Key Findings

- There are three options for incorporating wind. Utility includes it in the power supply, net metering (individuals and businesses connect) and a qualifying facility (city project). When the utility provides its own wind source, the impacts are fairly straightforward because the utility adjusts rates to compensate for the lower cost of alternative wind energy (when compared to diesel fuel in rural Alaska). The second way to integrate wind is for the utility to, in effect, pay for energy produced by individual homes or businesses (called net metering). Regulation requires BUC to allow net metering for small wind resources less than 25 kW. In addition, output from larger wind projects can be sold to the utility at the avoided cost of power. However, the BUC has to sign off on those projects through an interconnection agreement.

- The City could receive additional revenues by selling wind generation output. If the City owns the wind project, sells the energy as a qualifying facility (QF) and receives the utility’s avoided fuel cost for any generation provided, it is estimated that the City could increase revenues by $100,000 per year.

- Ratepayers could potentially save an additional 0.6 percent to 0.8 percent if the utility owns and operates the wind project. Depending on the ownership structure, replacing 2.5 percent of the the diesel generated power supply with wind energy could save almost one percent in overall rates.

Incorporating Alternative Energy in Bethel

There are three ways to incorporate alternative energy sources into the resource mix in Bethel as described in the following sections.

Utility Integrates on its Own

When the utility integrates alternative energy (particularly wind) on its own, the impact to ratepayers is fairly straightforward. The utility essentially purchases the necessary equipment to generate the alternative energy and pays for the costs of that equipment through rates. So long as the cost to provide alternative energy is less than the cost of fuel, the impact to ratepayers should be a downward adjustment on rates. However, when a third party provides the alternative energy (wind) to the utility and is paid the avoided cost of fuel for the power, ratepayers will not necessarily see a rate impact. If the City provides wind to an investor-operated utility (IOU) or a cooperative, there may be some public benefit because the city can utilize the surplus revenue (between the cost of owning and operating the wind turbines and the avoided fuel cost) to reduce its own electricity costs, thereby freeing up City revenue for other services.
Net Metering

Net metering is a process by which utility customers operating small generators can purchase electricity from a utility when needed and sell any excess generation back to the utility company. In January 2010, the RCA formally adopted net metering for Alaska. The new rules only apply to utilities with total retail sales of five million kWh or more and require that utilities interconnect with eligible customer generation systems up to a system-wide total capacity of 1.5 percent of their average retail demand. After reaching the 1.5 percent level, the utility can choose to add more power through net metering or turn down additional requests. As BUC sells more than five million kWh per year, BUC is required to offer net metering to its customers up to a total of 65 kW.

Eligible customer generation systems are limited to a total on-site capacity of 25 kilowatts. Technologies eligible for net metering generation are limited to solar photovoltaic, solar thermal, wind, biomass, hydroelectric, geothermal, hydrokinetic, ocean thermal, landfill gas and biogas energy, along with other sources as approved by the Commission that generally have similar environmental impact. Net metering customers are billed for net monthly consumption. If the customer uses 500 kWh and generates 300 kWh, he or she will be billed for 200 kWh. When more electricity is generated during a given month than is consumed, the customer is credited for the excess at a published wholesale power rate.

Qualifying Facility

Another option for an alternative energy project is to sell the energy as a qualifying facility (QF) and receive the utility’s avoided cost for any generation provided. Bethel Utility Corporation (BUC) lists the current avoided cost of power at $0.3647 per kWh. In order to connect with BUC as a QF, the wind owner must establish interconnection facilities that meet certain federal safety and reliability standards. An interconnection agreement between the QF and the utility is required.

The City’s proposed wind generation project exceeds the requirements for net metering covered by the RCA regulation. Therefore, if the City’s wind project were to progress, it would most likely be a QF.

Integration of Wind Power in Bethel

Many rural villages in Alaska have installed wind-diesel systems to save on fuel costs and to mitigate fuel price risk. The Alaska wind-diesel experience has so far been generally economically favorable, saving isolated systems $2.25 to $5.40/gallon in diesel costs. With diesel prices on the rise and falling capital costs, it makes sense for either the City or BUC to consider some investment in wind resources.
Current status of Wind in the City of Bethel

The City has been exploring the feasibility of alternative energy sources, such as larger-scale wind energy. According to a 2006 AEA study, wind resources at or near Bethel, Alaska are categorized as Class 4 (or “good”) for wind power development. Class 4 or greater typically indicates that average wind power density at a height of 30 to 50 meters will produce energy suitable for utility or small-scale wind applications.

In 2006, the City petitioned, and was awarded, a State of Alaska legislative grant to complete a wind energy feasibility study. The completed study (up to 60 percent engineering and design study for wind resources) evaluated wind installations consistent with low, medium, and high penetration scenarios. The study recommended Fuhrlander 600 kW wind turbines and a battery system for the integration of the variable resource.

In 2008, the City petitioned for an AEA grant to install four 100 kW Northwind turbines. The AEA awarded the City two grants totaling nearly $3 million. The City is required to obtain an interconnection agreement from BUC and QF rate documentation before the grant money is released. Bethel Utility Corporation has not shown much interest in an interconnection agreement with the City.

One of the issues, according to BUC, is that the current equipment at BUC’s generators would need to be updated in order to take output from an intermittent resource like wind. There are technical challenges involved with integrating alternative energy into the Bethel electric grid. In order to use wind turbines for power generation, the power company has to be able to monitor the wind and energy coming in, and at a moment’s notice fire up backup diesel generators when the wind dies down. System upgrades to the generation equipment used by BUC could be needed, including higher-technology equipment and a small generator that would fire up quickly.

Some individuals and institution, for example, the association of Village Council Presidents (AVCP) and Yukon-Kuskokwim Health Corporation (YKHC) are purchasing and erecting wind turbines to supply some of their own electricity needs under net metering arrangements with BUC. For YKHC, energy savings strategies have been more cost effective than wind generation. But where they are able to have windmills, these are successfully augmenting their electricity needs. Yuut Eliauaurviaq teaches maintenance and technical skills to install and service the wind turbines. The turbines used to generate electricity for individual facilities tend to be smaller turbines; these are also proving useful in nearby villages.

Because wind turbines can have potential negative impacts (e.g., noise, damage to property if the blades disconnect, interference with the airport’s air rights), the City Planning Department is looking at developing City guidelines or regulations for locating and maintaining turbines to avoid conflicts among neighbors. The City has looked into other alternative energy sources; studies show that solar is viable in Bethel, but wind power is more financially efficient (more “bang for the buck”).

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1 Interviews with city staff.
Assumptions in the Wind Sensitivity Model

The following assumptions were used in the benefit-cost analysis of wind resources.

- Four 100 kW Northwind turbines, with a total capacity of 400 kW.
- Net capacity factor equals 30 percent; annual energy produced equals 1,040 MWh, or approximately 2.5 percent of the City’s power needs.
- Capital cost of $7,995 per installed kW.
- AEA grant will pay for most of the capital costs (nearly $3 million).
- Annual operations and maintenance (O+M) is $158/MWh and does not include integration.
- Avoided diesel use is based on BUC generator efficiency as calculated for 2010 at 13.8 kWh per gallon.

Potential Options for Wind

There are two main ownership options for wind resources: city owned and utility owned. These are discussed below.

City Owned

The first option is if the City owned the wind resources and obtained a QF agreement with BUC. In this case, the City is responsible for all O+M, the capital costs not covered by the AEA grant, and interconnection costs (including the upgrade at BUC’s plant that is required to integrate wind output). As a BUC QF customer, the City would receive $0.3647 per kWh of wind energy delivered to the BUC grid, assuming avoided fuel cost is the method used to pay for wind energy. This revenue could be used to offset the City’s electricity costs.

Utility Owned

The second case is if the utility owned the wind resources and passed diesel fuel cost savings to its customers through reduced rates. In this second case, the utility would be responsible for all O+M, the capital costs not covered by the AEA grant, interconnection costs, and integration costs.

It is important to note that if TDX Power purchases BUC, their significant experience in wind-diesel systems could further increase benefits in reduced O+M costs and better availability. TDX currently operates a wind-diesel system with the highest wind penetration in the US on Saint Paul Island, as well as a 1-MW wind capacity system in Sand Point.
Power Cost Equalization and Wind

In the utility ownership case, the costs and benefits are somewhat more complicated due to the PCE program. The PCE reduces incentives for utilities to install renewable resources because renewable resources reduce eligible PCE costs, mainly fuel costs. PCE eligible expenses include fuel expenses: the costs of fuel, plus transportation and non-fuel expenses (e.g., salaries, insurance, taxes, power plant parts and supplies, interest and other reasonable costs). Wind turbine O&M would count toward the PCE credit; however, the reduced fuel consumption would also reduce the PCE. The analysis reviews the impact of adding wind resource after the impact of the PCE.

Results of Wind Sensitivity

Based on the assumptions listed previously, the potential rate impact was calculated assuming that the City owns and operates the wind turbines and sells the output to the utility under a QF arrangement. In addition, the potential rate impact was calculated under a second scenario where the utility owns and operates the wind turbines.

Results: City Ownership of Wind

If the City owns the wind turbines and sells power to the utility based on a QF contract, the City would be responsible for all costs related to the turbines, while reveues would be dependent on the utility’s avoided cost for power. As a QF customer, it is assumed that the City would receive $0.3647 per kWh of wind energy delivered to the utility grid.

The annualized cost of the wind turbines is approximately $200,000 per year after receiving the grant. The wind project reduces diesel use by 72 gallons per MWh or an estimated 75,000 gallons per year. The projected revenue to the City is $300,000 annually (assuming the avoided cost remains at $0.3646 per kWh). This results in the City receiving an additional $100,000 per year in net revenues from wind, which can be used to offset the City’s own electricity costs.

Figure 7.1 and Table 7.1 provide the rate impact compared to business as usual under a City ownership of the wind project.
Figure 7.1 Average Rate with PCE: Integration of Wind, City Ownership

Table 7.1 Comparison of Utility Rates by Ownership Category: City Ownership, Wind Integration

<table>
<thead>
<tr>
<th></th>
<th>All Customers</th>
<th>Residential</th>
<th>City Facilities</th>
<th>All Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg. Rate</td>
<td>% Impact</td>
<td>Avg. Rate</td>
<td>% Impact</td>
</tr>
<tr>
<td>BUC</td>
<td>$0.430</td>
<td>0.0%</td>
<td>$0.2939</td>
<td>0.0%</td>
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<td>$0.2800</td>
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<tr>
<td>Coop</td>
<td>$0.411</td>
<td>-4.5%</td>
<td>$0.2787</td>
<td>-5.2%</td>
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</tbody>
</table>

Note: % impact is the percent change in rates when compared to the BUC business as usual scenario.
Results: Utility Ownership of Wind

In the second case, the utility owns the wind resource and passes the diesel fuel cost savings to its customers through reduced rates. In this case, the utility is responsible for all O+M, the capital costs not covered by the AEA grant, interconnection costs, and integration costs. However, the utility would also see a reduction in diesel costs to offset the cost of the wind project.

Figure 7.2 and Table 7.2 provides the rate impact compared to business as usual under a utility ownership of the wind project. In this case, the rate impact differs based on the ownership of the utility due to the different financing and taxing costs. The annual costs of operating the wind project after receiving the grant are $215,000 for the IOU, $200,000 for the municipal utility, and $195,000 for the cooperative.

Figure 7.2 Average Rate with PCE: Integration of Wind, Utility Ownership
Table 7.2 Comparison of Utility Rates by Ownership Category: Utility Ownership, Wind Integration

<table>
<thead>
<tr>
<th></th>
<th>All Customers</th>
<th>Residential</th>
<th>City Facilities</th>
<th>All Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg. Rate</td>
<td>% Impact</td>
<td>Avg. Rate</td>
<td>% Impact</td>
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<tr>
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<td>-5.6%</td>
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</table>

Note: % impact is the percent change in rates when compared to the BUC business as usual scenario.

Results: Utility Ownership and No Grant

In order to demonstrate the benefit of the grant, the wind scenario was modeled assuming that the new utility would not be able to obtain the grant. Figure 7.3 and Table 7.3 provides the rate impact compared to business as usual under a utility ownership of the wind project without grant funding. In this case the IOU option results in higher rates compared to the current BUC without wind case. Only in the municipal and cooperative ownership scenarios will ratepayers still benefit from the wind generation. This scenario demonstrates the importance of grants for wind development in rural Alaska.

Figure 7.3 Average Rate with PCE: Integration of Wind, Utility Ownership, No Grant

![Figure 7.3 Average Rate with PCE: Integration of Wind, Utility Ownership, No Grant](image)
Table 7.3 Comparison of Utility Rates by Ownership Category: Utility Ownership, Wind Integration, No Grant

<table>
<thead>
<tr>
<th></th>
<th>All Customers</th>
<th>Residential</th>
<th>City Facilities</th>
<th>All Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg. Rate</td>
<td>% Impact</td>
<td>Avg. Rate</td>
<td>% Impact</td>
</tr>
<tr>
<td>BUC</td>
<td>$0.4304</td>
<td>0.0%</td>
<td>$0.2939</td>
<td>0.0%</td>
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<td>Coop</td>
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<td>-4.1%</td>
</tr>
</tbody>
</table>

Note: % impact is the percent change in rates when compared to the BUC business as usual scenario.

Results: Utility Ownership and Additional Integration Costs

In this scenario, it is assumed that the utility will need to spend an additional $1 million for integration costs. It is still assumed that the utility will receive the grant to offset capital costs. Figure 7.3 and Table 7.3 provides the rate impact compared to business as usual under a utility ownership of the wind project with the additional integration costs.

Figure 7.4 Average Rate with PCE: Additional Costs to Integrate Wind, Utility Ownership
### Table 7.4 Comparison of Utility Rates by Ownership Category: Additional Costs to Integrate Wind, Utility Ownership

<table>
<thead>
<tr>
<th>All Customers</th>
<th>Residential</th>
<th>City Facilities</th>
<th>All Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg. Rate</td>
<td>% Impact</td>
<td>Avg. Rate</td>
</tr>
<tr>
<td>BUC</td>
<td>$0.4304</td>
<td>0.0%</td>
<td>$0.2939</td>
</tr>
<tr>
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<tr>
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<td>$0.2818</td>
</tr>
<tr>
<td>Coop</td>
<td>$0.4092</td>
<td>-4.9%</td>
<td>$0.2790</td>
</tr>
</tbody>
</table>

Note: % impact is the percent change in rates when compared to the BUC business as usual scenario.