BREK TECHNICAL ASSISTANCE REQUEST

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One of the biggest challenges facing BREK is module and system testing, specifically the tools and facilities required to conduct full-scale tests. On the hardware side, this requires a 1500 V_{DC} supply and solar array emulator, and a 600 V three-phase AC load that can emulate grid conditions and faults; it is difficult for a startup company to acquire this testing capability and such test facilities would significantly benefit the company. On the firmware side, a Controller Hardware In-the-Loop (CHIL) simulator would significantly facilitate firmware development.

Our proprietary Composite Converter Architecture incorporates partial-power converter modules having high frequency planar magnetics, low current film capacitors, and low loss, leading to high power density at new power levels. We will begin with development and testing of a single power converter module, with firmware development conducted simultaneously. We propose to initiate development of firmware using a CHIL simulator, so that this work can begin before power hardware is operational. The initial phase of hardware testing will involve a partial-power converter module under dc conditions. The final phase will involve the complete 250 kW inverter system having a 1500 V_{DC} PV input and a three-phase 600V_{AC} output.

Over the course of the Set! phase, we have designed and fabricated a proof-of-concept converter module. This module has achieved 98% efficiency at 17kW, however, we are power limited at our facility and cannot test it at full capacity. Required tests include incrementally bringing the power stage up to full voltage and full power, as well as gate driver control circuitry reliability. For these tests, we plan on a simple open loop control to exercise the hardware, as we expect the firmware to still be in development.

Another challenge is certification to UL 1741 and IEEE 1547 standards. While the test and debugging described above will help prepare BREK for these certifications, it would be extremely helpful to learn from engineers who have experience with such certifications. Such certification processes are lengthy and expensive. Therefore it is critical that we apply for certification only after meeting both customer specifications and applicable standards.

Over the next few months BREK hopes to achieve the following:

1. Use a CHIL Simulator to develop and test our controller firmware. This will allow us to develop our firmware in parallel with the hardware development
2. Conduct single phase 20kW PCB card validation tests at 750 VDC input and 490VAC output.
3. Conduct single phase 40kW module validation tests at 1500 VDC input and 490VAC output.

4. Conduct single phase 40 kW module Validation tests with 1500VDC emulated solar input and 490 VAC output.
5. Conduct 3 phase 120 kW module validation tests with 1500VDC emulated solar input and 490 VAC output.
6. Conduct 3 phase 240 kW module validation tests with 1500VDC emulated solar input and 490 VAC output.

A proposed timeline is presented below (Figure 1).

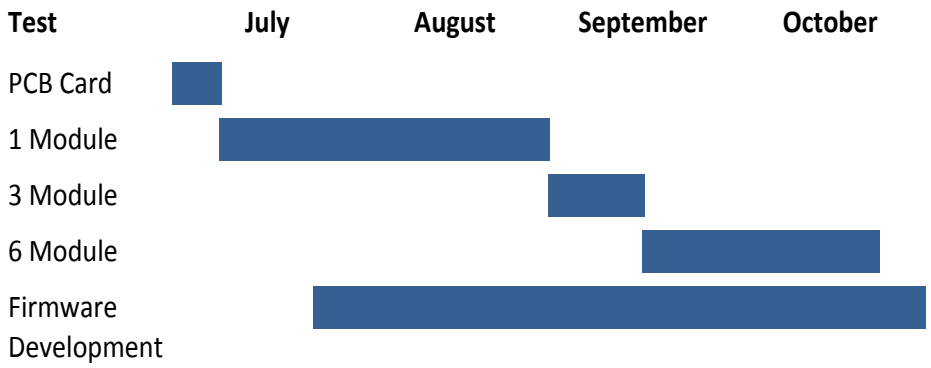

Figure 1. Proposed testing timeline.

Our hope is to use the capabilities at the Energy Systems Integration Facility (ESIF) at the National Renewable Energy Lab (NREL). NREL is not only close geographically, but has extensive facilities for solar array simulation and is capable of delivering 1500 V_{DC} at 250 kW with its 1 MW grid simulator, 250 kW bi-directional battery simulator, and 1.5 MW photovoltaic simulator (Figure 2). Furthermore, NREL engineers and scientists have knowledge and experience with the UL and IEEE certification processes. We have already spoken with Dr. Bill Kramer, Senor Scientist at ESIF, regarding test equipment and leasing laboratory space at NREL.

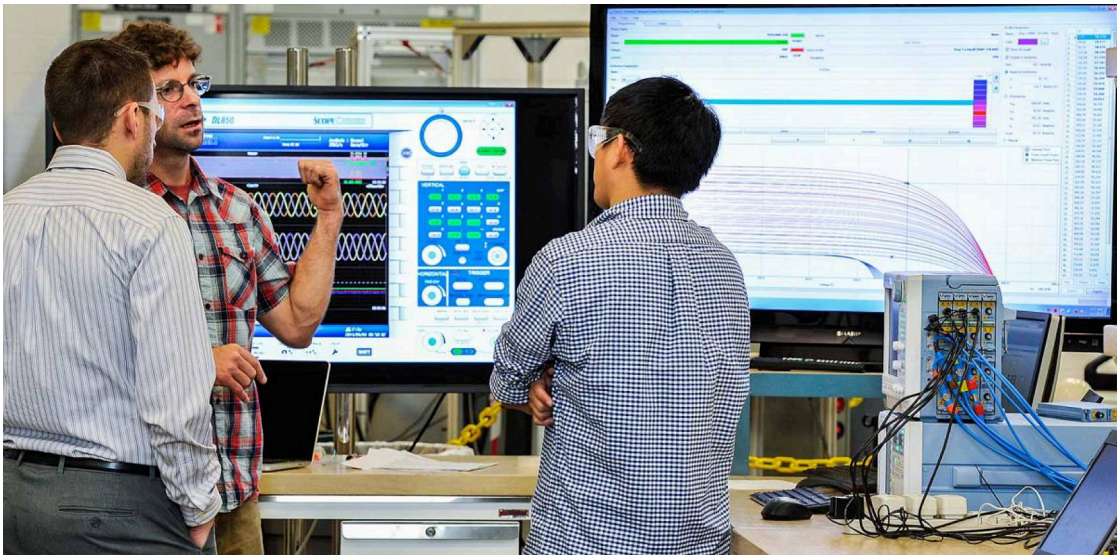

Figure 2. Inside ESIF's Power Systems Integration Laboratory.
(Photo Credit: NREL)