Alaska Energy Authority

AEA Hydroelectric Program

Daniel Hertrich, PE

BIA Providers Conference, December, 2015

Alaska Energy Authority: Mission

"To Reduce the Cost of Energy in Alaska"

- AEA is an independent and public corporation of the State of Alaska
- Created by the Alaska Legislature in 1976
- 44.83.070: " The purpose of the Authority is to promote, develop, and advance the general prosperity and economic welfare of the people of the state by providing a means of financing and operating power projects and facilities that recover and use waste energy and by carrying out the powers and duties assigned to it under AS 42.45."

AEEE/REF/PPF – Daniel Hertrich

Bradley and Snettisham – Bryan Carey

Susitna-Watana – Wayne Dyok

Focusing on Communities

- Emphasizing community-based approach to projects
- Technical assistance, regional planning and project management
- Provide synergy between planning, projects and funding sources
- Assist communities to move to project-ready status

AEA Hydro divisions

- Alternative Energy and Efficiency program (includes support for Renewable Energy Grant Fund and Power Project Loan Fund)
- Bradley Lake and Snettisham Projects (AEA owned hydros)
- Susitna-Watana hydro project

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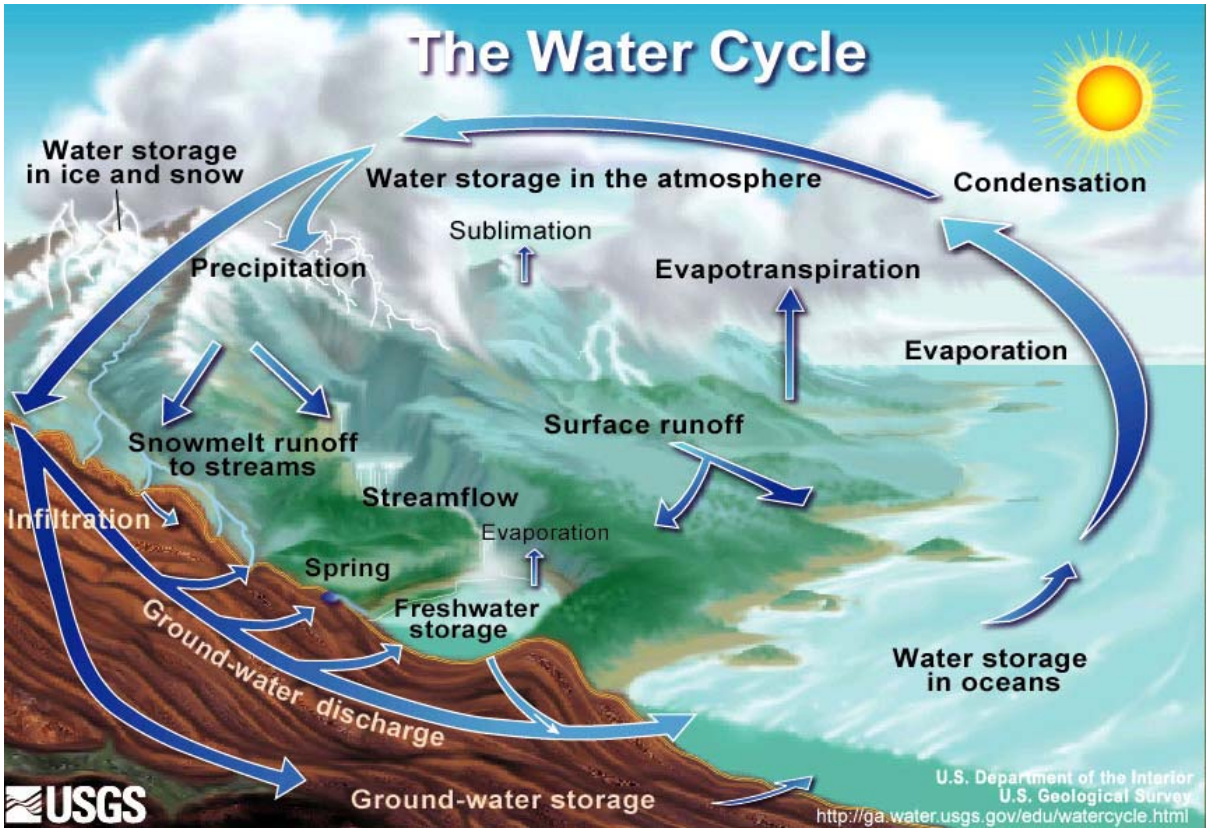
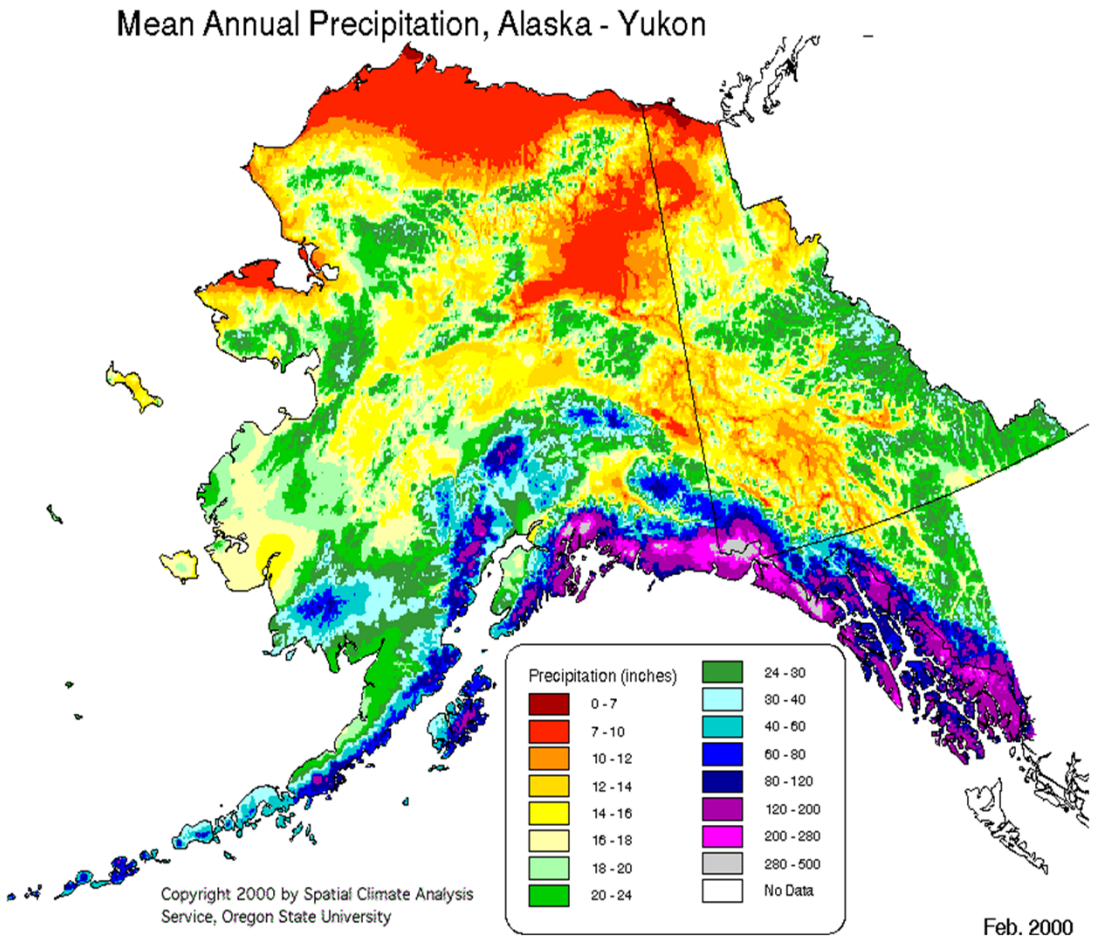
What Nature Gives Us

Hydro power is the original solar energy capture




Mean Annual Precipitation, Alaska - Yukon
Precipitation (inches)
0 - 7
7 - 10
10 - 12
12 - 14
14 - 16
16 - 18
18 - 20
20 - 24
24 - 30
30 - 40
40 - 60
60 - 80
80 - 120
120 - 200
200 - 280
280 - 500
No Data
Copyright 2000 by Spatial Climate Analysis Service, Oregon State University
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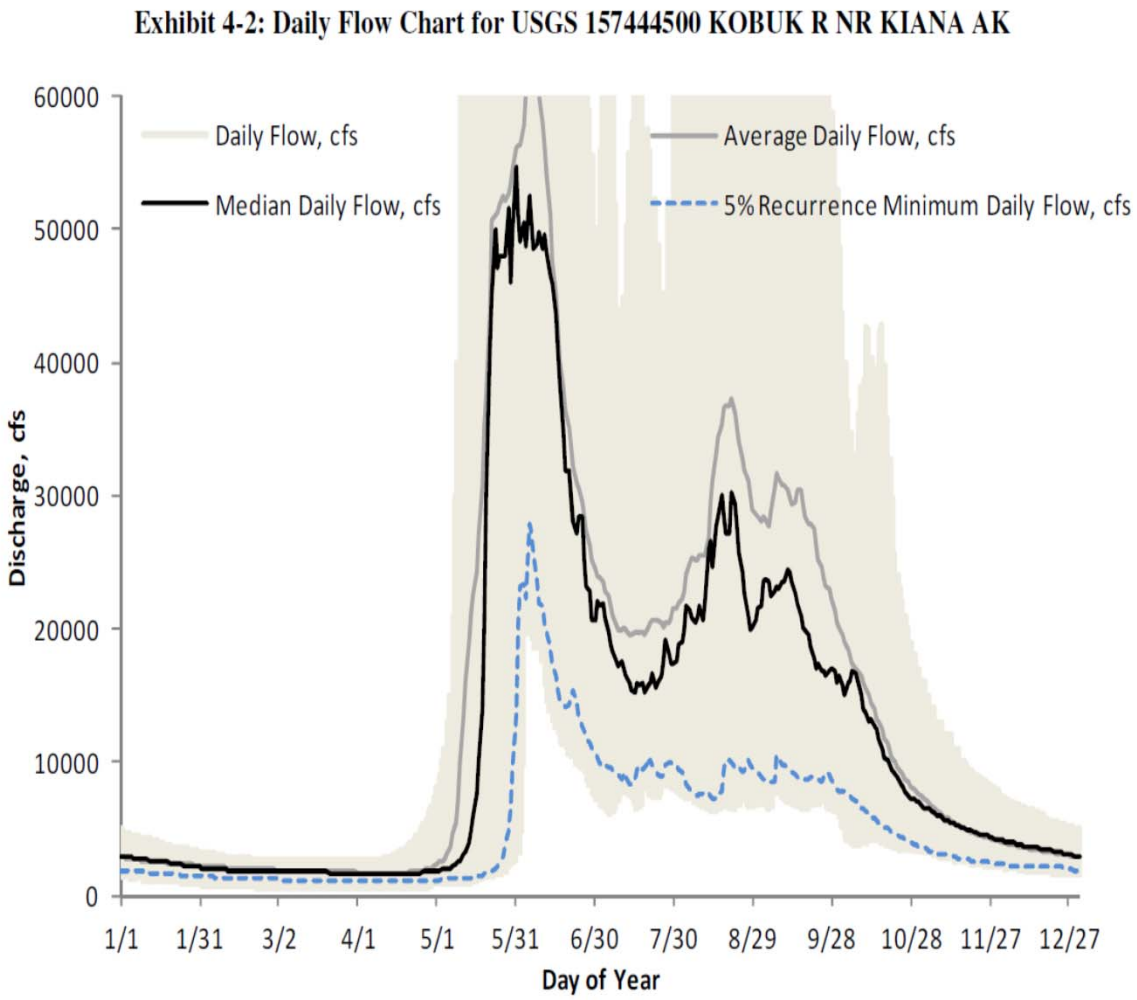
Hydroelectric Energy Generation



<u>Determining energy generation from water resource</u>

- Develop hydrograph from stream gauging data collection

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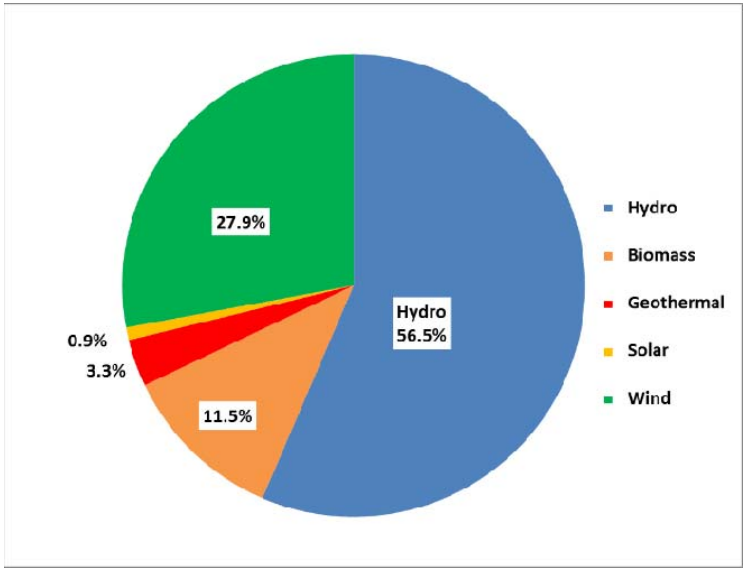
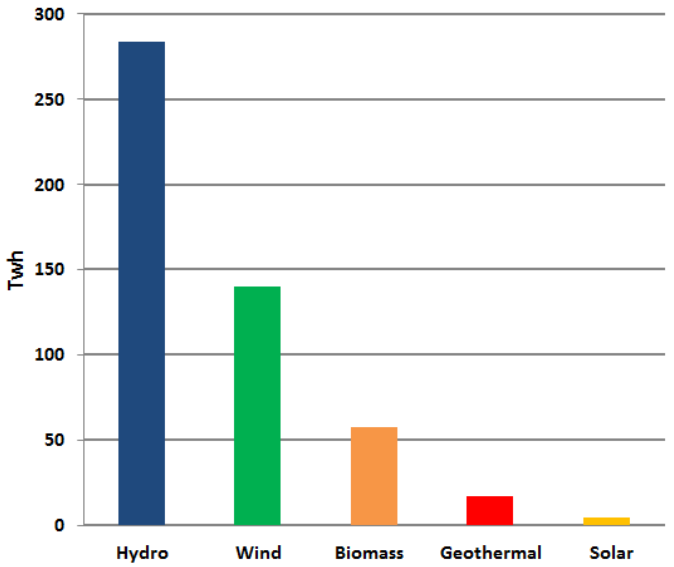
Hydropower is the Foundation of Renewables in the U.S.

EIA Generation data from 2012



Renewable Generation (Twh)



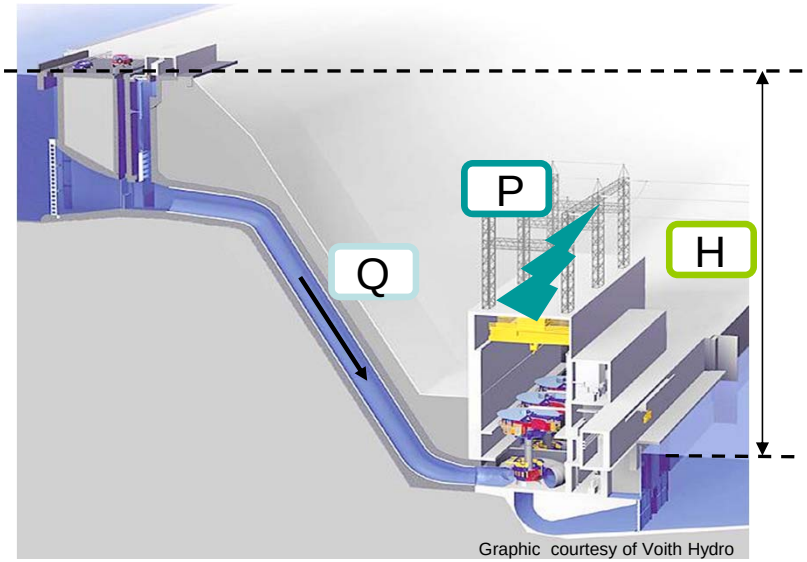
How Hydroelectric Power Is Captured

- Elevation difference creates head pressure and water motion.
- Created by natural geography, or by dams.

Photo courtesy of Voith Hydro

How Hydroelectric Power Is Captured

- Elevation difference (head) creates the water flow
- Turbines are used to convert hydro into electrical energy



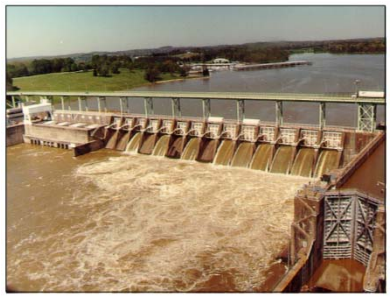
•Power ~ Head x Discharge

- Discharge drives size of the plant
- Head drives type of plant

- Projects generally fall into 2 types
  - Run of River (no storage)
  - Storage

Multi-Purpose Uses

- Dams and Reservoirs provide other attributes than power



Flood control

Navigation

Drought Mitigation

Irrigation

Recreation

Hydroelectric Project – What is it Typically?

Hydroelectric Development

- Every project is different. There is no standard infrastructure unlike wind turbines, gas turbines, and diesel power plant developments
- Significant data collection, planning, and permitting effort required
- High up front cost with very low operational cost
- One consistency is that they are fixed installations with usually only minor changes in infrastructure and operational changes over time

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Factors Affecting the Utilization of a Hydroelectric Resource

Typical influencing factors affecting the utilization of a hydroelectric resource:

- Water supply
- Topography
- Geology
- Winter and ice conditions
- Regulations and land use
- Supporting infrastructure
- Need for power and the cost of alternatives
- Funding, planning, and project management

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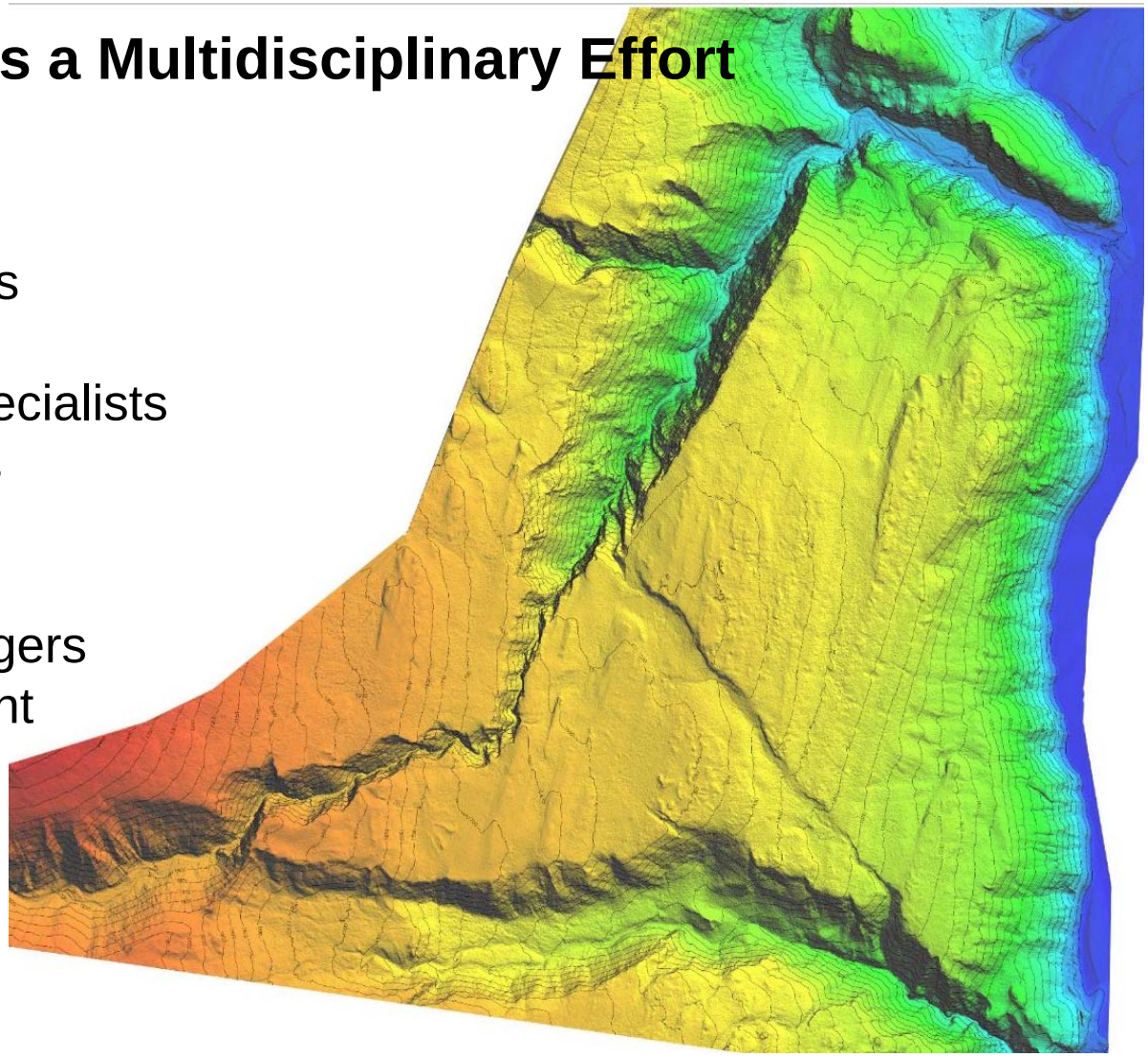
Development is a Multidisciplinary Effort

- Hydrologists
- Surveyors and Land Managers
- Engineers
- Regulatory and Permitting Specialists
- Aquatic and Wildlife Biologists
- Cultural Historians
- Economists
- Business and Financial Managers
- Public Utilities and Government



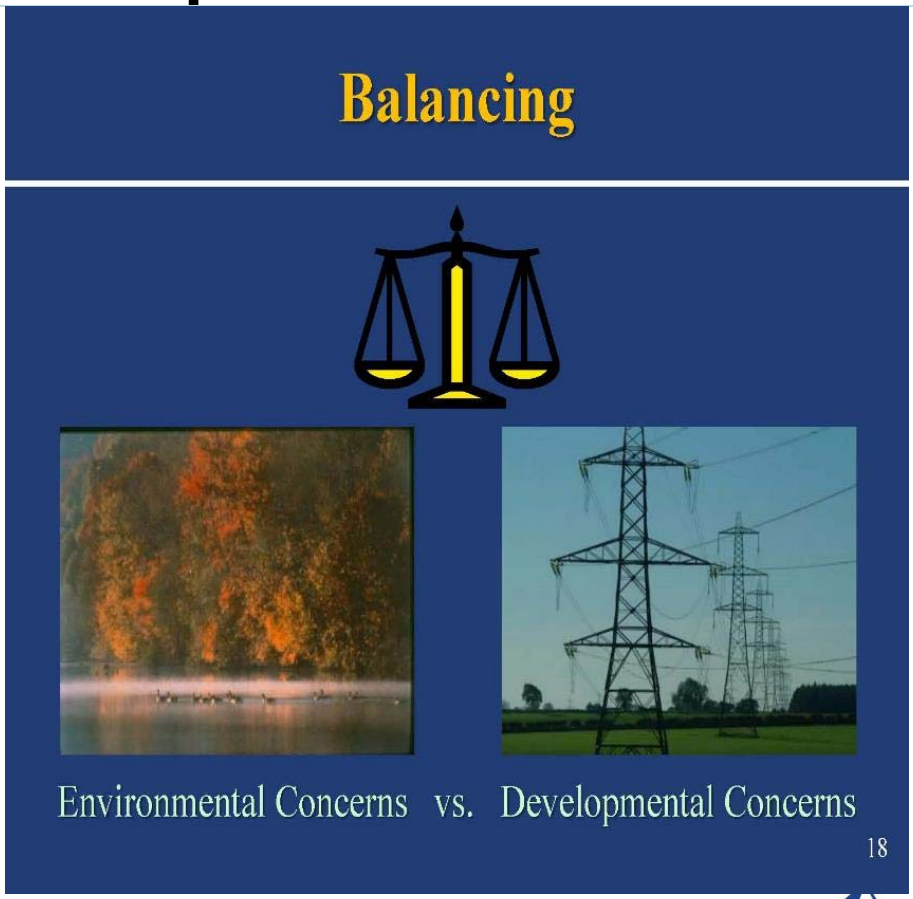
Balancing Resources in Hydroelectric Development

<u>Analyze the impacts to resources from two perspectives:</u>

1. The impact the development has on fishery resources.

   and conversely

2. The impact the fishery resources have on the development.



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Examples of Projects in Development – Grant Lake

Fish Resource

- Investigations – snorkeling and trapping

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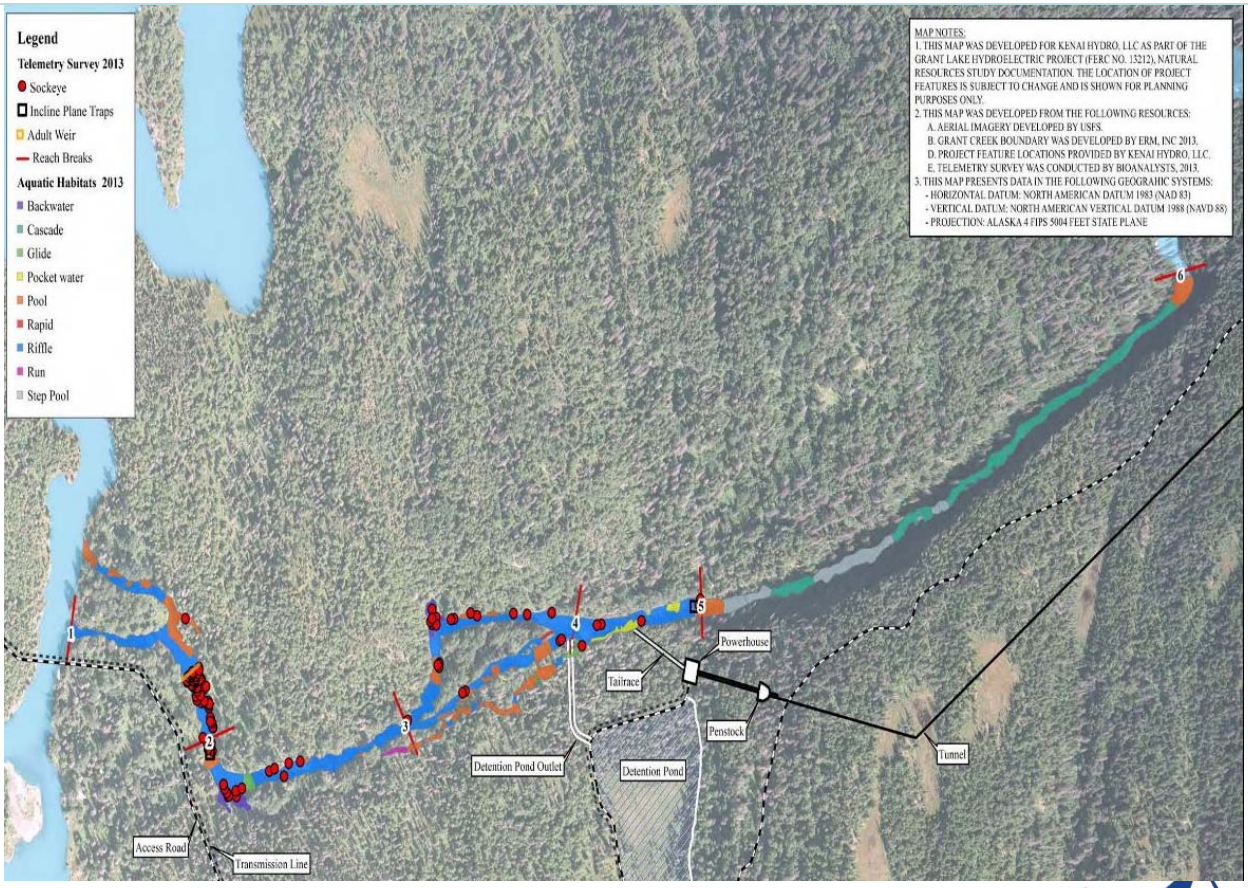
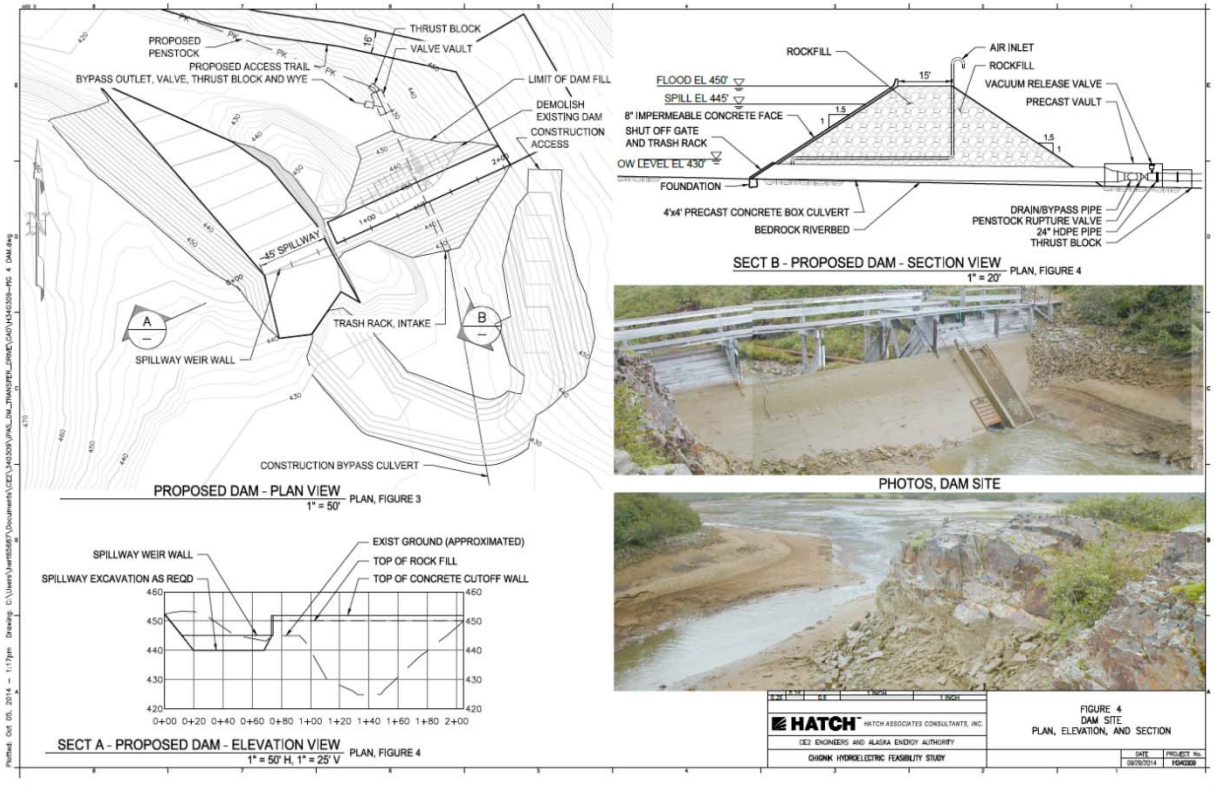
Examples of Projects in Development – Grant Lake

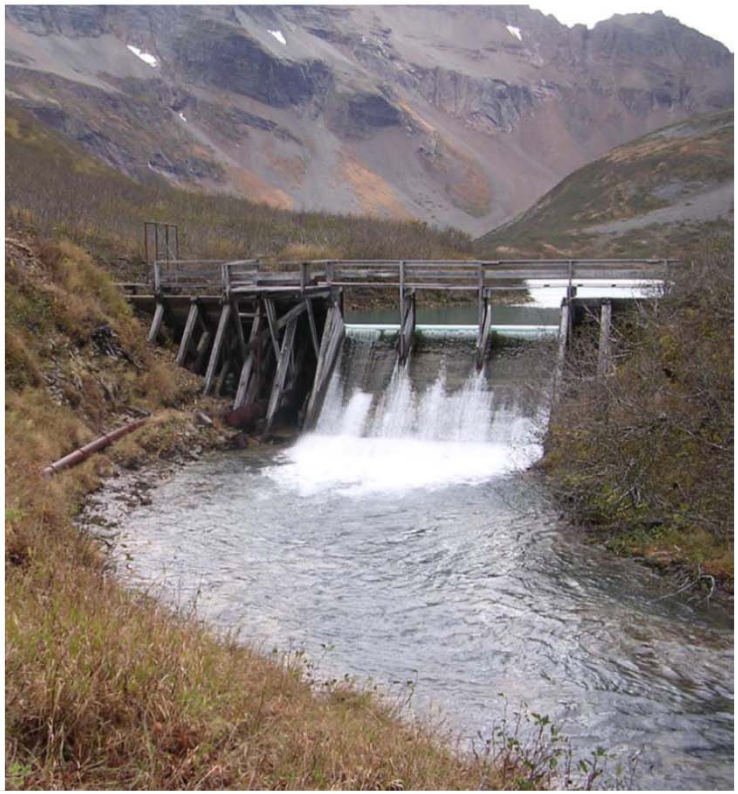
Fish Resource

- Radio telemetry results

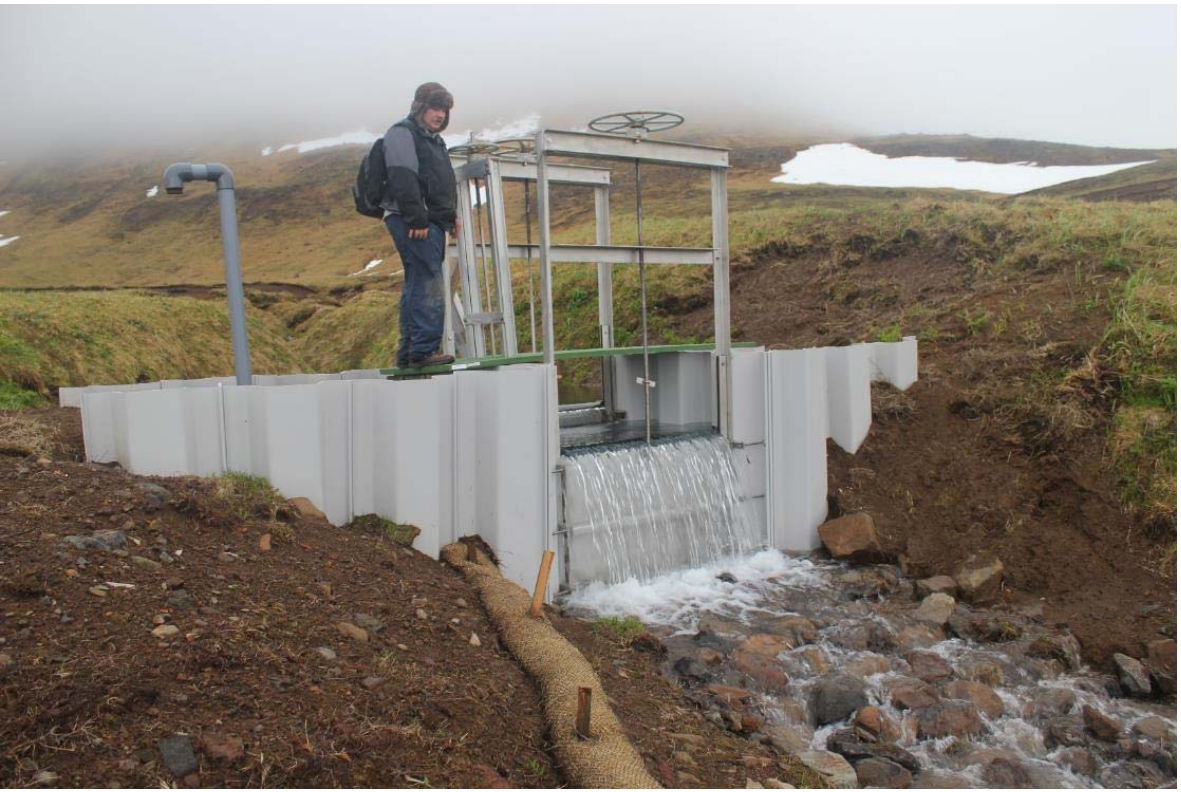


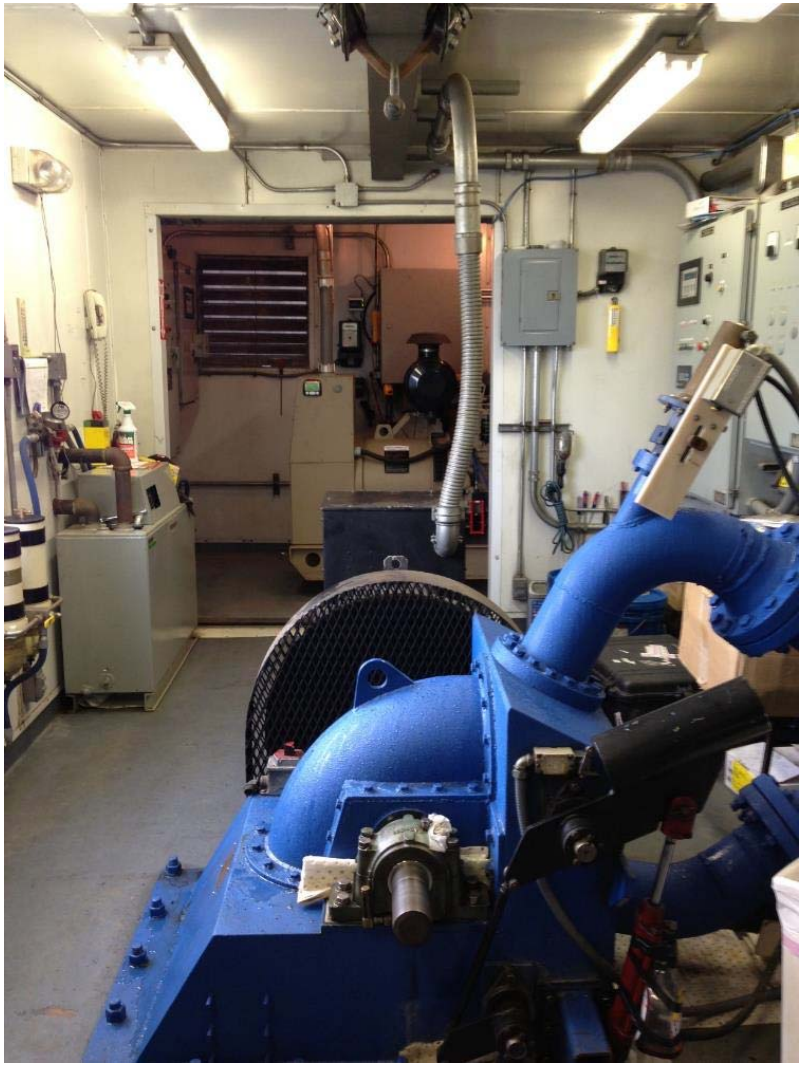
Chignik hydro replacement





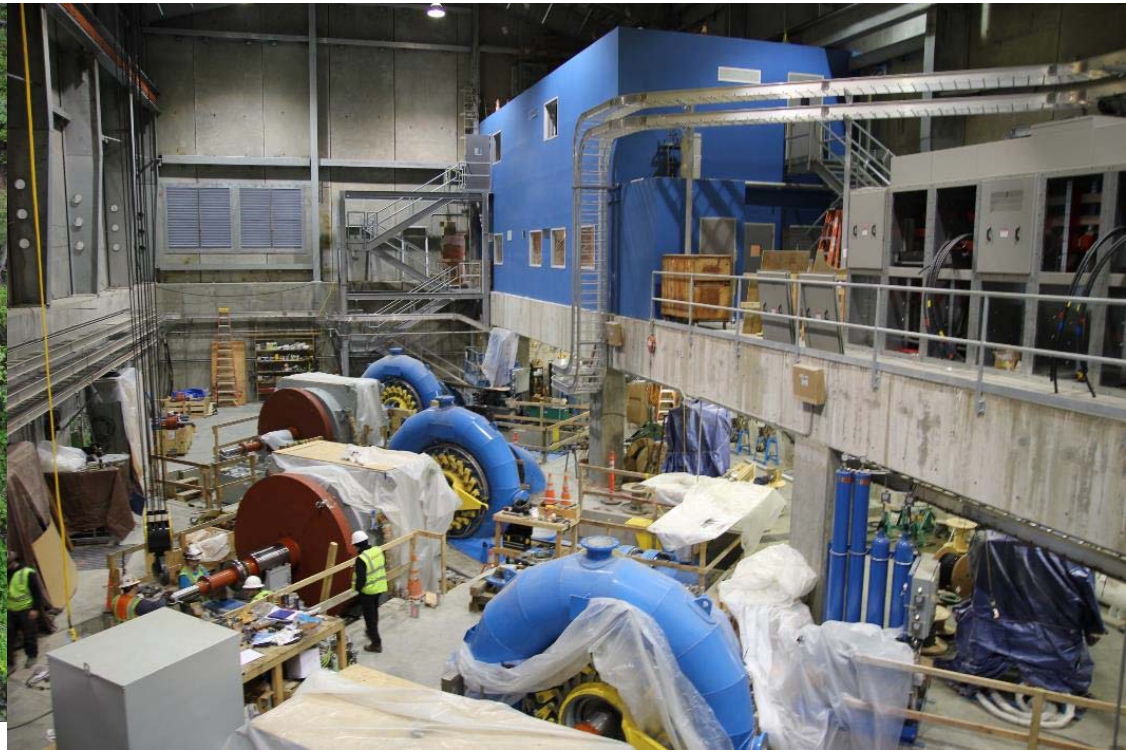
Akutan





Allison

Blue lake



Chignik Lagoon

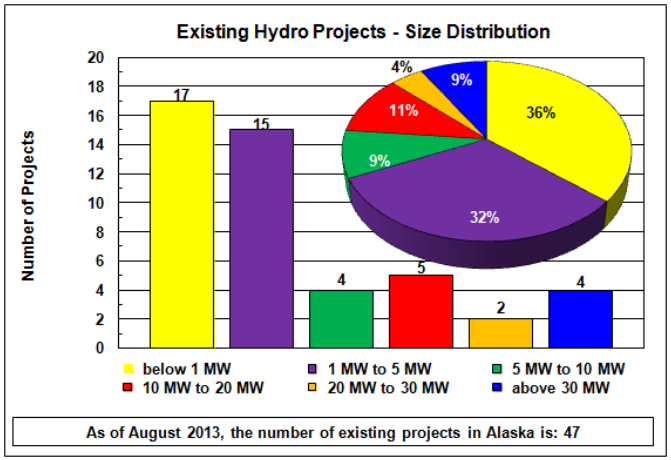
Existing Hydropower in Alaska

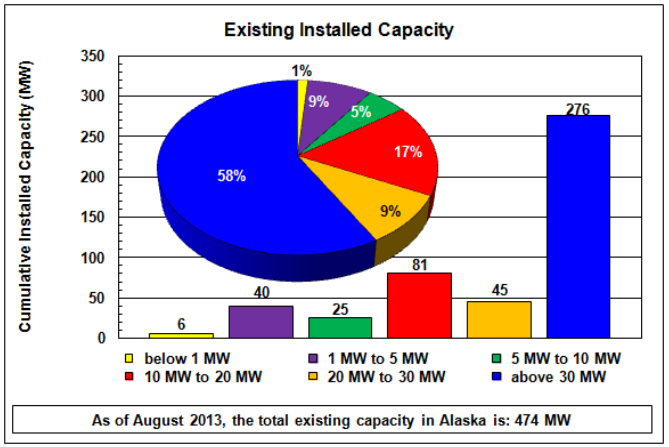
Alaska's Average Electrical Energy Make-up, 2011				
Oil	Gas	Coal	Hydro	Wind
15.6%	57.8%	5.9%	20.3%	0.3%

- 20% of Alaska's electrical energy comes from hydropower
- 68% of sites have a capacity below 5 MW
- 58% of total capacity is from 4 sites with greater than 30 MW capacity

Number of Existing Projects: 47

Total Installed Capacity: 474 MW





Renewable Energy Fund Round 9 Hydro Applications

- 20 Hydroelectric and 2 hydrokinetic applications received

Project Name	Applicant Phases	Grant Fund Request	Total Match	Total Cost for Requested Phases	Total Cost Through Construction
Igiugig RivGenÂ® Power System Commercial Project	Construction	$1,490,077	$641,663	$2,131,740	$2,131,740
Elfin Cove Hydroelectric Permitting	Design	$88,000	$22,000	$110,000	$3,835,000
Indian River Hydroelectric Project - Construction	Construction	$809,000	$1,115,280	$1,924,280	$2,298,280
Chignik Hydroelectric Dam Project	Design	$1,025,175	$60,251	$1,085,427	$7,200,000
Hydro Power Generator Adak	Construction	$294,102	$126,044	$420,146	$420,146
Gunnuk Creek Hydro Rehabilitation - IPEC Kake	Construction	$3,920,000	$1,545,000	$5,465,000	$5,795,000
Ouzinkie Hydroelectric Power Project	Construction	$397,427	$4,014	$401,441	$401,441
West Creek Hydroelectric Project	Recon	$320,000	$25,000	$345,000	
Scammon Bay Hydroelectric Project	Feasibility	$305,000	$3,050	$308,050	$4,114,132
Fivemile Creek Hydroelectric Project	Construction	$3,400,000	$2,600,000	$6,000,000	$6,580,000
Grant Lake Hydroelectric Project	Design	$4,000,000	$875,528	$4,875,528	$59,067,808
Old Harbor Hydroelectric Project â^'Geotechnical Study and Final Design	Design	$1,092,500	$57,500	$1,150,000	$10,317,500
Waterfall Creek Hydroelectric Construction Project	Construction	$675,000	$5,525,000	$6,200,000	$6,950,000
False Pass Hydroelectric Feasibility Study and Conceptual Design	Feasibility	$187,000	$33,000	$220,000	$4,621,500
Cosmos Hills Hydroelectric Design & Permitting	Design	$341,335	$37,200	$378,535	$37,041,535
Yerrick Creek Hydropower Project: Construction	Construction	$4,000,000	$15,000,000	$19,000,000	$20,675,000
Hydrokinetic Feasibility Study: False Pass, Alaska	Feasibility	$440,319	$62,500	$502,819	$502,819
Neck Lake Hydropower Project: Phases II-III	Design	$395,200	$98,800	$494,000	$3,019,975
Clearwater Creek Hydropower Project: Phase II	Feasibility	$386,000	$100,000	$486,000	$15,891,000
Craig Water Treatment Plant Micro-Hydro	Design	$80,000	$10,000	$90,000	$297,510
Upper Hidden Basin Diversion - Geotechnical Investigation	Feasibility	$750,000	$750,000	$1,500,000	$79,992,000
Water Treatment Plant Inline Micro Turbines	Construction	$1,100,000	$240,000	$1,340,000	$1,340,000
		$25,496,135	$28,931,830	$54,427,966	$272,492,386

Renewable Energy Fund Round 9 Hydro Application Summary

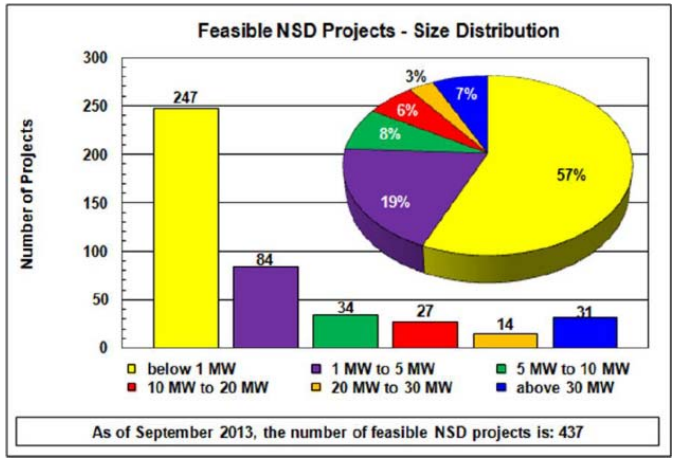
Phase	Sum of Grant Fund Request	Sum of Total Match	Sum of Total Cost for Requested Phases	Sum of Total Cost Through Construction
Construction	$16,085,606	$26,797,001	$42,882,607	$46,591,607
Design	$7,022,210	$1,161,279	$8,183,490	$120,779,328
Feasibility	$2,068,319	$948,550	$3,016,869	$105,121,451
Recon	$320,000	$25,000	$345,000	
Grand Total	**$25,496,135**	**$28,931,830**	**$54,427,966**	**$272,492,386**

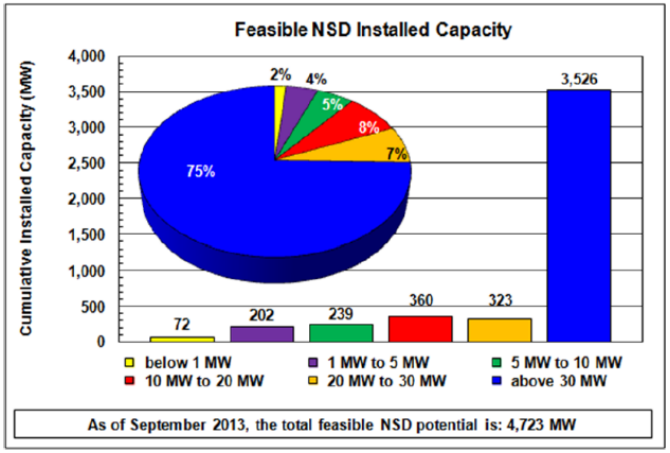
Alaska NSD Results:
Feasible Potential

- Does not include projects considered unfeasible due to economic, environmental, cultural, or land use restrictions.
- 76% of sites have a capacity less than 5 MW.
- 31 sites with a capacity above 30 MW comprise 75% of Alaska's potential.

Number of "Feasible" Projects: 437

Total "Feasible" Potential: 4.723 GW





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