

Title: Task 2111.002 Sustainable Balancing of Real Power in an Electric Grid

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Sponsor: SRC sponsored Smart Grid Research Centre-SGRC at CMU

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Description: The system level automation in an electric grid is limited, and feedback controls are mostly manually operated. In addition, demand side response needs to be automated as well. Under Task 2111.002, we proposed formal mathematical frameworks to ensure seamless automation of conventional electric grids. To maximize the system-wide efficiency, and ensure pre-specified performance standards for reliable operation, we adopted a two-pronged approach. First of all, the frequency response characteristics of smart loads were harnessed to minimize the use of conventional generation resources. A model-based framework was proposed which highlights information that needs to be exchanged and embedded into smart loads in order to provide regulation. Secondly, high degree of efficiency was achieved by automating load-following function for generators based on their sustainable natural-cycles. A control-based alternative to conventional static economic dispatch, based on energy-conversion dynamics of different generation technologies, was proposed. Our framework highlights the necessity of model-based automation to ensure system-wide efficiency, while following load variations over wide ranges of operating conditions.