National Hydropower Asset Assessment Program (NHAAP)

**What:**
- A core geospatial energy-water database
- A core hydropower project configuration and production database
- Dynamic linkages to multiple agencies and federally-chartered energy-water-ecology data products

**Who**
- Authorization, funding, and guidance from DOE
- NHAAP team of hydropower engineers, aquatic ecologists, environmental assessment professionals, and geospatial analysts to validate, integrate, maintain, and disseminate information
- Federal agency partners whenever possible, including Reclamation, Corps, and USGS

84,000 Dams
17,000 Stream gages
5,116 Hydroelectric Units
1,200 Climatology Stations
The U. S. Hydropower Fleet

Legend
Capacity
- 0 - 100 MW
- 100 - 500 MW
- 500 - 1500 MW
- 1500 - 3000 MW
- 3000 - 6809 MW

Build Time
- pre 1900
- 1900 - 1929
- 1930 - 1939
- 1940 - 1949
- 1950 - 1969
- 1970 - 1989
- 1990 - 2008

Map information was compiled from the best available sources. No warranty is made for its accuracy and completeness.
Sources: National Inventory of Dams, 2010

U.S. Hydropower Assessment - Annual Meeting 2011
U.S. Hydropower – 2011 Status

**Rated Capacity**
- Non-Fed 57 GW
- Corps 21.6 GW
- Reclamation 15.1 GW
- TVA 5.2 GW

**Number of Units**
- Non-Fed 4,370
- Corps 432
- Reclamation 198
- TVA 116

**Technology**
- Francis 51 GW
  - 19 GW
  - 720 Units
- Kaplan 19 GW
  - 2.6 GW
  - 330 Units
- Other 26 GW
  - 1,501 Units
- Pelton 2.6 GW
  - 330 Units

**Size (Capacity) Distribution**
- Not Shown: Bath County (VA) 6@477 MW
- Shown: Grand Coulee (WA) 3@600 MW, 3@805 MW
The Energy-Water-Environment Context for National Hydropower Assessments

Integrated energy-water-environmental planning is a key to success!
Hydropower Assessment & Development

Scale
Users & Uses
Policy Analysis
Research Programming
Transmission Planning
Environmental Planning
Generation Planning
Project Developers
Site-Specific Feasibility
Technology Deployment
Project Developers

Clarity
Modeling & Remote Sensing
Increasing Detail
Decreasing Uncertainty
Site-Specific Assessment

Roles
Government
Industry
## Classification of Hydropower Assets & Opportunities

<table>
<thead>
<tr>
<th>Hydropower Resource Class</th>
<th>DOE Water Power Effort</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing Assets</strong></td>
<td><strong>National Hydropower Asset Assessment Project (NHAAP)</strong> includes all FERC-licensed,</td>
<td>• Asset configuration, monthly production, water availability, and power</td>
</tr>
<tr>
<td></td>
<td>Corps, Reclamation, and TVA hydropower facilities.</td>
<td>system context database assembled in 2010.</td>
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<tr>
<td></td>
<td></td>
<td>• Environmental, cost, and economic modules integrated in 2011.</td>
</tr>
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<td></td>
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<td>• Public data portal mid-2011.</td>
</tr>
<tr>
<td><strong>Upgrades &amp; Expansions</strong></td>
<td>• <strong>Hydropower Advancement Project (HAP)</strong> will assess potential for increased</td>
<td>• Interim 2009 assessment</td>
</tr>
<tr>
<td></td>
<td>generation through efficiency improvements and uprates at 50 projects nationwide</td>
<td>• Best Practices Catalog</td>
</tr>
<tr>
<td></td>
<td>• Expansion study criteria TBD</td>
<td>• Assessment Manual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Nationwide Opportunity Summary 2012</td>
</tr>
<tr>
<td><strong>Non-Powered Dams</strong></td>
<td>**Assess the amounts of new hydropower energy resources potential in existing</td>
<td>• March FY11 – Generation &amp; Capacity Summary for US Non-Powered Dams</td>
</tr>
<tr>
<td></td>
<td>non-powered dams (H&gt;10 feet).</td>
<td>• Mid FY11 – NPD Database available via NHAAP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Late FY11 – Cost and Supply Curve Report for US Non-Powered Dams</td>
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# Classification of Hydropower Assets & Opportunities

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| **Pumped Storage**        | Identify the readily developable potential for new large scale (>100MW) pumped storage hydropower facilities. | • FY11 - Baseline Assessment of existing and proposed PSH  
• New Engineered cost study for existing pumped-storage facility |
| **Constructed Waterways** | Assess technically feasible energy generation related to different classes of constructed waterways | • FY11 Demo of Irrigation System Opportunities Assessment (INL) |
| **New Sites**             | Assess energy resource potential from new, low-impact hydropower facilities. | • FY12 activity TBD |
Pumped-Storage Hydropower Challenges:

- Technical?
- Economic and financial?
- Policy?
- All of the above?
Non-Powered Dam Potential: 12.6 GW at 54,000 Dams
Non-Powered Dam (NPD) potential is concentrated:

The NPD Top 10:
• 3 GW at Corps of Engineers Facilities
  • 4 Ohio River Dams
  • 1 Mississippi River Facility
  • 1 Alabama River Facility
  • 2 Tombigbee River Facilities
  • 1 Arkansas River Facility
  • 1 Red River Facility

The NPD Top 100 includes 8 GW
• Including 81 Federal (Corps) facilities

260 MW at Reclamation facilities

In Construction:
• Cannelton: 2-unit (44 MW)
• Smithland: 2-unit (48 MW)
• Meldahl: 3-unit (111 MW)

In Planning or Design:
• Willow Island: 3-unit (84 MW)
• RC Byrd: 3-unit (76 MW)
NHAAP Preliminary Environmental Assessment of Non-Power Dam Potential

Most non-powered dams and potential capacity can be developed outside of critical habitat, parks, and wilderness areas.
Non-Powered Dam Potential With Other Renewables

- Non-Powered Dam Potential exists in areas with less than ideal wind and solar resources

- Water availability, particularly for regulated rivers, is NOT correlated with wind and solar availability (combined firming of capacity)

Wind & Solar Maps: NREL
Next Steps and Summary of Non-Powered Dam Efforts

• Improvements in Methodology (FY11)
  – Refined seasonal/monthly flow statistics, flow-duration analysis
  – Refine gross and net head computations for Top 100
  – Intelligent penstock diversion model for mountainous regions

• Feasibility Assessment (FY11)
  – Fact-based environmental data overlays and statistics (Critical species, Impaired streams, …)
  – Updated cost estimators for powerhouse construction

• 3 GW at the Top 10; 8 GW at the Top 100
  – What are the policy and process barriers to development of these concentrated resources?
Acknowledgments and Credits

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