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Project Status:

Dakota Turbine and Inverter Commercialization Project

Contract No. Roo7-0015

Contract Extension Request:

Project Overview:

Dakota Turbines is very appreciative of the funding provided by the North Dakota Industrial Commission through Renewable Energy Council. Although we do not have the hard numbers from a completed system, we have enough information from the test bed to know that we will exceed the efficiencies that we had projected at the time of our grant application.

In the controlled environment of the test bed we can very accurately measure "power in and power out". For example; we know the inverter is an amazing 96% efficient. That kind of efficiency is usually only attained by the best of the very small solar inverters. The turbine itself is currently 85+% efficient. We believe that can also be raised to the low 90's, but it would take a lot of experimentation to unlock the answers from within the very complex working relationship of the turbine and inverter. This will become part of a product improvement effort that will be ongoing into the future.

The remaining wild card in determining the "real world" efficiency of our system is the blades. Both sets of blades we have used to date have performed just as projected by the manufacturer. The new blades we are awaiting are projected to be about 5% more efficient than the previous sets. That would put our system at a Coefficient of Power (cp) of about .43. (that is .43 out of the theoretical (Betz) limit of .593) To put that into perspective, even using the usually exaggerated power curves of the competition, and third party software to do the analysis, most struggle to get into the .30's for a few mph in the middle of their power range, quickly dropping off on both sides of that. We anticipate being able to initially start around .40 throughout the whole range of wind speeds up to the point we purposely shed power on the upper end. We then expect to hit or very closely approach .43 once the control software is tuned to the operating characteristics of the new blades.

Justifications for Extension:

When Dakota Turbines submitted the grant proposal we intended to build a turbine and inverter and connect to the grid, with the only requirement in doing so being an inter-connect agreement from the Utility. We also projected a separate and off to the side effort to achieve UL certification of the inverter. All of that changed early last fall when the State Electrical Engineer announced that no turbines would be hooked to the grid in North Dakota without the newly proposed UL 6142 certification. The Standards for 6142 have not been adopted, but we have an agreement with the State Engineer and UL to do a “field certification” that will allows us to connect our system to the grid.

In order to achieve UL listing, the physical components of the turbine, tower, and inverter – including the control systems, have to be in “final form”. That includes the control software, which cannot be finalized without running in the real world to be able to optimize the system. The field certification will allow us to connect to the grid and complete the optimization of the software that then gets tested as part of the final “system”.

In the long run, the events that have disrupted our projected budget and schedule might turn out to be a positive. Although none of the required changes for UL have, or ever will, add to an increase in efficiencies, the time lapses they caused allowed us more time to do testing that probably would have otherwise been assigned to future product improvement efforts. We not only have a better product at this point, but might have avoided a re-certification by both UL and the Small Wind Certification Council (SWCC). Both UL and SWCC require re-certification if any “significant changes” are made. (it is up to their discretion on the definition of significant changes)

Another positive of UL’s involvement in the middle of the project time frame is that the component/wiring/epoxy type changes could be made in-house versus later at their testing facilities. Hopefully, we will only have to deal with results of their “destructive tests”, where they purposely short circuit the systems or otherwise push them till something blows. At the amps and voltages our system is capable of generating, the damage could run from a single cheap component failing protecting the rest of the system – lucky – to damage beyond repair.

We would have been over budget and behind schedule without UL’s involvement, just from solving the individual component issues we encountered in the earlier development stages of the inverter. We wound up taking in-house the manufacture of several major components to solve problems, costing us both time and money. The quarterly reports we have submitted have detailed the issues that have cost us in both time and money, as well as many of the solutions that have created additional efficiencies. As we approached the end of the grant period our product development was finished, and the product itself superior to even what we had hoped it would be. There are however two hurdles to overcome to attain commercial status for our turbine system.

The easiest being the Small Wind Certification Process. This involves buying the right

equipment and following strict protocols in collecting the data they produce. Some of the equipment is already in-house, with the remainder identified and will be purchased in a timely manner as needed. We are also fortunate to have an Executive Board Member of the SWCC that lives in North Dakota who has agreed to help insure we follow proper procedures in collecting the data. The whole process involves some time and money, but is pretty straight forward and there should be no unknowns. This certification is going to be required to be eligible for any incentives, rebates, or possibly even to connect to a Utility in the foreseeable future.

The second hurdle is obtaining a UL stamp of approval. This process is about as convoluted as the SWCC process is straight forward. The original projected cost of this process was $60,000. That number was based on what it cost two other manufacturers of slightly smaller inverters to achieve the UL 1741 status. (the inverter side of UL 6142 will adopt, or point to 1741) Even though that number probably includes many of the component/wiring/epoxy issues we have already addressed, the unknowns of the destructive tests could very easily exceed that total in a worst case scenario. We will send two inverters to UL's test lab. One to continue testing, and one to be worked on, along with a technician and tens of thousands worth of components to repair 4 to 6 "events". Many of the components that are likely to be affected are built to our specifications, and are long lead-time items that need to be on hand for timely replacement.

The original number for the UL costs included only the inverter. Under UL 6142 the turbine now has to endure the same procedures, with the potential to accrue similar costs. UL 6142 had not yet been invented when we applied for the original grant, as such nothing was budgeted for this contingency. We fully acknowledge that whether or not to fund this part of the UL certification process as part of a project extension is up to your discretion, as it was not part of the original grant application.

Because this line item in the budget is nothing more than an educated guess, with such a large range from high to low, we would suggest an "up to" approach. Up to $60,000 for the inverter alone, and up to $100,000 for both the inverter and turbine. Funds in this category would be treated as a separate pool of funding, utilized only for invoices directly related to UL certification expenses. Please reference separate budget document for budget details.

Summary:

The discovery of the patented "Sliding Stator Technology" that caused the start of this turbine project ensured us from the start, unique characteristics and efficiencies not available to any other manufacturer of small wind turbines. Even though we have since found a method to electronically duplicate the advantages of the sliding stator technology, our primary objective as stated in the application, was to create a wind turbine with a "payback period" of less than 10 years. Having found the spreadsheet, dated 9/21/2009, which we had used to calculate our payback period about the time of application, at just under 12 years. Updating the Annual Energy Production (AEP) number on that spreadsheet with our latest complete set of

information, and with the same incentives in place, drops the payback time frame to just under 9 years, effectively surpassing our original goal of 10 years. Even that latest set of information pre-dates several improvements made recently, and does not include the 5% gain we anticipate with the new blades.

The turbine and inverter are verifiably efficient at 85+% and 96%, respectively. The tower system is simple in design, can be raised and lowered at the flip of a switch, and has been engineered and "stamped" as ready for commercial sale. All 3 products are done, except for 2 procedures necessary to attain the certifications required for commercialization of the turbine and inverter.

We would ask for a time extension of one year. On the UL side, once the field certification is done this fall, we will optimize the software and the equipment can then be sent to their lab for testing. This process should be completed over the winter months. On the Small Wind Certification side, once the software is optimized we will instrument the adjacent Met Tower and start collecting data. The data collecting and duration tests should also be completed over winter. The only variable might be how long it takes the SWCC to get through the back-log of test data being submitted to them on the front end of this Certification process. Even if that might take a few months, our obligation in the testing process will have been completed.

We are of course frustrated at being behind in the schedule as outlined in our original grant application. But we are also happy, and proud to be able to state, that the quality and/or efficiency of the products at this point in time also exceed our projections. It is our hope that the Renewable Energy Council of the ND Industrial Commission would agree that they would like to continue to assist us in reaching the small wind market.

We would be more than happy to provide any further information that might be required, or to present at the Sept. 8th meeting. Also, please visit our web site at – www.dakotaturbines.com

Respectfully,

Keith Monson
Dakota Turbines, Sales

Posi Lock - Dakota Turbines® - 18 month Budget

1/1/2010 - 7/1/2011

Un-anticipated and/or required additional costs

Projected remaining UL certification costs --- UP TO those limits suggested

↓ Original Grant Budget				↓	To Date - Actual		Grant Extension Budget Request	
Category	**Work Description**	**Total Cost**	**Duration Months**	**Grant Funds Requested**	**Total Actual Costs**	**Total Actual Grant**	**Total Costs Remaining**	**Additional Grant Funds**
					(Project as of 6/13/11)			
Personnel								
Project Leader/Management	Design - Coordinate - Manufacture/Assembly	140,000	18	$ -	140000			
Lead Electical/Software Dev.	Design - Build/Test - Update -	60,000	18	$ 30,000	65411	32705	40000	20000
Marketing/Research	Design - Blades - Marketing - Funding	60,000	18	$ 30,000	60000	30000	40000	20000
	Consultant Services (software & design assistance)				**25600**	**12800**		
Contract Services								
Blade Design - 1st generation	Design Blades with Specific Paramenters	15,000	1	$ 7,500	↓			
Blade Design - 2nd generation	Design Blades with Specific Paramenters	5,000	0.5	$ 2,500	↓			
Blade Manufacture - 1st gen.	Temporary Mold and 1st Blade Set	7,500	2	$ 3,750	↓			
Blade Manufacture - 2nd gen.	Production Mold and 2nd Blade Set	25,000	2	$ 12,500	51139	25569	15000	7500
UL Certification	Required Certification for Grid Interconnect	60,000	6 - 10	$ 30,000	9275	4638		
	UL Inverter					**UP TO**	**50725**	**25373**
	UL Turbine					**UP TO**	**40000**	**20000**
Equipment/Components						**Misc.**	4000	2000
Turbine Components/Updates								
Electrical/Software/Turbine	Proto-Type Stage - continued development	5,000	8	$ 5,000	↓			
	1st Production Model Electronics (coils)	5,000	0.5	$ 2,500	↓			
	2nd Generation Production Model Electronics	3,000	0.5	$ 1,500	18600	9300		
Inverter	Proto-Type Stage - continued development	2,000	8	$ 1,000	↓			
	1st Production Model Electronics	7,000	1	$ 3,500	↓			
	2nd Generation Production Model Electronics	5,000	1	$ 2,500	28500	14250		
Inverter Enclosures (3)	Inverter Equipment Enclosures (3)	7,500		$ 3,750	7500	3750		
Turbine Monitoring Equip.	Use Certification Protocals to Monitor Turbine	22,500	18	$ 11,250	2000	1000	20500	10250
	Test Stand (for turbine & inverter testing)				**14135**	**7068**		
	Assembly Fixtures (coil winder, molds, etc.)				**6110**	**3055**		
Other Equipment								
	Tower Certification (engineers stamp)				**7500**	**3750**		
Complete 2nd Turbine, Tower	Current Proto-Type simply needs run-time to	50,000	4	$ 25,000	55400	27700		
and Inverter	test all physical components - Anticipate							
	incorporating all improvements found in 1st 6							
	months - 2nd version of proto-type to be running							
	spring of 2010							
Electronics Monitoring Equip.	Grid-Tie Test and Verification Equipment	12,500	18	$ 6,250.00	9000	4500	3500	1750
	TOTAL COSTS:	**$ 492,000**	**REQUESTED**	**$ 178,500**	$ 500,170	$ 180,085	$ 213,725	$ 106,873