Wind and Hydroelectric Feasibility Study

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Doug Vaught, PE—Consultant

Bristol Bay Native Corporation
A Landscape of Promise
Bristol Bay Native Corporation
Invested in the Region
• Southwest Alaska
  – 29 communities
  – 7,800 residents
  – 10,000 brown bears
  – 55,000,000 salmon

• 40,000 square miles—about size of Ohio
• 68% Native
  – Yup’ik Eskimo
  – Athabascan
  – Aleut

• Hit hard by growth of farmed salmon—region declared economic disaster area 4 of 7 past years

• Abundance of
  – natural resources
  – wild places
  – resourceful people
  – dramatic landscapes
• Alaska Native Claims Settlement Act (ANCSA) transferred title to:
  – 3 million surface and subsurface acres to the regional and village corporations
  – 150 thousand surface acres to Native people

• Every Native with ties to BB region and alive in 1971 became a BBNC shareholder
• Elected directors duty:
  – protect and develop responsibly land entitlements
  – survey and factor in shareholder needs and concerns
  – strategically plan

• Shareholder mandate:
  – be profitable corporation
  – create dividends responsibly
  – use cultural values as guideline for economic and resource development

• Investment objective:
  – cultural heritage
  – business goals
  – resource availability
BBNC Present Priorities

“Enriching our Native way of life”

• Subsistence preservation
• Jobs/education
• Tourism potential
• Regional construction projects
• Oil and gas exploration
• Mining development
• Wind energy
BBNC’s Project Objectives

• Awarded grant in September 2003

• Installed NRG meteorological towers, sensors and data loggers (planned 5-8, completed nine installs by October 2004)

• Analyze wind data from data loggers (in progress)

• Assess existing power systems in villages (in progress)

• Survey renewable energy resource possibilities in the region (in progress)

• Perform computer modeling and economic analyses to support wind power development in the region (winter 2004 – late 2005)
Feasibility Study is a Cooperative Financial and Technical Effort

- Bristol Bay Native Corporation
  - Personnel time and travel expenses for met tower installations
  - Modeling and data management
- Alaska Energy Authority
  - Purchased NRG meteorological towers/loggers
  - Pay for shipping of equipment to villages
- Alaska Village Electric Cooperative
  - Pay most labor expenses for New Stuyahok and Togiak (utility for two villages in Bristol Bay)
- Individual Villages/Local Utilities
  - Labor support and other expenses
SW Alaska Wind Workshop

October 8-9, 2003, Dillingham, Alaska

Collaborative effort of:

- Bristol Bay Native Corp.
- Alaska Energy Authority
- NREL
- 50 participants from W. Alaska and Aleutians
- Discussed issues of wind power development in SW Alaska
Power Systems – Small Villages

- Wind-diesel hybrids
- Power quality issues at medium to high penetration – most likely to save fuel
- Wind turbines: 50-100 kW
- Designs are complex
- Workforce often not highly skilled – maybe only 2 people
- Not much equipment
Power Systems – Hub Cities
Barrow, Bethel, Nome, Kotzebue, Dillingham, Naknek, others

• Several diesel generators – low MW range (total)
• Wind turbines: 50-225 KW – larger systems
• Fewer complex design issues – low penetration still saves lots of diesel fuel
• Highly skilled workforce
• Lots of heavy equipment
Meteorological Towers

- Alaska Energy Authority purchased 30 met tower systems from NRG in Vermont
- 30 meter aluminum towers (typical hub height of 50-100 KW wind turbines used in Alaska)
- Wind speed measured at 30 m and 20 m levels
- Wind direction measured at 30 m level
- Temperature measured at 2 m level
- Data logger: Symphonie Internet Enabled logger – 12 channel, 10 minute data intervals, data stored in data cards, retrieved by local operators and mailed to Anchorage for download
A special problem of Alaska construction Permafrost!
New Stuyahok, Alaska
October 10, 2003
Utility: Alaska Village Electric Coop
### Site Information:
- **Project:** AVEC
- **Location:** Near airport runway
- **Elevation:** 227

### Sensor Information:
- **NRG #10 Ane., mph:** Channel 1
- **NRG #40 Ane., mph:** Channel 2
- **No Sensor:** Channels 3, 4, 5, 6, 7, 8, 9, 10

<table>
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<tr>
<th>Channel</th>
<th>1</th>
<th>2</th>
<th>7</th>
<th>9</th>
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<tbody>
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<td><strong>Height</strong></td>
<td>29.4 m</td>
<td>19.8 m</td>
<td>29.4 m</td>
<td>4.7 m</td>
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**Generated Wednesday, August 26, 2004**
### Site Information:
- **Project:** AVEC
- **Location:** Near airport runway
- **Elevation:** 227

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<td><strong>Wind Speed Direction</strong></td>
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**Generated Thursday August 26, 2004**
March 2004
Wind Rose Ch 1, 7
SITE 0064
New Stuyahok

Site Information:
Project: AVEC
Location: Near airport runway
Elevation: 227

Anemometer on channel 1:
NRG #40 Anem, mph
Height: 29.4 m
Serial #:

Vane on channel 7:
#200P Wind Vane
Height: 29.4 m
Serial #:

Outer Numbers are Average TIs for speeds greater than 10 mph
Inner Circle = 0%
Outer Circle = 30%

- Percent of Total Wind Energy
- Percent of Total Time

Total 10-minute intervals: 4464
Intervals used in calculations: 4464
Percent data used: 100
Site Information:
Project: AVEC
Location: Near airport runway and taxiway
Elevation: 227

Sensor on channel 1:
NRG #40 Anem, mph
Height: 29.4 m
Serial #:

December 2003
Hourly Averages Graph Ch 1
SITE 0064
New Stuyahok

Average Hourly Values

Values in mph

Days

Average Value: 13.5

Generated Friday, February 06, 2004
Total 10-minute intervals: 4464
Intervals used in calculations: 4464
Percent data used: 100
NRG Systems SDR Version 4.25
Dillingham, Alaska
April 22-23, 2004
Utility: Nushagak Electric Cooperative
1st Dillingham site – Kanakanak Hospital area
Frequency Distribution

Wind Speed in mph

Relative Frequency %

0 1 2 3 4 5 6 7 8 9 10

4/22/2004 to 8/19/2004

Frequency Distribution Ch 1
SITE 2259
Dillingham - Kanakanak Hospital

Site Information:
Project: Tribal Energy Program grant
Location: Dillingham, Alaska
Elevation: 130 ft

Sensor on channel 1:
NRG #40 Anem. mph
Height: 96 ft
Serial #: SN:

Generated Wednesday, August 25, 2004
Total 10-minute intervals: 17280 Intervals used in calculations: 17100 Percent data used: 99
NRG Systems SDR Version 4.20
2nd Dillingham site -
130 ft State Communication Tower
Frequency Distribution

Wind Speed in mph

Relative Frequency %

0  1  2  3  4  5  6  7  8  9  10

4/22/2004 to 8/19/2004

Site Information:
Project: Tribal Energy Program grant
Location: Dillingham, Alaska
Elevation: 124 ft

Sensor on channel 1:
NRG #40 Anem. mph
Height: ft
Serial #: SN:

Frequency Distribution Ch 1
SITE 2255
Dillingham - Windriver Road

Generated Friday, October 15, 2004
Total 10-minute intervals: 17200  Intervals used in calculations: 17147  Percent data used: 99.2
NRG Systems SDR Version 4.28
Another special Alaska problem…

Bear trail!

Bear! Bear deterrent

Bear protection!
Alaska Energy Authority planning new powerplant in 2005 – looking at wind-diesel with ~100KW wind turbines
Togiak, Alaska
August 30-31, 2004
Utility: Alaska Village Electric Coop
Chignik Lagoon
Economic Analysis for Wind Generation

- Planning on NREL, AEA, and AVEC support to assist with analysis of renewable energy options and their economic viability for Bristol Bay villages
  - Focus initially will be on villages where wind data have or will be collected and other villages that may already have data
  - HOMER software
  - Hybrid2 software
Wind-Diesel Workshop
plus trip to St. Paul Island, Kotzebue, and Selawik