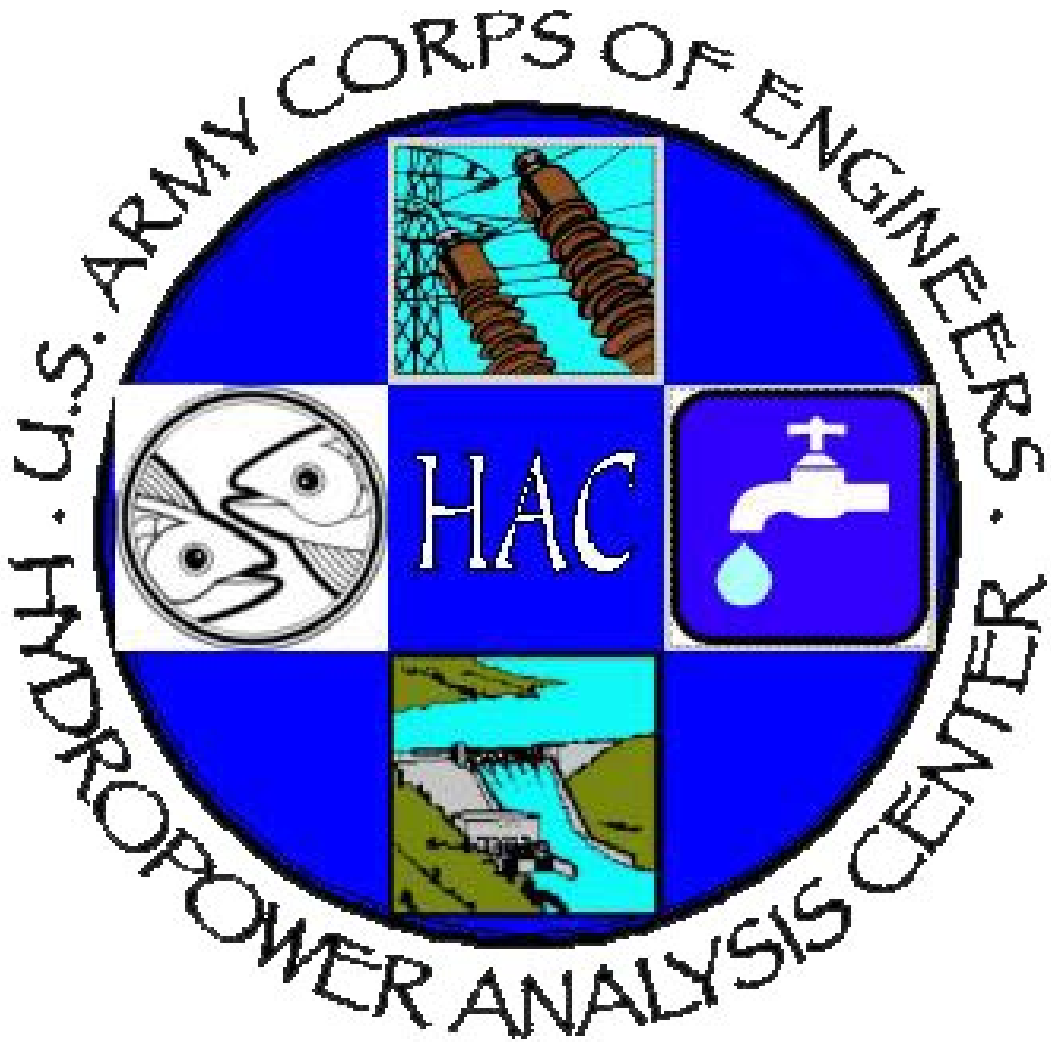
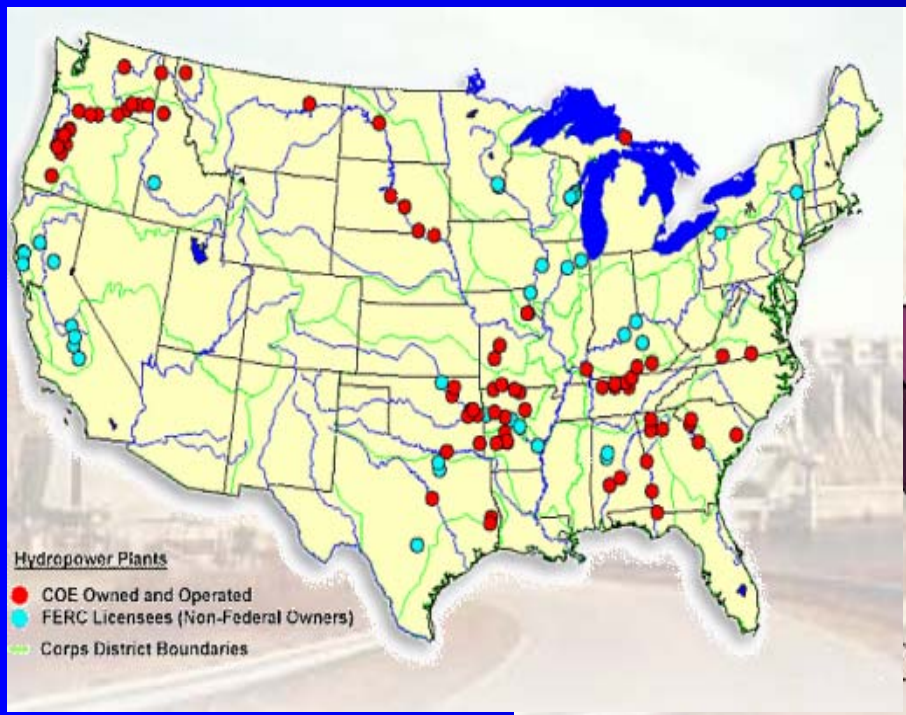
HYDROPOWER ANALYSIS CENTER

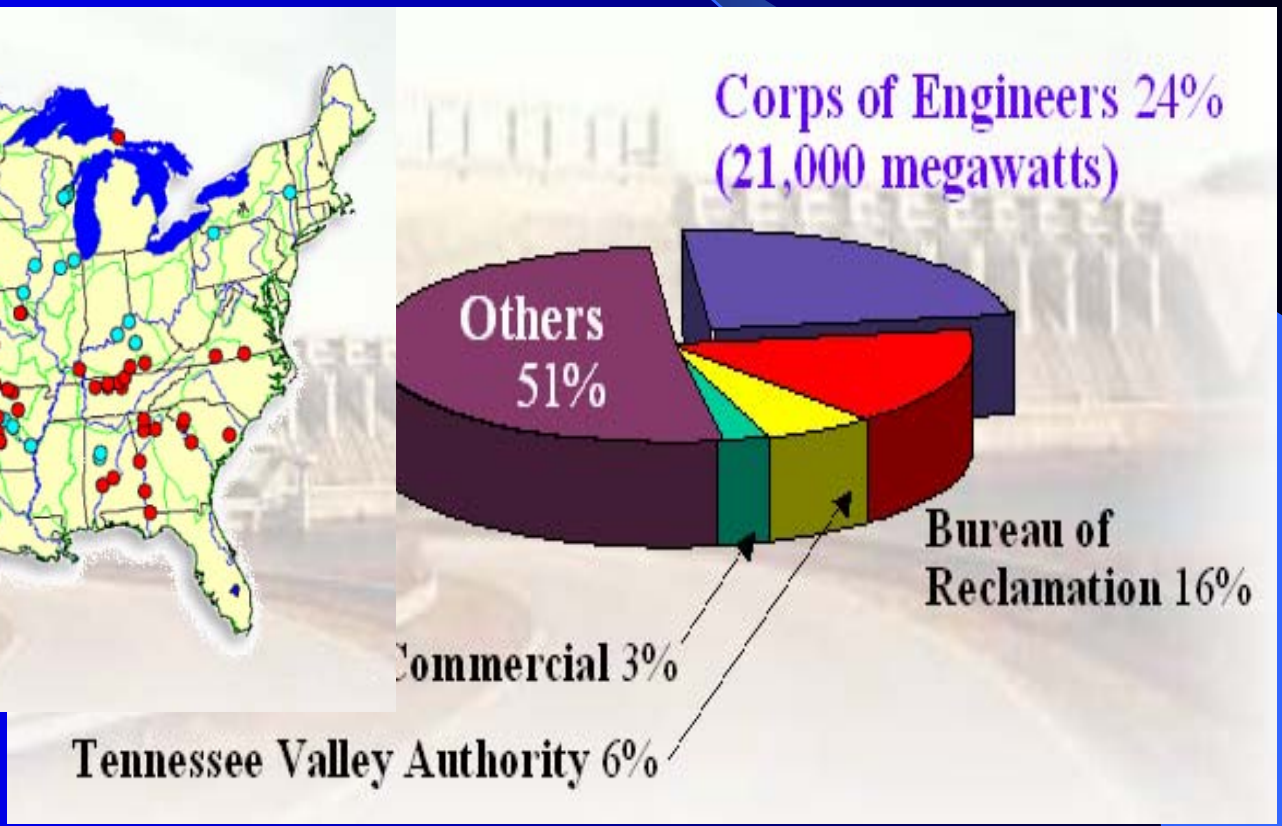


The Corps and Hydropower

Corsp Hydro: 24% of US hydro; 3% of US Electrical Power.

$18 billion investment (75 plants; 375 generating units); $450 million in annual revenues





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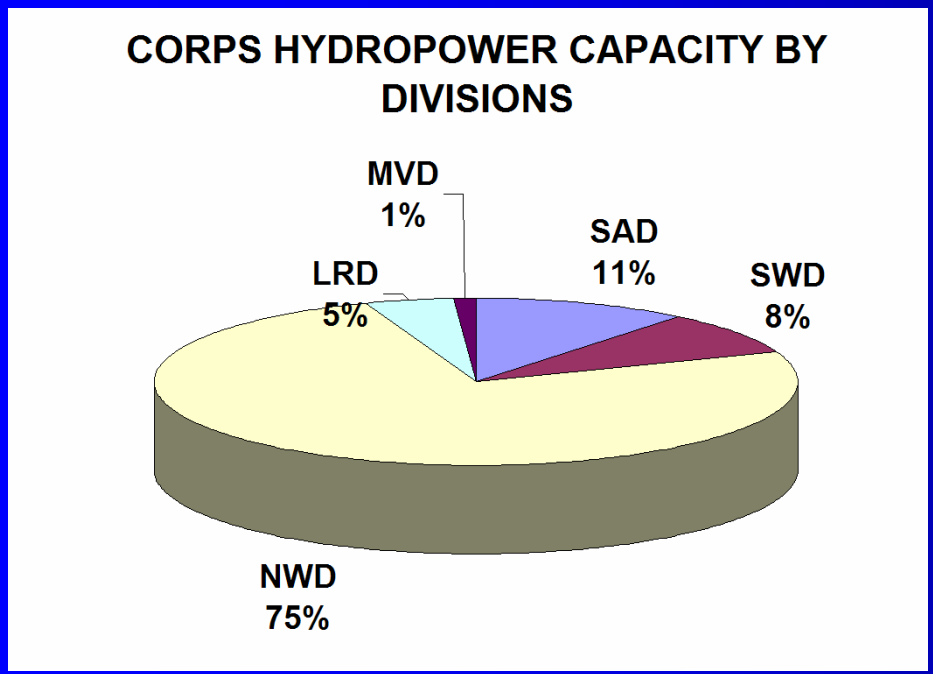
NWD-NP Hydropower

65% of Corps Installed Capacity is in NWD-Columbia; 75% in NWD



Largest NWD-NP Hydropower Dams (by MW Install. Cap.)

Chief Joseph (NWS) 2,460

John Day (NWP) 2,160

The Dalles (NWP) 1,800

Bonneville (NWP) 1,093

McNary (NWW) 980

LWG, LGS, LMN (NWW) 810 (each)

IHR (NWW) 603

Libby (NWS) 525

Dworshak (NWW) 400

Total Willamette (NWP) 320

Bonneville Dam Second Powerhouse

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HAC Roles & Capabilities

The HAC has over 40 years of experience in :

- Powerplant sizing, upgrades, and rehabilitation
- River system analysis
- Cost allocation and reallocation
- Power value and benefit computations
- Environmental and other powerplant studies

- Staff is cross-trained & familiar with stakeholders in all regions
- Works closely with 16 districts, PMA's, HQUSACE
- Helps the COE meet its hydropower functions efficiently
- Maintains in-house hydropower expertise to ensure that Corps can continue to efficiently carry out its hydropower mission
- Support US assistance to Third World countries (e.g., Chin Korea, Nigeria, Mozambique, etc.).

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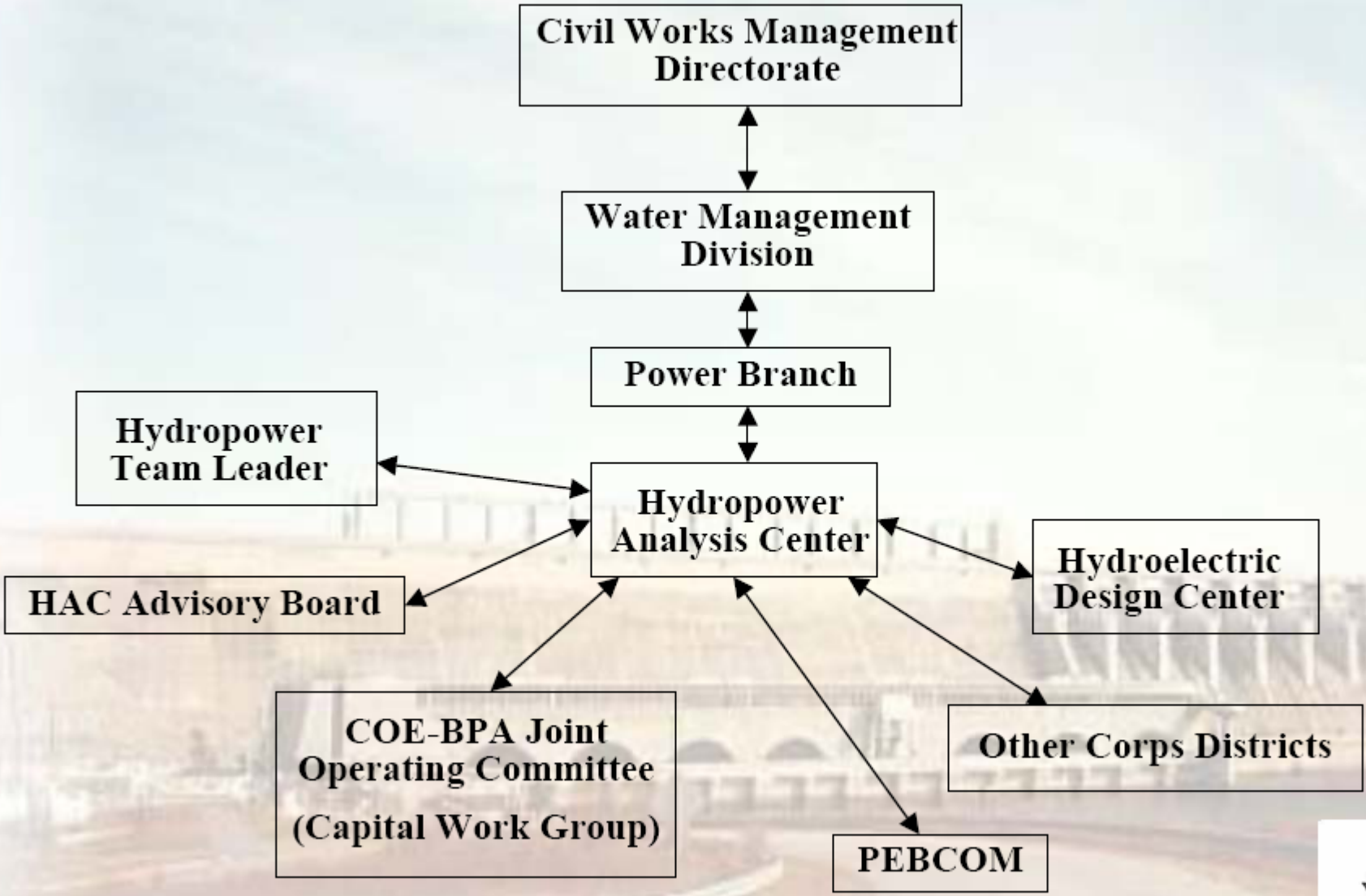
Organization and Affiliations



Problems & Opportunities

- **Average age of powerplants: 35 years**
- **349 turbines are due for replacement/rehab due to**
  - ✓ Normal wear and tear
  - ✓ New operating criteria for turbines operation
- **Need to develop rehabilitation/upgrade plan for ALL Corps generation facilities**
  - ✓Investments to be systematically analyzed and prioritized on a system basis –rather than piece-meal.
  - ✓Recognize regional differences
  - ✓Adapt to new funding climate
  - ✓Use uniform and consistent evaluation criteria

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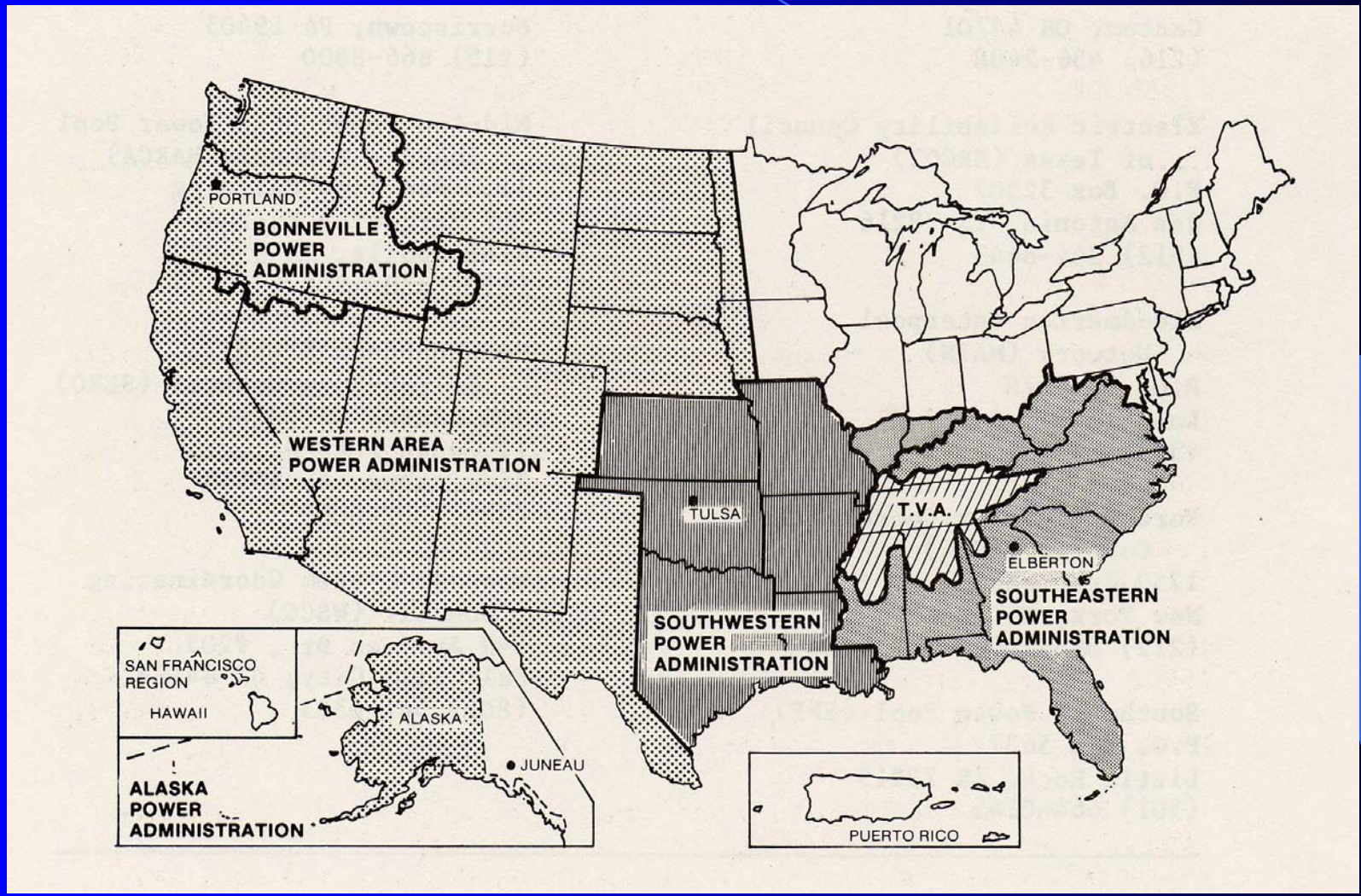
Federal PMA Boundaries



Summary of Corps Hydropower Authority

- Responsibility to consider hydropower in planning studies is clear
- Congress has chosen to treat Federal hydropower development on a project by project basis
- Nearly all Corps hydropower installations are at projects having flood control and/or navigation functions

“Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units.”

P&G, p. 1, 1 March 1983

TWO HYDROPOWER CENTERS OF EXPERTISE:

- Hydropower Analysis Center (HAC):

hydropower and water resource planning and analysis

(originally established in 1949)

&

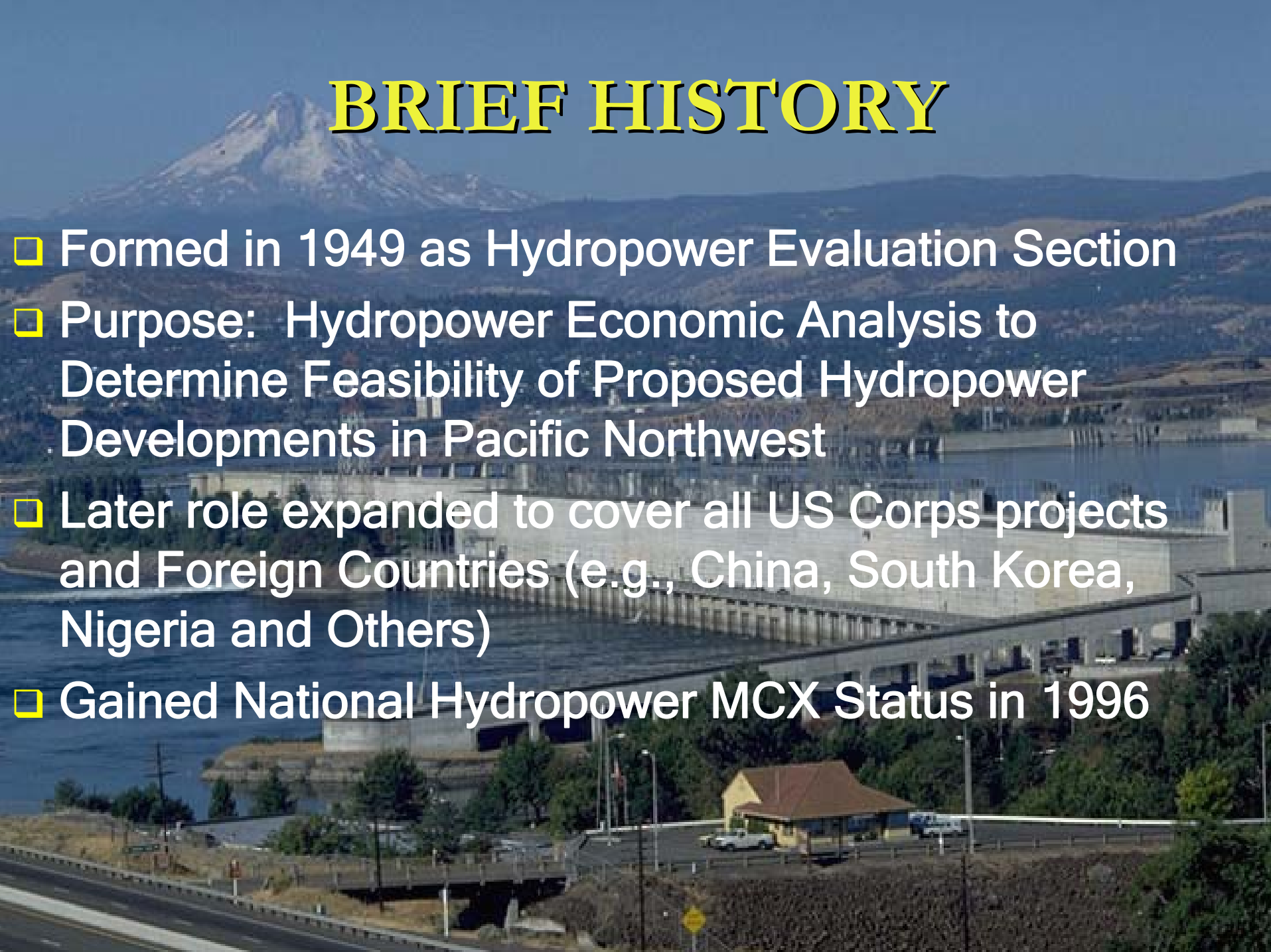
- Hydroelectric Design Center (HDC):

engineering and design

(originally established in 1948)

BRIEF HISTORY

- Formed in 1949 as Hydropower Evaluation Section
- Purpose: Hydropower Economic Analysis to Determine Feasibility of Proposed Hydropower Developments in Pacific Northwest
- Later role expanded to cover all US Corps projects and Foreign Countries (e.g., China, South Korea, Nigeria and Others)
- Gained National Hydropower MCX Status in 1996



ER 1110-1-8158

- Designates Hydropower System Analysis MCX
- Mandates all USACE elements to coordinate with and use MCX services.
- Requires MSC's to monitor and certify appropriate use of MCX's

•Supports HDC

•Serves Other Districts

MAIN EXPERTISE AREAS

1. Hydropower Planning
2. Energy Studies
3. Capacity Studies
4. Economic Analysis
5. Power Impact Studies
6. Turbine Performance Selection
7. FERC Licensing
8. Regional Planning Issues
9. Hydropower Manual
10. Treaty PEBCOM
11. Procedures Development

MAJOR PLANT REHABILITATION

- Alternatives Plan formulation
- Energy and Capacity
  - ✓ Production
  - ✓ Values
  - ✓ Benefits
- Risk Analysis
- Technical Review

Examples of Rehabilitation Projects

Under Construction:

- **Bonneville** *(Portland District)*
- **J. Strom Thurmond** *(Savannah District)*
- **Dardanelle** *(Little Rock District)*
- **John H. Kerr** *(Wilmington District)*
- **Garrison** *(Omaha District)*
- **Jim Woodruff** *(Mobile District)*

Under Design:

- **Whitney** *(Ft. Worth District)*
- **McNary** *(Walla Walla District)*

Under Planning:

- ***Garrison, Omaha***
- ***Denison, Tulsa***
- ***Chief Joseph, Seattle***
- ***Old Hickory, Nashville***
- ***Fort Randall, Omaha***
- ***Cougar, Portland***
- ***Center Hill, Nashville***
- ***Barkley, Nashville***

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MAJOR RIVER SYSTEM POWER & ECONOMIC ANALYSIS

due to changes in project operation, equipment, water diversions, and others

- Calculate Changes in Energy and Capacity
- Estimate Energy and Capacity Values
- Estimate Power Benefits
- Assess Other Related Impacts

Examples of River System Studies

- Columbia River System Operation Review
- Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint systems (ACT-ACF)
- Savannah River Basin Comprehensive Study

COST ALLOCATION & WATER SUPPLY REALLOCATION

- Analysis of hydropower benefits for multi-purpose water resource projects.
- Identify power benefits and revenue foregone with storage reallocation for municipal and industrial uses (White River Minimum Flow Study, SWL and Lake Greeson, MVK)

POWER VALUE COMPUTATION

- Compute Energy and Capacity
  - ✓ Values
  - ✓ Production
  - ✓ Power Benefits (Values* Production)

Power production cost model (PROSYM) is maintained for power systems studies anywhere in the USA.

MISCELLANEOUS POWER PLANT STUDIES

- Environmental/Fishery: Power Impacts from project features changes (The Dalles Sluiceway, NWP; Variable Q Flood Control, NWS).
- Generator Rewind and Uprate (Narrows Generator Rewind, SWT; Garrison Uprate, MRR)
- Plant Expansion (Expand/Add generation capabilities @ Libby, NWS).

SPECIAL PROCEDURE TO SUPPORT COE-BPA INVESTMENT DECISION

- Traditional COE Approach
- Developing the CIDAG
- Key details of CIDAG
- Applications

Water Supply Analysis

- *Hydrologic Analysis & Modeling*
- *Generation Impacts*
- *Economic Impacts*

Example: White River Min Flow Water Supply Reallocation Study; 2001; Little Rock District. Reallocating power storage to provide a minimum flow for fish in the White River. All five White River basin projects are impacted (including Bull Shoals Dam).

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