Removing Barriers to Renewables Based Remote Community Microgrids

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Rural Alaska

• 180+ Diesel off grid communities
• Trends: High energy prices, increasing use of renewable forms of energy, wind/pv/biomass,
• requires better everything, planning, management, training, technology,
• Increased integration for efficiency, loads growing

• Kwigillingok, population, 388, 24% well below poverty level,
• System: 5 Windmatic 17 S turbines
• Diesel power plant, 275 kW (2), 190 kW (1), 95 kW (1)
• Average load 150 summer, 200 Winter, peak 285 kW, (schools are bigger)
Two Perspectives

All progress is precarious, and the solution of one problem brings us face to face with another.

Martin Luther King 1963

If once a man indulges himself in murder,
Very soon he comes to think little of robbing,
And from robbing he comes next to drinking,
And sabbath-breaking, and from that to incivility and procrastination

Thomas de Quincey, English essayist and author
Chaninik Wind Group Villages

- Kongiganak pop. 359
- Kwigillingok pop. 388
- Kipnuk pop. 644
- Tuntutuliak pop. 370

On average, 24% of families are below the poverty line.
“We try our best to keep up with costs of fuel and lights, in order to have transportation for survival.”

-Sarah

“Installing wind turbines will be great because of high prices of stove oil is too high. Helping reduce electricity bills would help to buy oil to keep the houses warm.”

-Paul
Annual Average Village Fuel Usage

- Electricity
- Transportation
- Heating
Wind-Heat Smart Grid
Use Wind to Heat Homes and Balance Grid

Benefits:

- Lower heating costs
- Improves economics of wind
- Reduce Fuel dependency
Utility Challenge: Metering and Distribution

• Reliable
• Stable
• Optimized

But also:

- Efficient
- Wind/PV
- Economical

Utilities are good!, They keep the lights on!
METER ID: 0480000077

SERVICE LOCATION
POLE49 TXFM49
Kipnuk, AK 99614

CURRENT OUTAGE

OUTAGE HISTORY

<table>
<thead>
<tr>
<th>Outage Time</th>
<th>Restore Time</th>
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<tbody>
<tr>
<td>09:29:05</td>
<td>null 2013-03-31</td>
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<tr>
<td>17:48:28 AKST</td>
<td>18:40:37 AKST 2013-02-25</td>
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<tr>
<td>11:21:33 AKST</td>
<td>11:37:36 AKST 2013-02-15</td>
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</tbody>
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Smart Metering and Information

- Two way communication
- Outage management
- Multiple rates
- Accurate accounting
- Customer involvement
**Meter Details**

- **METER ID:** 048000006
- **Account Number:** 04890003
- **Address:** CF Kipnuk Water Sewer Washeteria 3, Kipnuk, AK, 99614
- **Disconnect:** N
- **Rate:** Commercial

**On-Demand Meter Reading**

- **Last Read:** 04/27/2013 01:00 AM AKDT
- **Register Read:** 275.8 kWh
- **Multiplier:** 120
- **Total Consumption:** 33096.0 kWh

**Interval Data**

- **Timeframe:** From: 2013-04-26 To: 2013-04-27
- **Available Channels:** kWhDelivered, kVARhDelivered, kWh, kVARh, PowerFactor

**Average values from 2013-04-26 to 2013-04-27**

11:00
kVA: 3.690 kVA
What’s Next: Self Regulating Grid
Collection of Appliances Acting as a Group

Units Individually sense Hz and vary duty cycles

Three phase unit, maintains distribution phase balance

multiple units sense load and act independently
To increase wind and solar

Need real energy!

- Modular battery unit
- Integration, control, communication
- Connected anywhere on distribution system
Why LiOn batteries

- Benefit from robustness and reliability of auto
- Virtually no maintenance
- Easily transportable

- Lithium ion: removes operating constraints
- 10 times energy density as lead acid
- 2.5 x price, lasts 10 x longer
- Fast opportunistic recharge
Lithium Ion Batteries

Characteristics

Battery Modules
People work!
Building Training, Support, Local Capacity
Questions?

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