April 19, 2011

Asa Hopkins
Department of Energy,
Office of the Under Secretary for Science (S4),
1000 Independence Ave.,
SW., Washington, DC 20585.

Dear Asa,

The Emerge Alliance is pleased to submit this response to the DOE's request for comments on the Department of Energy Quadrennial Technology Review Framing Document.

Members of the EMerge Alliance[1] strongly recommend the DOE consider specific categorical inclusion of the cross-cutting concept of <u>DC Microgrids</u> in the Strategy/Technology portion of your framing Document.

The reasoning for this recommendation is presented hereforth:

The vast majority of electricity is currently supplied to devices in the form of alternating current (AC). But today's electronic devices (such as computers, florescent lights, variable speed drives, and many other household and business appliances and equipment) need direct current (DC) power, which must be converted from the AC power supplied. Moreover, distributed renewable generation (such as rooftop solar) produces DC power, which in turn must be converted to AC power to be used in a building's electric system. These AC-DC conversions (or DC-AC-DC in the case of rooftop solar) result in substantial electrical energy losses and waste heat.

But according to the Zero Energy Commercial Buildings Consortium final report[2], "*DC micro-grids would fundamentally change the way power is supplied in commercial buildings, eliminate ac-dc conversions at the equipment level, simplify equipment designs and layouts, provide improved interfaces with renewable energy sources and storage, and save energy*."

DC Microgrids can provide for the following:

1. ***Energy Savings*** – while the amount of savings in electrical energy is somewhat difficult to completely capture, a Yale published research estimate[3] puts the annual potential reduction at over 8% of the total national electric load or approximately 400 million kWh per year. This does not take into account additional energy savings as a result of less cooling being required in buildings where fewer electronic conversion devices are used.

2400 Camino Ramon, Suite 375, San Ramon, CA 94583 | phone +1.925.275.6617 | fax +1.925.884.8668

www.EMergeAlliance.org

2. ***Renewable Energy Integration*** – DC microgrids facilitate simple and more energy efficient coupling (eliminate need for multiple inverters/converters) of distributed alternate and renewable energy generators (solar, wind, fuel cell, etc.) that natively produce dc power. Industry sponsored research[4] at the Electrical Power Research Institute (EPRI) has concluded that multiple distributed source generation coupled onto a common dc bus can simplify and make more efficient the use of site based alternate energy.
3. ***Energy Storage*** – Local energy storage will be essential to the widespread use of non-dispatchable distributed energy generators. The distributed bus architecture of dc microgrids allows simple and more energy efficient coupling of natively dc (batteries, Ultra capacitors, etc.) electricity storage.
4. ***Control & Monitoring –*** Most modern controls, sensors and monitoring systems natively run on dc current and are digitally and/or microprocessor based.[5] The use of dc microgrids therefore greatly simplify the electronics involved with electrical and energy system control and monitoring by eliminating the need to convert AC power to operate.
5. ***System Reliability*** – The intrinsic redundant, disaggregated topology of dc microgrid networks assure a higher level of basic service reliability. By being 'islandable' both public grid and the individual microgrids can be isolated from one another during other dynamic and damaging linear failure events and disturbances. The reduction in subsystem and device level power conversion/inversions generally improves 'mean-time-to-failure' levels in the equipment.
6. ***BEV/PHEV Integration*** – As electric vehicles begin to populate our national automotive fleet, plug-in charging and their potential use in providing supplemental storage or electricity back-up capability, electric power grids will increasingly need to accommodate this shift in energy distribution and use. Since these vehicles run on pure and modulated dc electric systems, dc microgrids will more easily provide for their charging (including fast dc charging) and storage connectivity needs, again with fewer wasteful power conversion/inversion steps.
7. ***Domestic Eco-System Growth –*** The US has been an historical leader in the development of a number of critical sub-set technologies and industries that underwrite the needs of DC Microgrid systems deployment. The commercial deployment of DC microgrids will present significant revenue and employment opportunities for domestic manufacturers and service related providers.

We believe the DC microgrid concept can provide a new dimension of utility and efficiency to improve our country's electrical energy system. We further believe it is a critically needed addition to the work and goals of the current Smart Grid overhaul. DC microgrids hold the potential to change the paradigm of a centralized power generation and distribution system to one more akin to the distributed network configuration of the Internet. As such, we could expect it to be more flexible, accommodate greater innovation and generally be more accommodating of the power sources and loads that have come to be and will continue to develop.

But widespread deployment of DC microgrids will not happen automatically – the impediments to deployment need to be dealt with at a variety of levels and from a number of perspectives. This is why we also believe the DOE should play a vital role in assessing and addressing the needs of this emerging technology, including catalyzing the development of a robust supporting commercial eco-system and coordinating the revision of existing and adoption of new code and regulatory treatments.

In conclusion, we herewith beg your thoughtful consideration of this recommendation.

About the EMerge Alliance

The EMerge Alliance is an open industry association leading the rapid adoption of safe DC power distribution via dc microgrids through the development of EMerge Alliance standards. These innovative standards integrate infrastructures, power, controls and devices in a common microgrid platform to facilitate the hybrid use of AC and DC power throughout buildings for unprecedented design and space flexibility, greater energy efficiency and improved sustainability. The not-for-profit Alliance is accepting new members at various levels. For more information, please visit www.EMergeAlliance.org.

References:

1 http://www.emergealliance.org/About/OurMembers.aspx

2 http://zeroenergycbc.org/pdf/CBC%20Technologies%20Report%202011.pdf

3 http://environment.research.yale.edu/documents/downloads/0-9/05-DC-Microgrids.pdf

4 http://www.emergealliance.org/imwp/download.asp?ContentID=19276

5 http://www.emergealliance.org/imwp/download.asp?ContentID=19272

Respectfully submitted, on behalf of the full membership,

Brian T. Patterson
Chairman

2400 Camino Ramon, Suite 375
San Ramon, Ca 94583
717-433-5443 (mobil)
717-396-6038 (fax)
mailto:btpatterson@armstrong.com
http://www.emergealliance.org