

NEED AREA: Emerging/Renewable Energy Technologies				
	Today's performance	Near-term Needs	Mid-term Needs	Long-term Needs
Conventional Hydropower	<p>5-15% fish and aquatic life mortality</p> <p>Low DO impact of deep water intakes in impoundments</p> <p>Instream flow needs for fish potentially overstates</p>	<p>R&D: Continue improvements to fish-friendly turbines</p> <p>R&D: Develop improved fish movement aids (upstream movement devices)</p> <p>T&E: Demonstrate behavioral techniques—structure avoidance (light, noise, etc.)—to reduce fish impacts</p> <p>T&D: Demonstrate dissolved oxygen mitigation techniques to maximize hydropower generation (DOE/TVA/BPA)</p> <p>R&D: Develop decision support models for release schedules—flow variability and timing(DOE)</p> <ul style="list-style-type: none"> Improve meteorological forecasting for operations (seasonal predictive capability) <p>R&D: Determine/analyze sources of generating variability—regional, related to climate, data collection activity(DOE)</p>	<p>T&E: Pilot-testing of advanced systems to reduce implementation risks</p> <p>T&E: Fine tune water release practices for maintaining fish habitat/populations.</p>	<p>GOAL: Better integration of hydropower into energy reliability discussion, identify benefits of hydro in energy reliability, and improve performance of hydro systems with ecological system.</p>
Alternative Hydropower	<p>Potential for as much as 75GW of small/alternative/run of river hydro available in U.S., ~25% of national power needs in next 25 years</p>	<p>T&D: Conduct/fund proof of concept demonstrations of kinetic energy turbine systems (DOE)</p>		
		<p>T&E: Investigate reregulating wiers as a means to enhancing the energy and water efficiency of existing storage infrastructures (FFERC/DOE)</p>		
		<p>T&E: Develop and test micro turbines for irrigation systems</p>		
Renewable based electric power generation	<p>Many limitations on renewable energy penetration into market, though often use little water</p>	<p>R&D: Development of control mechanisms for renewable energy technologies</p> <ul style="list-style-type: none"> Algorithm development Develop scalable/modular control mechanisms Develop controls for integrating wind/pv with desalination/wastewater treatment plants Develop control systems for off-grid pumping <p>R&D: Develop improved meteorological & river flow forecasts to improve integration of pumped storage-wind</p>	<p>T&E: Renewable energy-powered oil and gas water treatment—systems integration</p> <p>T&E: Pilot scale demos of distributed generation to collect cost and performance data</p>	
Oil shale and oil sands	<p>3-5bbl water: 1 bbl product (shale)</p> <p>1-3bbl water: 1bbl product (sands)</p>		<p>R&D: Continue development of less energy/water intensive in-situ gasification processes and assess impacts on water quality and quantity</p>	

Topic 1. Conventional Hydropower

GOAL: Better integration of hydropower into energy reliability discussion, identify benefits of hydro in energy reliability, and improve performance of hydro systems with ecological system.

- Continue improvements to fish-friendly turbines
- Develop improved fish movement aids (upstream movement devices)
- Demonstrate behavioral techniques—structure avoidance (light, noise, etc.)—to reduce fish impacts
- Demonstrate dissolved oxygen mitigation techniques to maximize hydropower generation
- **Develop decision support models for release schedules—flow variability and timing**
 - **Improve meteorological forecasting for operations (seasonal predictive capability)**
- STUDY: Determine/analyze sources of generating variability—regional, related to climate, data collection activity
- Mid-Term activity: Pilot-testing of advanced systems to reduce implementation risks
- Mid-Term activity: Fine tune water release practices for maintaining fish habitat/populations.

Topic 2. Alternative Hydropower

- Conduct proof of concept demonstrations of kinetic energy turbine systems
- STUDY: Investigate reregulating weirs as a means to enhancing the energy and water efficiency of existing storage infrastructures
- Develop and test micro turbines for irrigation systems

Topic 3. Renewable based electric power generation

- Development of control mechanisms for renewable energy technologies
 - Algorithm development
 - Characteristics: Scalable/modular
 - Applications: Integrating wind/pv with desalination/wastewater treatment plants; Off-grid pumping
- **Develop improved meteorological & river flow forecasts to improve integration of pumped storage-wind**
- Mid-Term activity: Renewable energy-powered oil and gas water treatment—systems integration
- Mid-Term activity: Pilot scale demos of distributed generation to collect cost and performance data

Topic 4. Oil shale and oil sands

- Mid-Term activity: Continue development of less energy/water intensive in-situ gasification processes