MEMO
TO: Art Durham, Opto Generic Devices, Inc.
FROM: Sam Baldwin, Office of Energy Efficiency and Renewable Energy, USDOE
RE: Observations on the Opto Generic Devices Motor Drive
DATE: October 14, 2003

I appreciated the opportunity to review your optical encoder driven adjustable speed motor drive systems last week and wanted to provide some observations on them.

1. As you know, a low-cost Adjustable Speed Drive (ASD) for AC induction motors is the "holy grail" of electricity conservation. Motors consume over half the electricity generated in the U.S. If half of these motors could be converted to adjustable speed with average energy savings of 1/3, this would reduce U.S. electricity consumption by about 15% when fully deployed, saving the equivalent of roughly $20 billion per year at current electricity consumption rates. A five-minute search on Google generated an article that estimated the global electronic motor drive market was already at $12.5 billion/year in 2000 and projected growth to $19 billion/year by 2005.[1] In addition to their energy savings, there is great interest in ASDs because they can improve overall performance, such as better controlling building HVAC systems or industrial production lines.

2. An important factor constraining the market penetration of electronic adjustable speed drives so far has been their high cost, with the drives typically costing up to several times more than the motor itself. These high costs are driven by the complexity of current drive designs, which require large numbers of electronic components and complex controls. Lower cost drives will open many new opportunities for using ASDs.

3. Current ASD designs use various combinations of chopped sinusoidal waveforms or voltage- or current-fed pulses to drive the motor; these can generate substantial harmonics, result in torque pulsation in the motor, or otherwise stress the motor and grid system. The Pulse-Width Modulated ASD, for example, generates variable width voltage pulses that are smoothed by the motor stator inductance to generate an approximately sinusoidal waveform. PWMs can inject substantial harmonics into the power line and can also induce substantial voltage stresses on the stator coils.

4. The optical encoder-based motor drive system that Opto Generic Devices (OGD) has developed appears to address several of the difficulties of current ASD designs.
   It appears to be inherently lower cost due to its simpler form and its lower parts count than present designs.
   It is likely to inject fewer harmonics into the power line and put less high voltage stress on the stator coils than present designs due to the near-sinusoidal form of the optically generated waveform and/or its potentially improved match to the motor.
   It appears to be readily adaptable to a variety of different motors and operating conditions.

[1] John Lewis, "Electronic Motor Drives to Take Off," January 7, 2002, http://www.manufacturing.net/dn/index.asp?layout=article&articleid=CA187808

5. I observed the OGD drive operate a variety of loads and a wide range of conditions, including some that were quite difficult, such as operating a compressor at very low speeds. Although I obviously cannot underwrite, guarantee, warranty, or otherwise assure the performance of these drives—that is something any potential investor will have to do for themselves—I believe it is in the interest of outside parties to carefully examine and consider this technology due to its demonstrated operation, simplicity, potentially low cost, and its huge market potential. Of course, further work is needed on issues such as the OGD drive's long-term reliability under the broad range of field conditions, but its simplicity and low-cost reduce the potential risk these issues pose.

6. There may also be concerns about manufacturing variances in large-scale production of your optical drives, as we have discussed. Although further work will obviously be needed as you move towards large scale production, the waveform distortion potentially resulting from variances in manufacturing your system is very likely to be much less than that inherently generated by current ASDs such as PWMs.

7. As per our discussions, it sounds as though you have been careful about protecting the intellectual property of your system. I identified one additional area that you might consider protecting in my previous email, if your patents do not already do so, and a further review of your IP position might be useful at some point.

8. For your technical presentations, it would be useful to construct new diagrams that more directly describe the new operating regime that your system works in. Traditional engineers used to working with conventional torque-speed curves at a single voltage and frequency may not quickly understand the way your system works—I am also continuing to work to understand your system fully.

I hope these thoughts are useful to you and look forward to continuing to work with you on this technology. Please let me know of any questions or issues that I can help with.