Matthew Hall
mtjhall@uvic.ca

May 27, 2013

ART Turbine Inc.

To whom it may concern,

Drew and I were put in touch this past April, and I've been doing some data analysis and model development tasks for ART Turbine since that time. I'm writing to offer my personal opinions on the merits and potential of the ART Turbine technology.

I've been engaged in full-time wind turbine research for three years now. Initially, I worked with a vertical axis wind turbine (VAWT) startup in the Maritimes. My work there centered on developing a rapid prototyping-based rotor design methodology, and setting up the data acquisition system for an in-house wind tunnel. I left that job to pursue a master's degree in mechanical engineering at the University of Victoria, which I have just completed. My master's research focussed on the design of floating offshore wind turbines. This work has seen me presenting at a half dozen international conferences and, just last week, visiting the most sophisticated floating wind turbine experiments to-date, at the Maritime Research Institute of the Netherlands. I've been awarded Natural Science and Engineering Research Council scholarships for both my master's research and my upcoming PhD research. I declined a Pacific Institute of Climate Solutions research fellowship to instead join the University of Maine PhD program this fall to work on a project developing a 6 MW floating offshore wind turbine. The University of Maine is the leading institution in the US for floating wind turbines; it is expected to deploy North America's first grid-connected floating wind turbine later this week.

I chose to do some work for ART Turbine because I enjoy working on small innovative projects and because I think Drew has come up with a design that has more potential to capitalize on the VAWT niche than any other VAWT design I've come across. From the moment I stood on the property on Salt Spring Island and saw an ART turbine silently spinning, its silhouette shifting elegantly, I knew this was something well above the level of most VAWTs.

The ART Turbine features *all* the key advantages that a VAWT can have: omni-directional wind acceptance, rotor twist to eliminate torque fluctuations, a large base to house a large-diameter generator, plenty of space within the rotor to support an internal shaft, and low-TSR aerodynamics for quiet operation. But on top of all those technical strengths, the ART turbine has something that few, if any, other turbines have: a fantastically-*elegant* design. Drew has struck a brilliant balance between technical intelligence and aesthetic sense in his design, and I think the uniqueness of this balance is the ART turbine's greatest strength.

Designers far too often focus on only aerodynamic efficiency, which is notoriously difficult to model for VAWTs. As someone who comes from the technical design-optimization world, I am thoroughly impressed with Drew's more intuitive design approach, and the geometrically-elegant result. But, importantly, his design makes no sacrifice in performance. On the contrary, I've calculated power coefficients of just over 30% from the test data. That Drew has achieved a design of this performance with the resources he has is amazing.

The aesthetic strengths, quiet/flexible nature, and excellent performance of the ART Turbine make it, in my mind, the most commercially-promising VAWT design I have seen. While I don't expect it to compete with conventional turbines for 100 MW-scale wind farms, I think it holds tremendous potential for the off-grid, residential, and urban niche markets. The elegance of its design seems particularly suited for integrated wind turbine landscapes/architectures, which strikes me as an intriguing new application for wind turbines.

The elegance of the ART Turbine design has captured my interest from a technical perspective. The niche market potential of the design has won my support from business and sustainability perspectives. While my new Atlantic location will make involvement with testing impractical, I am enthusiastic to continue providing support in terms of data analysis, modelling, engineering advice, and connections with the contacts I have across the wind energy research community. In particular, my experience with design optimizations incorporating cost factors could be beneficial when it comes to optimizing the full ART Turbine system for minimizing cost of energy. I hope I'll be able to continue my involvement with the ART Turbine technology as it develops.

Sincerely,

Matthew Hall