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.”
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

AEEE/REF/PPF – Daniel Hertrich
Bradley and Snettisham – Bryan Carey
Susitna-Watana – Wayne Dyok
What Nature Gives Us

Hydro power is the original solar energy capture
Hydroelectric Energy Generation

Determining energy generation from water resource
- Develop hydrograph from stream gauging data collection
Hydropower is the Foundation of Renewables in the U.S.

EIA Generation data from 2012

Hydropower 56.5%
Biomass 3.3%
Geothermal 0.9%
Solar 11.5%

Renewable Generation (Twh)

Hydro
Wind
Biomass
Geothermal
Solar
How Hydroelectric Power Is Captured

- Elevation difference creates head pressure and water motion.
- Created by natural geography, or by dams.
How Hydroelectric Power Is Captured

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

\[ \text{Power} \sim \text{Head} \times \text{Discharge} \]

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

Graphic courtesy of Voith Hydro
• Projects generally fall into 2 types
  – Run of River (no storage)
  – Storage
Multi-Purpose Uses

- Dams and Reservoirs provide other attributes than power

Images:
- 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
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
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

Analyze the impacts to resources from two perspectives:

1. The impact the development has on fishery resources.

   and conversely

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

Environmental Concerns vs. Developmental Concerns
Examples of Projects in Development – Grant Lake

Fish Resource
• Investigations – snorkeling and trapping
Examples of Projects in Development – Grant Lake

Fish Resource
- Radio telemetry results
Chignik hydro replacement
Blue lake
Existing Hydropower in Alaska

Alaska’s Average Electrical Energy Make-up, 2011

<table>
<thead>
<tr>
<th></th>
<th>Oil</th>
<th>Gas</th>
<th>Coal</th>
<th>Hydro</th>
<th>Wind</th>
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<tbody>
<tr>
<td>%</td>
<td>15.6</td>
<td>57.8</td>
<td>5.9</td>
<td>20.3</td>
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</table>

- 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

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Applicant Phases</th>
<th>Grant Fund Request</th>
<th>Total Match</th>
<th>Total Cost for Requested Phases</th>
<th>Total Cost Through Construction</th>
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<tbody>
<tr>
<td>Igiugig RivGen® Power System Commercial Project</td>
<td>Construction</td>
<td>$1,490,077</td>
<td>$641,663</td>
<td>$2,131,740</td>
<td>$2,131,740</td>
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<td>Elfin Cove Hydroelectric Permitting</td>
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<td>$110,000</td>
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<td>Indian River Hydroelectric Project - Construction</td>
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<td>$809,000</td>
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<td>$1,924,280</td>
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<td>Chignik Hydroelectric Dam Project</td>
<td>Design</td>
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<td>$1,085,427</td>
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<td>Hydro Power Generator Adak</td>
<td>Construction</td>
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<td>$126,044</td>
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<td>Gunnuk Creek Hydro Rehabilitation - IPEC Kake</td>
<td>Construction</td>
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<td>$1,545,000</td>
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<td>Ouzinkie Hydroelectric Power Project</td>
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<td>$397,427</td>
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<td>West Creek Hydroelectric Project</td>
<td>Recon</td>
<td>$320,000</td>
<td>$25,000</td>
<td>$345,000</td>
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<tr>
<td>Scammon Bay Hydroelectric Project</td>
<td>Feasibility</td>
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<td>$3,050</td>
<td>$308,050</td>
<td>$4,114,132</td>
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<td>Fivemile Creek Hydroelectric Project</td>
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<td>$4,875,528</td>
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<td>Old Harbor Hydroelectric Project &amp; Geotechnical Study and Final Design</td>
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<td>False Pass Hydroelectric Feasibility Study and Conceptual Design</td>
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<td>Craig Water Treatment Plant Micro-Hydro</td>
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<td>Upper Hidden Basin Diversion - Geotechnical Investigation</td>
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<td>Water Treatment Plant Inline Micro Turbines</td>
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<td>$1,340,000</td>
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$25,496,135 $28,931,830 $54,427,966 $272,492,386
## Renewable Energy Fund Round 9 Hydro Application Summary

<table>
<thead>
<tr>
<th>Phase</th>
<th>Sum of Grant Fund Request</th>
<th>Sum of Total Match</th>
<th>Sum of Total Cost for Requested Phases</th>
<th>Sum of Total Cost Through Construction</th>
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<tr>
<td>Construction</td>
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<td>Design</td>
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<td>Feasibility</td>
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<td>Recon</td>
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<td>$25,000</td>
<td>$345,000</td>
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<td>Grand Total</td>
<td>$25,496,135</td>
<td>$28,931,830</td>
<td>$54,427,966</td>
<td>$272,492,386</td>
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</tbody>
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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