

U.S. Department of Energy

Advanced Water Power



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DOE water power activities were restarted in FY 2008

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- DOE authorized to reestablish a water power program:
 - EAct 2005 addressed both conventional hydro (CH) plus marine and hydrokinetic technologies (MHK)
 - EISA 2007 emphasizing MHK
- \$10 million appropriated in FY08 for both CH and MHK
- '09 Budget → \$40m for CH and MHK
- Recovery Act



Technology Definitions

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- **Marine and hydrokinetic (MHK)** refers to energy from:
 - (1) waves, tides, and currents in oceans, estuaries, and tidal areas;
 - (2) free flowing water in rivers, lakes, and streams;
 - (3) free flowing water in man-made channels; and
 - (4) differentials in ocean temperature (ocean thermal energy conversion).
- **Conventional hydropower (CH)** refers to energy from any source that uses a dam, diversionary structure, or impoundment for electric power purposes.
- **Advanced water power** refers to both marine and hydrokinetic power and conventional hydropower.

MHK Development and Deployment faces Multiple Barriers

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- **Technologies in very early stage of development, few full-scale demonstrations**
 - Lack of cost and performance data
 - Lack of standards for development, testing, and evaluation
 - Prototype deployment is costly and time-consuming
 - High capital costs and technology risk
- **Unique survivability/reliability challenges**
 - O&M is difficult and costly in rough marine environments – must be minimized
 - Minimizing O&M in rough marine environments requires extremely robust designs
- **Lack of information on device/resource interaction**
 - Few technology-specific models and tools
- **Lack of detailed resource data**
- **Uncertain environmental, navigational, and competing use impacts**
- **Complex regulatory framework**



DOE's R&D Priorities for MHK

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Industry RD&D Needs *

- System Deployment and Testing →
- System Performance and Reliability →
- Environment →
- Standards Development →
- Resource Modeling →

DOE Water Power Program Priorities

- Facilitate the design, development and testing of full scale MHK prototypes and components in order to generate data on performance and impacts
- Facilitate design and development of systems and components in order to reduce technology costs and improve performance and reliability
- Identify, evaluate and mitigate environmental impacts
- Characterize, evaluate and compare the wide variety of MHK technologies; provide US input into standards development
- Determine the available, extractable, and cost-effective water resources in the US

* Results from the October 2008 Industry R&D Needs Workshop, Washington, DC

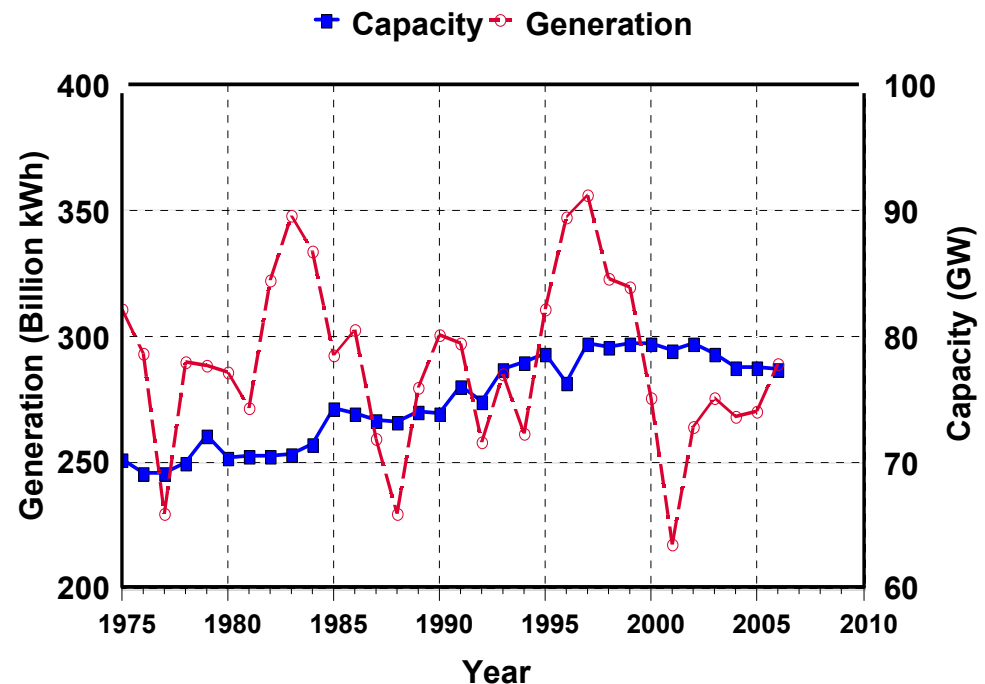
Multiple issues also confront existing hydropower assets in the U.S.

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- **Hydropower capacity stagnating or decreasing**
 - Federal projects are progressively less available for generation
 - Nonfederal projects have lower capacity factors after relicensing (renewal if operating licenses through the FERC)
- **History of environmental impacts**
- **Lack of comprehensive project-level information** (technology utilization, generation profiles, water use, etc.)
- **Minimal quantification of ancillary value**, esp. variable resource integration

Historical trends in Capacity and Generation



Program Priorities Aligned to Increase Hydropower Generation and Value

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Federal investment is necessary to overcome issues reducing hydropower generation and to take advantage of opportunities to increase grid stability and variable resource integration.

Water Program Priorities Include:

Increase Power Generation

- Develop and demonstrate technologies to modernize hydro facilities, including pumped storage
- Expand incremental hydropower

Improve Environmental Performance

- Technological advancements to improve fish passage
- Understand GHG emissions from reservoirs
- Assess cumulative impact and reduce stresses on wildlife and environment

Understand Assets and Resources

- Describe resources, generation patterns, water availability, cost of development and economic impacts of existing hydro fleet
- Identify full range of undeveloped incremental hydro resources and opportunities to update/modernize facilities

Maximize Ancillary Benefits

- Assess and quantify value of existing hydro/PS fleet to support grid stability and further integrate variable generation
- Identify opportunities to increase ancillary value, including the development of new technologies and processes, and policies

Ongoing Activities

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- 2008 Funding Opportunity Announcement
 - Technology/component development and testing
 - Resource assessments
 - Project siting studies
 - National Marine Renewable Energy Centers
- National Hydropower Asset Assessment Project
- Report to Congress: Potential Environmental Effects of Marine and Hydrokinetic Energy Technologies
- Cooperative Research and Development Agreements
- Global Marine and Hydrokinetic Technology and Project Database
- Jobs and Economic Development Index (JEDI) modeling
- International Energy Agency, Ocean Energy Systems (IEA-OES) Annex IV, Assessment of Environmental Effects and Monitoring Efforts for Ocean Wave, Tidal, and Current Energy Systems
- International Electrotechnical Commission, Technical Committee 114 Secretariat
- Marine and Hydrokinetic Industry Roadmap

2009 Funding Opportunities

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Industry-led Projects

- Topic Area 1: Marine and Hydrokinetic Energy Conversion Device or Component Design and Development
- Topic Area 2: Marine and Hydrokinetic Site-specific Environmental Studies/Information
- Topic Area 3: Advanced Water Power Market Acceleration Projects/Analysis and Assessments
 - Resource Assessments: In-stream, ocean current, non-powered dams, OTEC
 - Cost scenarios: MHK, OTEC
- Possibility of additional Conventional Hydropower Topics

Laboratory-led Projects

- Topic Areas 1 & 3: Supporting Research and Testing (MHK, CH)
 - Computational tools/models to predict device/array behavior; advanced materials
- Topic Areas 2 & 4: Environmental Assessment and Mitigation Methods
 - Tools and studies to predict, evaluate, and minimize environmental impacts

www.fedconnect.net search “advanced water power”

Water power questions?

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