning models exist, but limited local use and need much more detail, dissemination, and validation needed for wide-scale use to improve energy planning  High-level planning models for energy planning often limited by good baseline water data and future water use data.	R&D: Develop consistent framework and standards for integrated energy/water planning models through standards bodies such as AWWA, ASCE, ASME, w/DOE and fed agencies)		<b>GOAL: Establish regional integrated energy-water resource planning groups across the U.S.</b>
Economic/Policy Models	Some models and approaches exist – need further work and dissemination  Need models that work at various scales and can fit together into regional or national	R&D: Develop energy/water nexus-related policy and economic models for incorporation with climatic/water availability/energy models R&D: Develop long-term (25+ year horizon) energy/water planning models that incorporate increasingly complex water demand scenarios <ul style="list-style-type: none"> <li>• R&amp;D: Develop risk assessment/mitigation tools—include energy, water, econ, environment, policy, social issues and solutions into planning process</li> </ul> R&D: Create graphic visualization tools so that the energy/water interactions can be explained more clearly to decision makers  <b>GOAL: Obtain buy-in from FERC, state regulatory agencies (e.g., PUCs, DNRs, EPA) on model structure/outputs/uncertainties</b>	T&E: Validate cooperative processes and approaches with regional field tests (Look at what has/hasn't worked in energy/water planning at NWPwr & Conservation Council)  <b>GOAL: Assure that generation expansion deals realistically with water availability constraints in all electrical coordination areas (e.g., MAPP, MAIN, etc.)</b>	<b>GOAL: Establish regional integrated energy-water resource planning tools that can be used across the U.S.</b>
Water rights sharing and leasing modeling		R&D: Modeling of basin water sharing for different sectors including energy to develop contingency plan for energy reliability in basins(DOE/EPRI, other agencies)		
Electricity infrastructure research		R&D: New conductor materials; carbon fibers? (DOE) Double carrying capacity of existing infrastructure.		
Water infrastructure upgrades	Up to 40% loss in system	R&D: Develop/apply models of infrastructure failure to reduce/avoid system losses in future. R&D: Develop methods to quantify 'unaccounted for' water. R&D: Reduce cost of water pumping meters to allow for complete water accounting. R&D: Develop efficient, self-sufficient, integrated future infrastructures that reduce energy demand.		

Electricity infrastructure studies		<p>R&amp;D: Study of energy/water savings to be realized from T&amp;D upgrades: Broad context of need? (FERC/DOE)</p> <p>R&amp;D: Siting of national-level interstate grid to enable improved use of water efficient energy production or reduce fresh water use for energy production (DOE)</p>		
Co-location studies		<p>R&amp;D: Assess the opportunity regionally and nationally to co-locate energy and water facilities and assess energy efficiency and water efficiency improvements</p> <p>T&amp;E: Develop pilot-scale opportunities for co-location demonstration projects.</p>		
Distributed energy generation studies		<p>R&amp;D: Investigate line/DG integration issues as a means to making use of smaller, localized impaired water sources for cooling</p> <p>R&amp;D: Evaluate grid integration of distributed generation systems (microhydro, wind, etc.)</p>		
Misc. Economic studies/evaluations		<p>R&amp;D: Examine alternative economic development possibilities resulting from produced water availability</p> <p>R&amp;D: Quantify benefits of hydropower facilities(DOE/FERC/USACCE/BOR)</p> <ul style="list-style-type: none"> <li>• Environmental and flood control and recreational benefits.</li> <li>• Avoided groundwater pumping and energy use by downstream users.</li> <li>• Adding hydro to existing civil works: determining economic benefits</li> </ul>		

### Topic 1. Cooperative planning framework and approach research areas

- S&T platform to create consistent framework and standards for integrated energy/water planning models

### Topic 2. Economic/Policy model development/research areas

- Energy/water nexus-related policy and economic models for incorporation with climatic/water availability/energy models
- Risk assessment/mitigation tools—include energy, water, econ, environment, policy, social issues and solutions into planning process
- Graphic visualization tools so that the energy/water interactions can be explained more clearly to decision makers
- Mid-Term activity: Validate cooperative processes and approaches with regional field tests (Look at what has/hasn't worked in energy/water planning at NWPwr & Conservation Council)
- Long-term (25+ year horizon) energy/water planning models that incorporate increasingly complex water demand scenarios

### Topic 3. Water rights/sharing model development

- Model basin water sharing for different sectors including energy to develop contingency plan for energy reliability in basins

### Topic 4. Infrastructure research

- New conductor materials capable of doubling carrying capacity of existing electricity infrastructure
- Develop models of water infrastructure failure to reduce/avoid system losses in future.
- Develop methods to quantify 'unaccounted for' water.
- Develop low-cost water pumping meters to allow for complete water accounting.
- Develop efficient, self-sufficient, integrated future infrastructures that reduce energy demand.

### Topic 5. Studies and Analyses

- Electricity infrastructure studies
  - Study of energy/water savings to be realized from T&D upgrades: Broad context of need?
  - Siting of national-level interstate grid to enable improved use of water efficient energy production or reduce fresh water use for energy production
- Distributed energy generation studies
  - Investigate line/DG integration issues as a means to making use of smaller, localized impaired water sources for cooling.
  - Evaluate grid integration of distributed generation systems (microhydro, wind, etc.)
- Co-location studies
  - Assess the opportunity regionally and nationally to co-locate energy and water facilities and assess energy efficiency and water efficiency improvements
  - Develop pilot-scale opportunities for co-location demonstration projects.
- Misc. Economic studies/evaluations
  - Examine alternative economic development possibilities resulting from produced water availability
  - Quantify benefits of hydropower facilities
    - Environmental and flood control and recreational benefits.
    - Avoided groundwater pumping and energy use by downstream users.

- Adding hydro to existing civil works; determining economic benefits