OSD Maintenance Challenge

Abstract Form	
Paper Title:	Resilient Integrated Power Heating and Cooling System
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Abstract: (300-500 words)

This abstract presents a Resilient Integrated Power, Heating, And Cooling system (RIPHAC, pronounced "Rip-Pack"), which was developed under the U.S. Air Force Small Business Innovative Research (SBIR) grant contract FA8501-14-C-0004. The purpose of the system is to demonstrate an integrated cooling, heating, and power generation system that operates from multiple energy sources and that can be easily incorporated onto a building similar to a standard air conditioning system. The single system provides the same capabilities to a building as the combination of a conventional heat and cooling system, an uninterruptable power supply (UPS), and back-up generator, but with the added benefit of lower initial cost, reduced maintenance, and significant energy savings. The system can operate on energy provided from any combination of solar thermal collectors, photo-voltaic systems, natural gas, propane, or traditional grid power. Installation and maintenance is similar to a traditional air conditioning system, allowing affordable back-up power to be available for numerous locations that were not previously cost affective, and enhancing the energy resilience of any traditional building.

The prototype system provides 15-tons of heating and cooling with 7 kW of back-up power. The unit will be available for installation in mid-2017 to demonstrate significant reduction in building energy costs (75% reduction expected) for heating and cooling, plus the ability to provide back-up power. These dramatic reductions will be demonstrated through primarily 4 system operating modes: 1) Direct solar-thermal driven air conditioning, 2) The ability to put electric power back onto the grid, if excess solar energy is available, 3) Operation in a co-generation heating mode, which produces electricity as a by-product from heating the building, and 4) the ability of the system to operate autonomously and provide back-up power to the building in the event of an electrical grid failure.

Maintenance savings are realized by eliminating the monthly maintenance required to assure availability and reliability of traditional stand-by generators. The air conditioning and heating system that is used every day is also the back-up power system. 90% of the system has been built and is undergoing testing of the sub-systems and system modes.

The RIPHAC has broad application for both military and commercial installations, which can benefit from the availability of back-up power. As commercialization progresses and production costs decrease, the RIPHAC will seek to challenge conventional heating and cooling systems in traditional installations.