Barriers and Challenges to Hydropower Development in Rural Alaska

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Remarks today are limited to conventional hydropower. (Leaves out river hydrokinetic, ocean current and tidal projects; they are still in developmental stages).Will also excludethe Railbelt (Susitna - Watana, etc.)

From ISER's "Alaska Energy Statistics 1960 – 2009", hydropower accounted for 20% of statewide electrical generation in 2009.If the Railbelt is excluded, hydropower accounted for 62% of the power sold in rural Alaska.

Why hydropower:

- **mature technology**
- **sustainable energy source**
- **free fuel**
- **operational ease and low O&M costs**
- **if resource allows, can match power generation to load**
- **excess hydropower can be made available for dispatchable load (electric boilers for heating)**
- **exceptional long project life (100+ years)**
- **able to be integrated with other renewable energy systems such as wind and with diesel generation**

How it works:

- **water + gravity (formula for calc. hydropower has flow (Q) x gravity (H))**
- **conventional storage vs run-of-river;**
- **best – lake taps at high mountain lakes or rivers with natural barriers**
- **storage hydro can act as a giant battery by deferring hydro production when other temporalenergy sources are available**

Examples of some hydro success stories in rural Alaska:

- **King Cove - Delta Creek – 850 kW ROR**
- **Iliamna, Newhalen, Nondalton - Tazimina – 800 kW**
- **Larsen Bay - 400 kW**

- Atka –Chuniisax Creek - 250 kW
- Ouzinkie – 100 kW
- Glacier Bay – Falls Creek – 800 kW
- Kodiak, Port Lions – Terror Lake – 30 MW (plus 4.5 MW wind on Pillar Mtn)
- Cordova – Humpback Creek and Power Creek – 1.25 / 6 MW
- Valdez/Glenallen - Solomon Gulch – 12 MW

Some newly proposedin rural AK (Not in SE AK , but are they all feasible?):

- Chitina – Five Mile Creek – 300 kW
- Old Harbor – Mountain Creek – 265 kW
- YK Region – Chikuminuk – 13 MW
- Chignik Lagoon – Packer Creek – 400 kW
- Angoon – Thayer Creek – 1.1 MW
- King Cove (2nd hydro) – Waterfall Creek – 375 kW
- Copper Valley - Allison Creek – 6.5 MW;

Deployment scenarios: short, mid-term and long term in Alaska Energy Pathway

- Hydro in long term time frame (6 – 12 years from studies to first power)

CURRENT CHALLENGES:

Regulatory:

- licensing costs
- time to license (3-5+ years)
- FERC or no FERC
- regulatory risks give uncertainty as to impacts on project cost and energy generation
- operational impactsfrom mandatory conditions from resource agencies in FERC process (fish habitat protection, protection of federal lands, fishway prescriptions, etc.)
- local and state permits
- in some locations hydro development can increase available fish habitat and populations
- site control

Financing:

- large upfront capital costs
- where available bonds can be floated
- high costs in first years of operations
- best if spread over longer project life (+30 years)
- grants may be available to reduce borrowing costs (AEA has hydro-related grants at $53M + $57M match in RE Fund in Rds 1-4; 23 new applications in Round 5

- low ROI
- Power Project Fund (low interest loans)

Costs:

- tendency for estimated project budget to grow during design
- project budgets impacted by field changes during construction
- hydro construction costs today start at $7000/kW, can be higher for more remote communities
- cost overruns are possible

Projects:

- seasonality of flows vs load
- icing conditions and frazil ice
- distance of hydro site to village load
- costs of transmission and road access
- integration of hydro project to back-up diesel generation (electronic controls)
- potential for transmission interconnections between villages to share hydro resources
- heating loads may use up capacity quickly

Cost of energy:

- based on payments needed to make annual debt repayment, O&M costs and utility admin costs
- large storage hydros greater than 40 years fully paid off produce power at 1-2 cents/kWh
- recently constructed small hydro projects in the range of $0.25 - .35/kWh if construction costs are fully amortized, but less if grants are used to lower borrowed amts
- hydropower availability can vary as much as +/- 20% from the norm, depending upon the water year
- within a longer time frame, hydropower provides for rate stability that can last for 50 – 100 years

Take aways:

- Hydropower will not solve the energy needs for most villages, however, those lucky enough to have a hydro resource nearby should make every effort to investigate it, license and develop it if it looks feasible.
- Hydropower gives a surety in power sales rates that lasts for generations.
- It can be integrated with other renewable resources such as wind and with backup diesel so that increased reliability can be achieved
- Hydropower is the most mature of the renewable energy technologies
- Hydropower projects take a long time to license (3 -5 years) and their infrastructure costs a lot to build