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Use of hybrid generation to reduce requirement of grid-scale battery storage while emitting zero carbon dioxide

Jayanta S Kapat
University of Central Florida, USA

Steady penetration of solar and wind energy into US electric generation has brought significant changes to the industry. This has happened at a time when natural gas remains abundant and inexpensive. In fact, gas turbines running on natural gas are quite often touted as renewable-enabler as their fast start-up characteristics make them ideal for meeting grid demands when generation from solar and wind energies fall off. The combination of enhanced electric grid and back-up power generation would work nicely, except that carbon dioxide would still be emitted while using the back-up power generation. Of course, that can change when affordable, grid-scale battery storage is available. This presentation covers two different power production scenarios, where direct solar electricity generation can be complemented by alternative modes of power generation such that no carbon dioxide gets released to the atmosphere even when natural gas is used to complement the renewable generation. The first scenario covers solar thermal power generation hybridized with Super-Critical Carbon Dioxide (sCO2) power cycle with oxy-combustion of natural gas. Here, carbon dioxide will be naturally captured even when natural gas is used as the heat source, and in addition, water will be produced in the oxy-combustion process that will be available for consumption. The second scenario involves solar PV array to be complemented by a Salinity-Gradient-Solar-Pond (SGSP) that acts as a thermal storage to store the solar energy when available. When sun is not shining, stored thermal energy is converted to electricity through an Organic Rankine Cycle.

Biography

Jayanta S Kapat is currently the Pegasus Professor of Mechanical and Aerospace Engineering at the University of Central Florida (UCF). He received his doctoral degree in Mechanical Engineering from the Massachusetts Institute of Technology, and has been at UCF since 1997. Since 2012, he has been the founding Director of the Center for Advanced Turbomachinery and Energy Research (CATER) at UCF. He has supervised and graduated 20 doctoral students, most of who are currently at various OEM's such as Siemens Energy and Mitsubishi. He has over 200 journal and peer-reviewed conference publications.

Jayanta.Kapat@ucf.edu

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