

Alaska Energy Authority

Renewable Energy Fund Application – Wind Energy Best Practices Checklist

The following checklist contains detail items that are critical to the success of a Renewable Energy Fund application. The intent of the checklist is to aid applicants in the submission of a comprehensive project proposal.

Economic Analysis

- 🍎 Assumptions and their sources are clearly identified:
 - Cost of diesel at the utility
 - Cost of heating oil at the proposed secondary load customers
 - Efficiencies of the existing heating systems
 - Estimated maintenance and operating costs for the wind turbines and secondary load systems (\$0.xx/kWhr) are identified and the rationale of the estimates is discussed. List diesel O&M costs if available.
 - Wind turbine production estimates based on available Artic-rated systems that are appropriately sized for the community load.
 - HOMER model based on at least hourly load and wind data. 10-minute data is better.
 - Fuel delivery or meter data that quantifies the heat demand on proposed secondary loads.

Business Plan

- 🍎 The business plan should identify who will have overall responsibility for all components from the existing power plant and distribution system to the wind turbines and secondary load systems.
- 🍎 O&M plan.
- 🍎 PCE reporting, IRS payments and Bulk Fuel Loans must be current - RFA
- 🍎 The project is consistent with the Regional Energy Plan.
- 🍎 Power sales agreements – current and proposed.

Wind Resource Considerations

(Reconnaissance and feasibility grants should address all of these factors. Design and construction grants should have already addressed these topics.)

- Wind resource report is based on a local met tower with a minimum of 12 months of valid data.
- How reliable is the overall data? Are there gaps? Did any sensors or datalogger fail? Was a log sheet filled out during tower erection?
- How fast is the wind? Average speed, maximum, std. dev.?
- How does the wind speed vary throughout the day? Month to month?
- What does the wind speed distribution look like? Weibull K? Is it bi-modal with periods of calm, then severe storms? Is the distribution more continuous?
- How does the wind shear change with elevation (power law exponent)? How turbulent is the wind? What are the predicted maximum speeds over 20 and 50 years?
- How much icing is experienced at the site? How thick is the icing and how long does it last?
- What is the air temperature and density?
- How consistent is the wind data from one year to the next? How does it compare with long-term trends?
- How was the met tower site chosen? Are there nearby obstructions?
- How does the wind speed and wind rose compare with the statewide wind resource model for that location?
- How closely will wind turbines be placed near the met tower site?
- How does the wind rose affect siting for multiple turbines?
- What issues were raised by the FAA and US Fish & Wildlife Service during the met tower permitting process?

- What is the estimated net production for turbines being considered, assuming no wasted/excess power? Windographer defaults to an 82% availability. This is a reasonable estimate.

Design Considerations

□ Electrical System

- How does the community electrical load vary throughout the day? Month to month? What is the average, peak and minimum? If you aren't already collecting hourly or more frequent electrical load information, you should install a suitable datalogger as soon as possible.
- Are there seasonal loads due to commercial or traditional activities? How do the residential electrical loads compare with industrial and commercial loads throughout the day and month to month? What are the station service loads?
- Are there existing diversion electrical loads in the community? Are there electrical loads that could be converted to dispatchable loads if needed?
- What is the make, model, kW rating and age of each diesel genset? What are the fuel curves for each unit? What type of mechanical or electronic throttle controls exist? What are the actual reported kWhrs per gallon of fuel for this facility?
- What kind of switch gear exists – make, model, manual/automatic? Can the existing system be expanded for the proposed wind turbine and secondary loads? What kind of SCADA currently exists?
- Are upgrades or replacements planned for any key system components?
- Is there a heat recovery system? What loads does it feed? How are those heat loads monitored/quantified? How much heat is lost in the system? What is the annual heating fuel purchased for each of those loads?
- Are there additional potential electrical loads in the community that are not currently being met? Are any new electrical loads being planned?
- Where are the major electrical loads located in the community from a geospatial perspective?
- How well are the phases balanced in the distribution system? How are the transformers in the community loaded or overloaded? Where is there phase or transformer capacity to add additional loads?
- What is the condition of the distribution lines, transformers and poles?
- Provide a map showing single versus three-phase power lines and varying voltage levels?
- What are the parasitic and other system losses?

□ Secondary Load System

- What is the heat recovery percentage of each diesel genset? What heat loads are tied into the heat recovery system? How are those heat loads monitored/quantified? How much heat is lost in the system? What additional capacity is available?
- How many gallons of heating fuel are purchased annually for each current and proposed heat load? What is the daily and month-to-month profile of each heat load?
- Where are the major heat loads located in the community from a geospatial perspective?
- Are there additional potential heat loads in the community that are not currently being met? Are any new heat loads being planned? Where are they located relative to the powerhouse?
- What is the efficiency of current boilers? Where is space available to add electric boilers?

□ Compiling the Final Design Report

- Proposed electrical system line drawings showing turbines, transmission lines, distribution system and powerhouse. Label voltage and phase of lines, plus conductor type, size and resistance factor at 0 deg Celsius.
- How will wind turbine type, quantity and location affect power quality issues such as reactive power, power factor, voltage rise and other distributed generation issues? Does a basic voltage drop/rise

calculation indicate the need for additional analysis using the DG Toolbox or running a load flow analysis? Is complex PSSE modeling required?

- Detailed line drawing showing how wind power connects to the powerhouse through switchgear and how wind, diesel and diversion loads integrate with each other.
- Proposed and existing SCADA system drawing and description.
- Proposed physical layout at turbine site, powerhouse and transmission route.
- Proposed and existing diversion load drawing and description.
- Wind turbine models, sizes and quantities considered. Power curves for each turbine. Which qualified third-party test facility has certified the proposed turbines?
- Proposed budget and schedule based on current turbine pricing and construction estimates.
- A list of what permits will be needed for the project.
- A copy of the geotechnical reconnaissance report.
- HOMER model with accurate wind resource, electrical load, thermal load, wind turbine power curves, turbine availability, diesel power curves and diversion loads. Pay special attention to the excess power in the system and how that can be put to value-added use. (Include the electronic HOMER file in your submission, but limit the printed report to HOMER output from the proposed system.)
- Show how the economies of scale are affected by using different types and quantities of turbines. How do these options vary the overall system cost, the cost per installed kilowatt and unusable excess power? This analysis should reflect that offsetting electrical load has greater economic benefit than offsetting heat loads due to the varying efficiencies of diesel generators versus oil-fired boilers.
- If the project involves, or could involve, the intertie of two or more communities, analysis becomes more complex to determine where diesel and wind power generation are located relative to community loads. Cost and efficiency of reliable communication between the wind site and the powerhouse should be considered. Savings may be gained through consolidation of bulk fuel facilities or idling of power plants. Further, the larger load of the combined communities may allow for larger turbines with better economies of scale. These benefits should be weighed against any loss of rural employment or higher heating oil delivery costs for communities losing power plants.

Environmental/Permitting

- 🍎 Check the contaminated sites database to ensure project is not being built in a hazardous area.
- 🍎 Document communications and approval from US Fish & Wildlife Service, FAA, Army Corp of Engineers, DNR, local government and any other appropriate agencies.

Site control and local support

- 🍎 Site control finalized before construction funds are committed
- 🍎 Site control for pipelines and transmission or distribution power lines may be established using easements or utility right-of-ways so long as the period of the agreement meets or exceeds the intended life of the project
- 🍎 The landowner must provide proof of valid title to the land and/or written documentation of any private agreements
- 🍎 The landowner must warrant that there are no liens or encumbrances on the property
- 🍎 The grantee shall be responsible for resolving any land ownership disputes between state and/or federal entities, local landowners, native corporations, municipalities, boroughs and community organizations, or other entities.
- 🍎 If the project site is adjacent to or near an airport or runway, the grantee must research existing or pending leases and easements and DOT expansion or relocation plans.
- 🍎 Land transfers required for project development shall be recorded with the appropriate District Recording office and a copy of the recordation provided to the AEA grant manager.

- Provide letters of support, MOUs, cooperative agreements between the applicant, the utility, local government and project partners.

Common Pitfalls

- Placing all focus of the design at the wind turbine site - Much of the needed design activity deals with integrating wind power with the existing power plant, distribution system and community heat loads.
- Not realizing that most modeling tools estimate turbine performance on the lower-48 grid where all wind power can be absorbed by the grid – Greater than 40% capacity factors aren't reasonable estimates and they degrade the impression of your report.
- Ignoring the excess kilowatt hours reported by HOMER – This number must be subtracted from your total kilowatt hours to accurately estimate diesel fuel savings. Proposed projects should find a dispatchable load that can use this excess energy. Bear in mind that the economic benefit of offsetting a heat load is less than offsetting diesel electric generation.
- Insufficient analysis of heat loads in the community. Simply placing an electric boiler on the heat recovery loop is likely the best choice if 80-percent of the BTUs being added to the HR loop are being consumed by users to offset heating oil. If only 30-percent of the HR energy is being used to offset heating oil, a different building that cannot tie into the HR loop would be the better location.
- Oversized diesel generators may negate any assumed benefits from wind power – Wind diesel systems require small, medium and large gensets so that as wind power comes online, smaller diesel generators can be selected based on which generator is currently in the optimum part of the fuel efficiency curve for the net system load. A 1MW wind system proposed in Nome resulted in no actual fuel savings under the existing diesel configuration. Adding smaller gensets to the SCADA system provided for ~ 900,000 gallons of diesel savings per year with the proposed wind turbine. Further, lowering the minimum load setting on a generator may result in sending unburned fuel up the exhaust stack.
- Small (<400kW) 1200-RPM generators do not respond quickly enough to variable wind power to maintain frequency control on the system. 1800-RPM engines in this size range have proven to be more effective in wind-diesel systems - preferably with electronic controls. Larger (500kW and up) 1200-RPM generators have not been an issue to date.
- Oversizing the proposed wind system – A 250kW wind turbine on a system with an average load of 70kW is a potential disaster. Simply adding battery storage and an inverter may sound like a trivial solution, but this has not been successfully executed in Alaska. Large turbines can trip diesel gensets offline.
- Proposing unproven wind, storage or controls technology to the Renewable Energy Fund – New technology falls under the scope of the Emerging Energy Technology Fund and should be proven out in a more accessible location than remote Alaska.
- Proposing turbines that are not certified by an independent 3rd party – Turbine manufacturers make optimistic claims on the performance of their product. AEA requires wind turbines that have been verified by a certified test facility. These turbines also need cold weather packages.
- Ignoring the O&M challenges of a wind system – Communities who have personnel that are trained on wind systems and are comfortable climbing exposed towers to perform maintenance have a better chance at meeting the output projections of your design. Major impacts to production are seen the more remote a community is if there is no local trained support.
- Building a wind-diesel project without a remote SCADA system that allows for performance data collection and offsite troubleshooting.
- Building a wind project without performing a structured wind resource analysis. Building a wind project when the wind resource analysis indicates poor wind conditions.

