Southeast Conference

Alaska - British Columbia Intertie Feasibility Study

March 28, 2007
Juneau, Alaska
Centennial Hall Ballroom 3

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Introductions

(in order of initial appearance)

Jim Strandberg	Alaska Energy Authority
Nan Nalder	Hatch Acres
Randy Hardy	Hardy Energy Consulting
Del La Rue	Dryden & La Rue Consultants
Bob Griesbach	Hatch Acres
Dick Griffith	Hatch Acres

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Overview

Nan Nalder – Hatch Acres

- **AK – BC Intertie Feasibility Study**
  - –Purpose and scope of the study
  - –Issues shaping the study
- **Outline for Today's Presentation**

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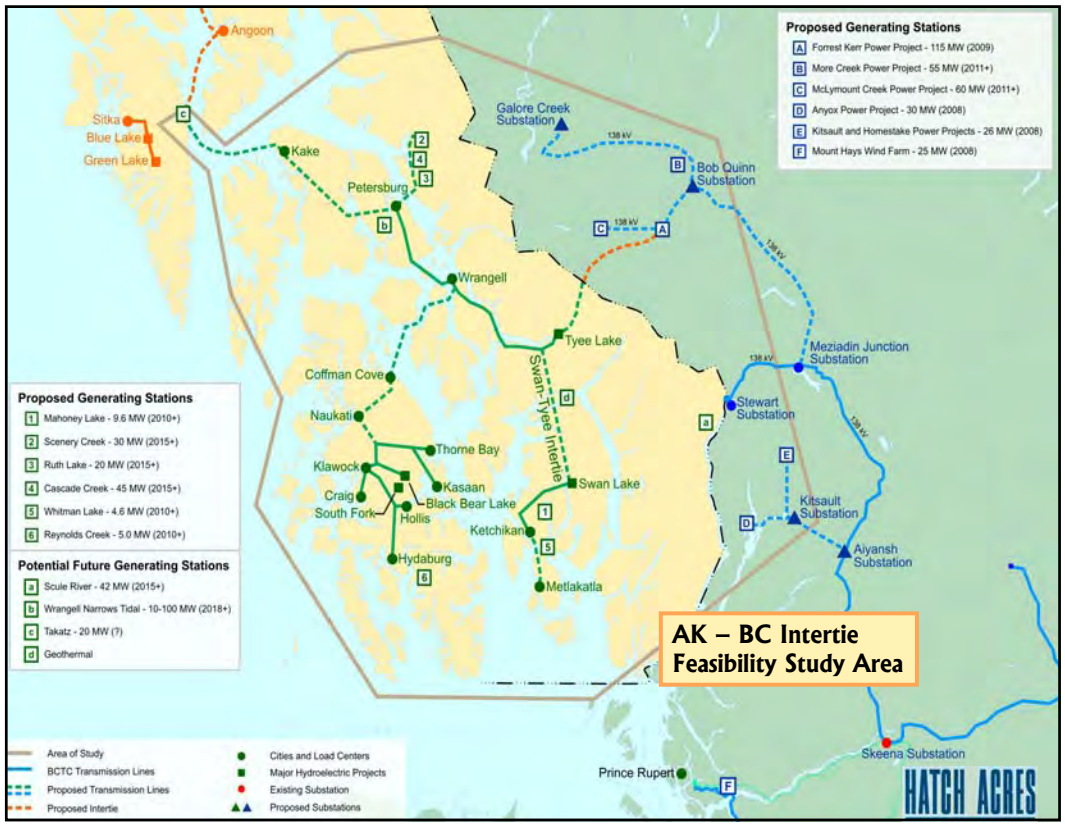

AK-BC INTERTIE FEASIBILITY STUDY: Purpose & Scope

Conduct investigations and prepare a report for use by decision-makers in reviewing and evaluating proposals for funding and related state action on proposed transmission segments and related issues.

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AK-BC INTERTIE FEASIBILITY STUDY: Purpose & Scope

- Swan Tyee Intertie
- AK-BC Intertie
- Future Generation Projects
- Future Management - Business Structure
- Market for Sale of Alaskan-generated Power
- Future Least-Cost Plans – SE Alaska & Export to BC
- Potential Development Scenarios

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Issues Shaping the Study

"If the State of Alaska provides funds to construct new transmission segments, will the private sector invest in new generation, including associated infrastructure to connect with the transmission grid;

and

Will the new generation projects use of the state-funded transmission, including the proposed AK-BC Intertie, result in revenues sufficient to cover O&M costs to maintain the transmission system over the long term?"

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Conclusions – Swan-Tyee Intertie

- The Swan-Tyee Intertie (STI) is technically feasible and fully permitted.
- The STI provides a significant opportunity to support commercial & residential conversions to electric heating with clean, renewable hydro power.
- The STI as currently proposed demonstrates strong economic value to the rate payers of Southern Southeast Alaska.

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Conclusions – AK-BC Intertie

- The AK-BC Intertie would provide a further opportunity to secure the energy future for Southeast Alaska.
- The technical feasibility and market potential of the proposed future hydro facilities & related transmission features look promising but cannot be definitively determined at this time.
- The permitting of the proposed hydro facilities and transmission features face significant, but not necessarily insurmountable, environmental & institutional challenges.

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Today's Presentation

- Future Management - Business Structures
- Markets Outside SE Alaska & Market Opportunities
- Regulatory Issues
- Transmission Line Costs & Issues
- Load Forecasts
- Power Generation Costs & Issues
- Potential Development Scenarios – With/Without Export
- Summary

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Business Structure

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Potential Future Business Structures

- Transmission Cooperative (TC)
- Unified System Operator
- Power Marketing Oversight

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Recommendations for Further Analysis

- Decision-making by AEA and potential future members of the 3 Functional Business Structure Elements
  - Transmission Cooperative
  - Unified System Operator
  - Power Marketing Oversight
- Clarify regulatory regime for export sales
  - Address issue of whether interstate commerce results from operation of the AK-BC Intertie
  - Prepare and file request for Declaratory Order with the FERC
  - Requires legal counsel
- Develop and propose tariff for use of the AK-BC Intertie and related line segments

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Power Market Considerations

Randy Hardy – Hardy Energy Consulting

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Principal Markets for SE Alaska Hydro

- BC Hydro or Powerex (the wholesale marketing arm of BC Hydro)
- PNW investor owned and/or publicly owned utilities.
- All these entities will need power to meet their load growth in the post – 2011 timeframe

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Transmission Interconnections – Export of SE Alaska Hydro

- AK-BC Intertie System
- BCTC Backbone Extension

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Market Opportunities

- SE Alaska hydro projects need to produce electricity for a price of $60/megawatt hour (MWh) or less to be economically viable for export.
- If project prices exceed $60/MWh they may be economic to export, but competitiveness will depend on greenhouse gas restrictions increasing future BC/PNW market prices.

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Market Oversight

- If the State can be assured that the projects are constructed so they will produce power for 50 years (the term of their FERC license), it may be possible to evaluate their economics over that longer timeframe, substantially increasing their marketability.
- Long term project operation would probably require more direct involvement by the State.

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Recommendation for Further Analysis

- Monitor implementation of BC Energy Plan Policies to identify potential for Alaskan sales to BC
- Monitor and advise AEA of emerging market opportunities in BC & PNW

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Regulatory Requirements

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Regulatory Requirements

- BC interconnection and export – United States
- BC interconnection and export – British Columbia
- Transmission siting – SE Alaska
- FERC licensing – new hydro projects

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Recommendation for Further Analysis

- Consult with RCA & FERC regarding regulatory structure for AK-BC intertie and determination whether interstate would commerce apply.
- Monitor progress of RCA rulemaking to adapt State Small Hydro Licensing Program (5 MW or less).

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Transmission Line Costs and Issues

Del La Rue – Dryden & La Rue, Inc.

- **Swan – Tyee Intertie (STI)**
- **AK - BC Intertie**

Overview of Transmission Lines Reviewed in this Study

- Swan-Tyee Intertie
- AK-BC Intertie
- Other Segments - Export Lines
  - Thomas Bay to Petersburg
  - Upgrade FDPPA Petersburg to Tyee Lake
  - AK/BC Border to BCTC System
- Other Segments – SE Alaska System
  - Petersburg – Kake
  - Metlakatla – Ketchikan

Swan-Tyee Intertie – Present Status

- Construction permits
- Clearing – approx. 2 miles + helipads
- ½ of micropile foundations installed
- All foundation material on site
- Pile caps on site
- Tower design essentially complete

AK-BC Intertie

- 26 miles
- 138kV Overhead
- Wood H-Structures
- Riverbed routing
- 2,350’ Elevation Pass

Other Segments - Export Lines

- Thomas Bay to Petersburg
  - No feasibility studies
  - Approx. 22 Miles (13 OH & 9 submarine in 3 crossings)
  - Expect extreme side-slopes
  - Frederick Sound
- Upgrade FDPPA Petersburg to Tyee Lake
  - No feasibility studies
  - System analysis
  - Compensation

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Other Segments - Export Lines

- AK/BC Border to BCTC System
  - No feasibility study
  - Assumed similar construction as AK-BC
  - Approx. 30 miles to Forrest Kerr

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Other Segments – SE Alaska System

- Petersburg – Kake
  - Definitive Report – 2005 D Hittle (Center-South)
  - Existing and New road
  - 69kV
  - 52 miles (50 OH, 2 mile submarine in 2 crossings)
- Metlakatla – Ketchikan
  - No feasibility study
  - Existing new road
  - 34.5kV
  - 15 miles (14 OH, 1 submarine)

Transmission Line Costs

Transmission Segments with Estimated Costs

	Segment	Estimated Capital Cost	Estimated O&M Cost
1	AK-BC Intertie Alaska[1]	$31,950,000	$360,000
2	Swan-Tyee Intertie[1]	$57,000,000	$500,000

Transmission Segments with Rough Order of Magnitude (ROM) Costs - Basis in Studies/Reports

	Segment	ROM Capital Costs	ROM O&M Cost
3	Petersburg to Kake[2]	$31,350,000	$210,000

Transmission Line Costs (continued)

Transmission Segments with Rough Order of Magnitude (ROM) Costs - Limited or No Studies/Reports

	Segment	ROM Capital Costs	ROM O&M Cost
4	AK-BC Intertie British Columbia[1]	$36,000,000	$450,000
5	Thomas Bay to Petersburg	$66,000,000	$810,000
6	Metlakatla to Ketchikan	$14,900,000	$125,000
7	Coffman Cove to Wrangell (HVDC)	$170,000,000	$1,300,000
8	Kake to Takatz (HVDC)	$160,000,000	$1,200,000

[1] Capital costs for this project include indirect costs such as permitting, engineering, etc.

[2] Capital costs for this project include indirect costs such as permitting, engineering, etc. Capital and O&M costs are based upon using road access entire length of the line.

[3] Costs for all submarine cables are based upon 30 year service life and no cable replacement.

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Load Forecasts

Bob Griesbach – Hatch Acres

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Load Forecast Considerations

- Historic sales, customers and generation data.
- Historic population figures.
- Growth in number of residential customers.
- Growth in consumption per residential customer.
- Growth in number of non-residential customers.
- Growth in consumption per non-residential customer.

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Load Forecast Considerations

- Spot load information.
- Commercial heat conversions.
- Residential heat conversions.
- Losses to determine net generation.
- Load factor to determine peak demand.
- Monthly load forecast.

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Load Forecast Factors

- Currently approximately 3 % of the electricity is supplied from diesel (2006). [2002 was 8.9%]
- No economic measure (eg GDP) for the communities in SE Alaska.
- Historic population growth in region is very low. [Avg. 0.77% from 1970 to 2005]
- Population forecasts are at State level.
- Annual electricity forecasts based on assumed growth rates plus spot loads and conversion to electric heating.

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Load Growth Factors

- Spot Loads:
  - Ship and Dry Dock Facility in Ketchikan
  - Kiln in Wrangell
- Commercial Heat Conversions
  - State & City Buildings in Ketchikan
  - Municipal Buildings in Petersburg
  - Municipal Buildings in Wrangell
- Residential Heat Conversions

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Load Forecast Assumptions

- Total sales converted to net generation using an estimated loss rate of 5.5 percent.
- Loss rate calculated from observed data at Ketchikan, Petersburg, Wrangell and Metlakatla.
- Net generation converted to peak demand using a load factor of 57.2 percent.
- Load factor calculated from observed values at Petersburg.

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Load Forecast Assumptions (continued)

- Generation planning requires monthly forecast for each community.
- Annual Forecast of existing loads converted to monthly based on:
  - Existing residential load used observed residential seasonal sales pattern.
  - Existing non-residential load and spot loads used observed non-residential seasonal sales pattern.

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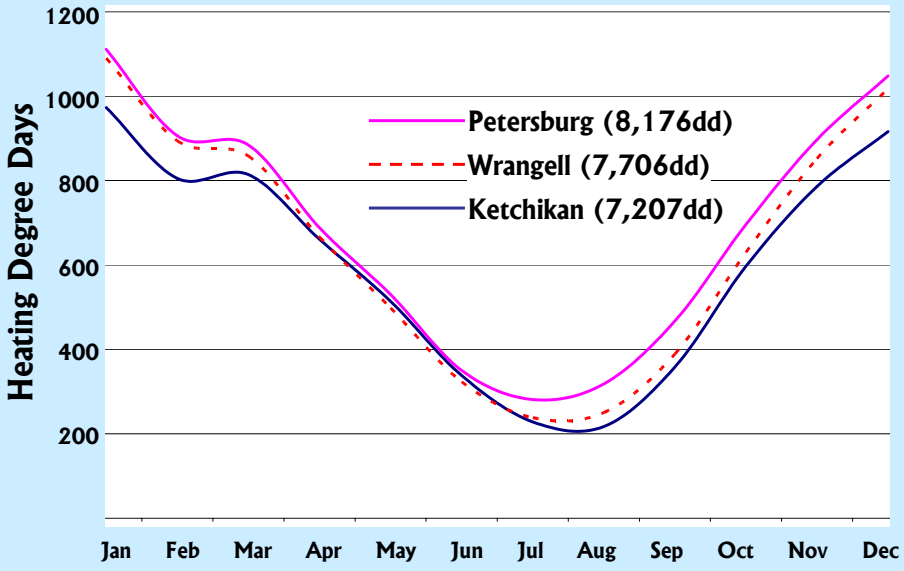
Seasonal HDD Pattern



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Reference, Low & High Load Cases: Sensitivity Basis

- Residential and non-residential customer growth rates.
- Residential and non-residential consumption per customer growth rates.
- Pace of new residential conversions.
- Pace of new commercial conversions.
- Spot loads unchanged between sensitivity cases.

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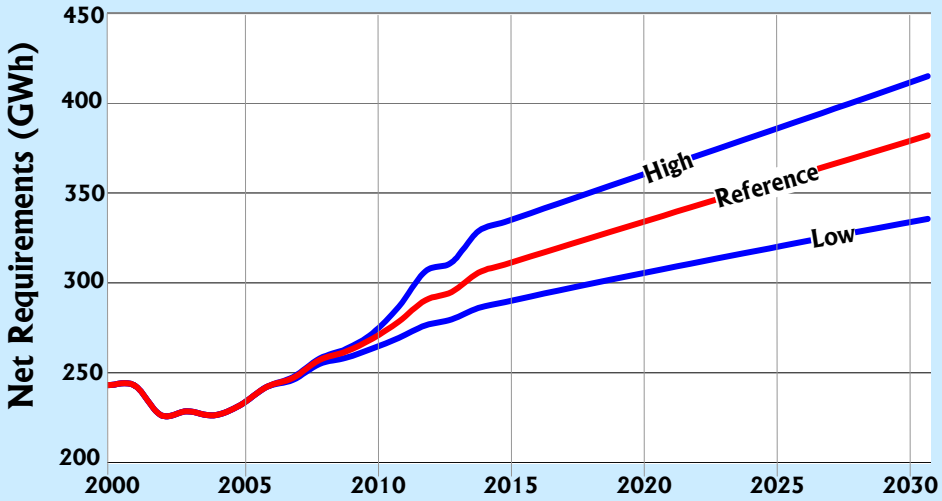
Load Forecast Results



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Average Annual Growth Rates: Reference Case 2005 - 2031

- Ketchikan 1.9%
- Petersburg 1.4%
- Wrangell 2.1%
- Kake 1.8%
- Metlakatla 1.5%
- Craig/Klawock/Thorne Bay/Hollis 1.4%
- Hydaburg 1.8%
- Coffman Cove 2.4%
- Naukati Bay 0.9%
- Whale Pass 1.1%

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Generation Resources

Dick Griffith – Hatch Acres

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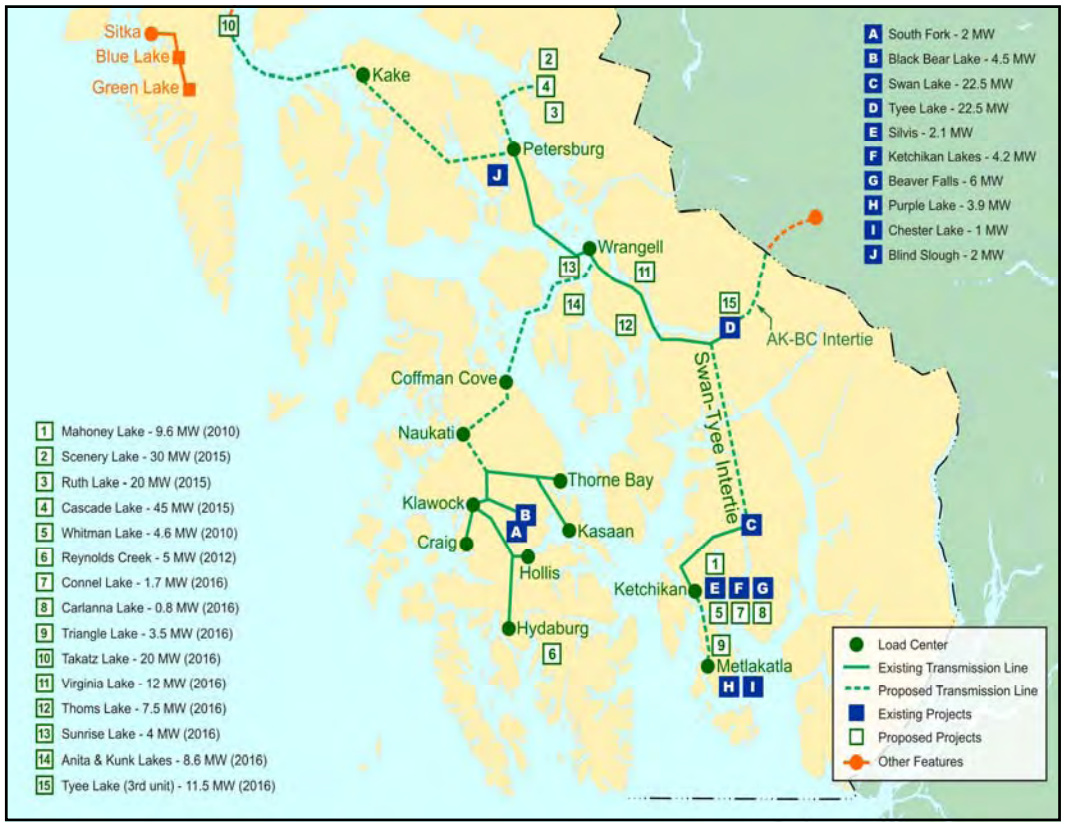

Existing Projects – Capacity & Energy Potential

	Project Name	Nearest Load Center	Licensee	Installed Capacity (MW)	Average Energy (GWh)	Firm Energy (GWh)
A	South Fork	Prince of Wales	APT	2.0	6.7	5.5
B	Black Bear Lake	Prince of Wales	APT	4.5	21.4	19.2
C	Swan Lake	Ketchikan	FDPPA	22.5	72.0	59.0
D	Tyee Lake	Wrangell/Petersburg	FDPPA	22.5	116.8	67.2
E	Silvis	Ketchikan	KPU	2.1	11.4	9.6
F	Ketchikan Lakes	Ketchikan	KPU	4.2	19.8	15.0
G	Beaver Falls	Ketchikan	KPU	6.0	38.4	33.0
H	Purple Lake	Metlakatla	MP&L	3.9	12.6	10.7
I	Chester Lake	Metlakatla	MP&L	1.0	3.5	2.1
J	Blind Slough	Petersburg	PMP&L	2.0	10.4	10.0

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Unconstructed Projects – Capacity & Energy Potential

	Project Name	Nearest Load Center	Licensee / Permittee	Earliest On-Line	Installed Capacity (MW)	Average Energy (GWh)	Firm Energy (GWh)
1	Mahoney Lake	Ketchikan	APT	2010	9.6	39.6	34.3
2	Scenery Lake	Export	CC, LLC	2015	30.0	128.7	102.8
3	Delta Creek (Ruth Lake)	Export	CC, LLC	2015	20.0	70.7	57.6
4	Cascade Creek (Swan Lake)	Export	CC, LLC	2015	45.0	202.3	159.1
5	Whitman Lake	Ketchikan	KPU	2010	4.6	19.6	17.0
6	Reynolds Creek	POW	APT	2010	5.0	6.1	5.5
7	Connell Lake	Ketchikan	None	2016	1.7	10.8	9.3
8	Carlanna Lake	Ketchikan	None	2016	0.8	4.2	3.6
9	Triangle (Hassler) Lake	Metlakatla	None	2016	3.5	13.1	11.4
10	Takatz Lake	Sitka / Export	None	2016	20.0	106.9	97.1
11	Virginia Lake	Wrangell	None	2016	12.0	43.8	37.9
12	Thoms Lake	Wrangell	None	2016	7.5	24.2	20.9
13	Sunrise Lake	Wrangell	None	2016	4.0	13.5	11.7
14	Anita & Kunk Lakes	Wrangell	None	2016	8.6	28.1	24.3
15	Tyee - 34.0 MW (incr.)	Wrgl/Ptsbg	None	2016	11.5	20.3	6.0

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Unconstructed Projects – Order of Magnitude Costs

	Project Name	Year of Base Estimate	Order of Magnitude Costs - 2007 Dollars: Capital Cost ($1,000)	Variable Cost ($1,000)	Cost of Power ($ / MWh)
1	Mahoney Lake	1998	$34,073	$553	$85
2	Scenery Lake	2006	$84,442	$1,695	$67
3	Delta Creek (Ruth Lake)	2006	$60,517	$1,135	$86
4	Cascade Creek (Swan Lake)	2006	$144,959	$2,535	$71
4b.	Cascade Creek (Swan Lake)	1984	$255,082	$2,255	$141
5	Whitman Lake	2006	$9,738	$273	$55
6	Reynolds Creek	2000	$19,750	$295	$307
7	Connell Lake	1996	$7,779	$110	$69
8	Carlanna Lake	1996	$3,735	$60	$87
9	Triangle (Hassler) Lake	2007	$15,613	$211	$114
10	Takatz Lake	1974	$134,204	$1,566	$117
10b.	Takatz Lake	1968	$198,438	$1,135	$163
11	Virginia Lake	1977	$127,575	$687	$255
12	Thoms Lake	1977	$136,108	$435	$481
13	Sunrise Lake	1988	$16,252	$239	$117
14	Anita & Kunk Lakes	1997	$111,922	$497	$345
15	Tyee - 34.0 MW (incr.)	1966	$10,114	$659	$73

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Development Scenarios

Bob Griesbach – Hatch Acres

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Economic Analysis Methodology

- Southeast Alaska Divided into 3 regions:
  - Tyee Region: Wrangell, Petersburg & Kake
  - Swan Region: Ketchikan & Metlakatla
  - Prince of Wales: Load centers in POW except Whale Pass
- Presently regions are isolated from each other and some load centers within a region are not connected to each other.

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Economic Analysis Methodology (continued)

- Key objective of analysis is to determine best way to supply Southeast Alaska demand in view of available resources.
- First determine least cost plan to supply demand without power exports.
- Then determine plan considering possible exports of power.

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Economic Analysis Methodology (continued)

- Several tasks undertaken to define study parameters including:
  - Review of existing studies
  - Review of existing system
  - Definition of candidate generation resources
  - Capacity and energy balances
  - Formulation of generation expansion plans
  - Modeling and evaluation of generation plans

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Economic Analysis Methodology (continued)

- For no export alternative considered:
  - Development of generation requirements without future connection between regions
  - Development of generation requirements with the future connection between regions
- Special purpose model developed to develop and analyze the generation developments.

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Economic Analysis Methodology (continued)

- To capture annual variations in demand and hydro capability, model carries out its calculations on a monthly basis
- Model capable of simulating maintenance period of power plants and transmission lines
- Model assumes local power supply for backup

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Economic Analysis Methodology (continued)

- Evaluation of supply alternatives carried out by comparing the present value (PV) of total annual supply costs
- Comparison of PV of costs of different alternatives allows determination of best timing for projects and supply modes
- Alternatives considering power exports followed similar methodology

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Economic Analysis Methodology (continued)

- In export cases, SE Alaska requirements were always met first, surplus was considered for export
- All transmission facilities were considered grant funded at this stage
- O&M cost of transmission facilities were part of overall costs

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Economic Analysis Methodology (continued)

- To test robustness of generation plans sensitivity was carried out on:
  - Load Growth
  - Capital cost of candidate generation
  - O&M costs of transmission
  - Fuel costs
  - Discount rate

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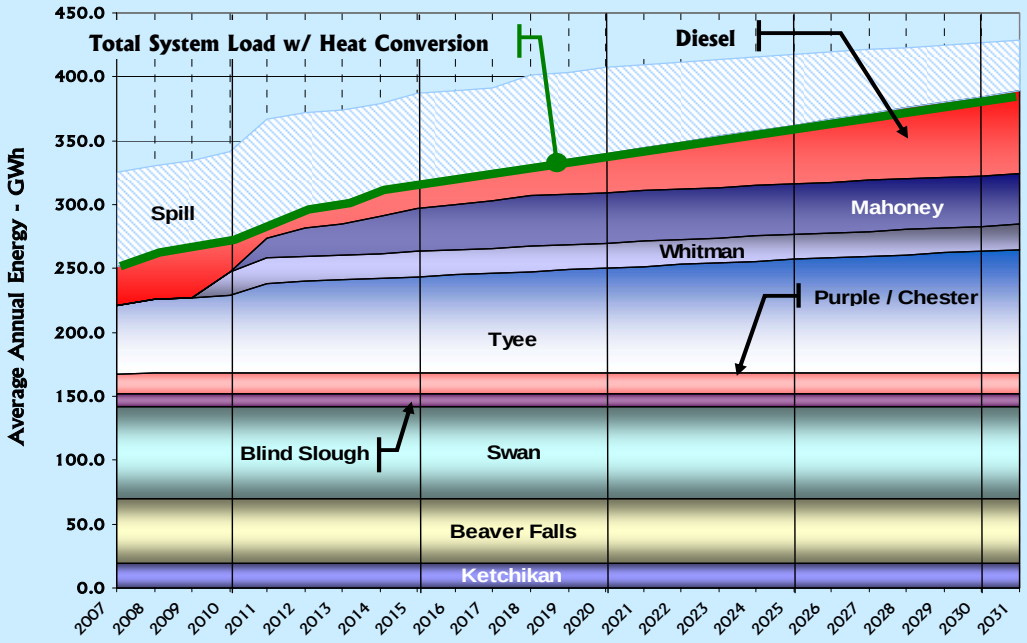
Load / Resource Balance w/o STI



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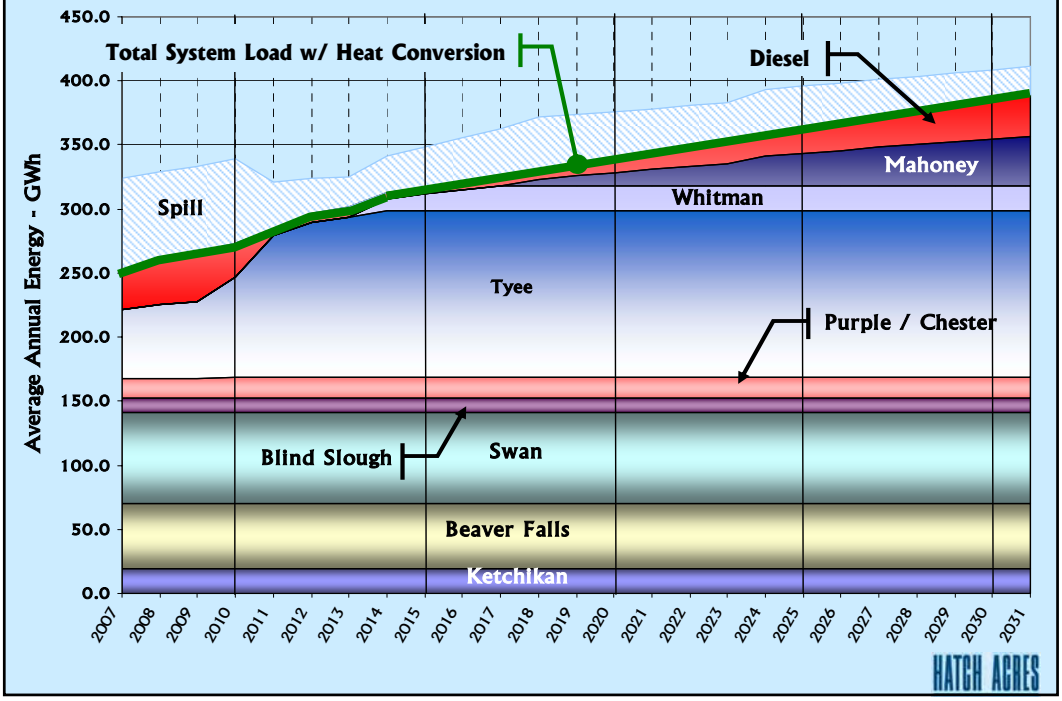
Load / Resource Balance w/ STI



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Economic Analysis Results: No Export

Transmission Connection	Cumulative Present Value of Costs @ January 2007 ($1,000,000) Discount Rate (Period = 2007-2046) 6%	8%	10%
Petersburg to Kake			
Reference Case	7.5	5.2	3.8
Low Case	6.5	4.6	3.3
Ketchikan to Metlakatla			
Reference Case	3.2	1.8	0.8
Low Case	3.1	2.1	1.4
Swan to Tyee			
Reference Case	33.2	27.0	22.8
Low Case	35.0	29.7	26.0
POW South to Coffman Cove & Naukati			
Reference Case	2.5	1.8	1.4
Low Case	3.0	2.2	1.6

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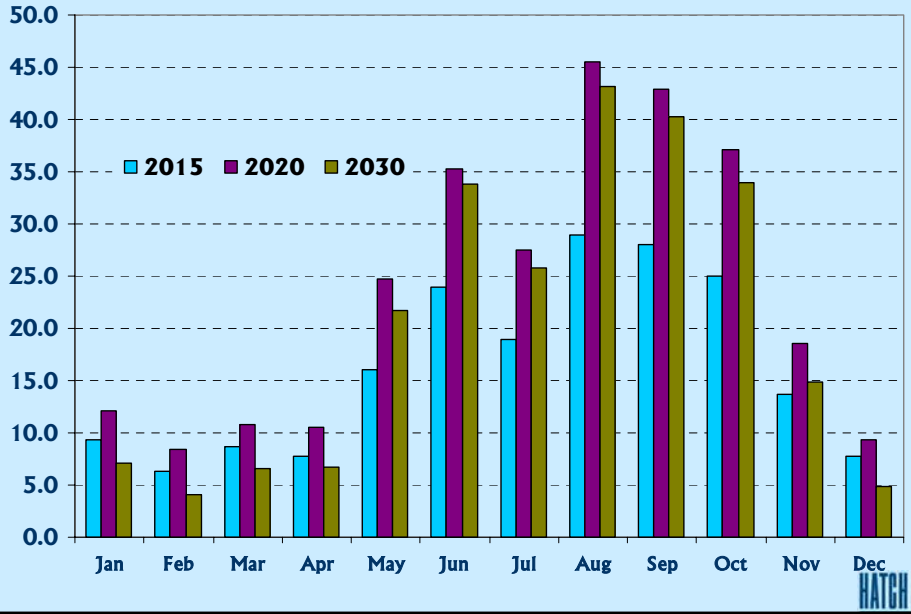
Export Energy Under Average Hydrologic Condition



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Economic Analysis Results: With Export @ 2015

Export Price ($MWh)	Cumulative Present Value of Costs to January 2007 ($1,000,000) Capital Cost Increase		
	0%	10%	20%
60	13.0	-9.8	-32.6
70	45.9	23.1	0.3
80	78.8	56.0	33.2

Assuumptions:

Project Financing period = 20 years
Discount rate = 6%
Analysis period = 40 years (2007-2046)

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Un-quantified Benefits

- Reduction of GHG from Diesel generation
- More heat conversions – reduced GHG
- Reduced spinning reserve requirements
- Gains in energy through complementary operation of hydro plants
- Assistance during maintenance outages
- More economic development

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Summary

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Conclusions – Swan-Tyee Intertie

- The Swan-Tyee Intertie (STI) is technically feasible and fully permitted.
- The STI provides a significant opportunity to support commercial & residential conversions to electric heating with clean, renewable hydro power.
- The STI as currently proposed demonstrates strong economic value to the rate payers of Southern Southeast Alaska.

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Conclusions – AK-BC Intertie

- The AK-BC Intertie would provide a further opportunity to secure the energy future for Southeast Alaska.
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- The permitting of the proposed hydro facilities and transmission features face significant, while not necessarily insurmountable, environmental & institutional challenges.

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Phase II – Ongoing Tasks

- Overarching issues
- Business structure
- Markets & market structure
- Regulatory issues
- Transmission costs & issues
- Power generation costs & issues

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Actions for AEA & AK-BC Work Group

- Transmission Cooperative (TC)
- Uniform System Operator (USO)
- Power Marketing Oversight Unit
- Level of State / Federal Jurisdiction

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Monitoring of 3rd Party Actions

- Market developments in BC & PNW
- FERC applications
- Decisions relating to stayed by Congressional Action (Mahoney Lake & Reynolds Creek)
- BCTC decision regarding NTL
- Technical improvements to transmission construction
- Hydro construction costs

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