Energy Syst (2012) 3:1–2
DOI 10.1007/s12667-012-0055-z

PREFACE

Preface

Marco Carvalho · Vijay Pappu

Received: 22 January 2012 / Accepted: 28 January 2012 / Published online: 9 February 2012

The promise of a smarter electricity grid could significantly affect how consumers use and pay for their electric power, and could fundamentally change the power Industry that we know today. Gaining increasing interest and acceptance, Smart Grid technologies combine power generation and delivery systems with advanced communication systems to help save energy, reduce energy costs and improve reliability. Combined, these technologies enable new approaches for load balancing and power distribution, allowing for optimal runtime power routing and cost management.

Such unprecedented capabilities, however, also introduce new sets of challenges at the technical and regulatory levels that must be addressed by the Industry and the Research Community. In this special issue of the Journal of Energy Systems, we have compiled select articles from the Systems and Optimization Aspects of Smart Grid Challenges Conference, organized in Gainesville, FL, in April 2011. The extended version of the selected articles included in this issue cover some of the key aspects of smart grid optimization and control.

From a distributed monitoring and measuring perspective, this special issue includes an article that proposes a Wide Area Measurement System (WAMS) based on synchronized phasor measurement units (PMUs). Aimed at improving overall system reliability, the proposed WAMS supports smart grid applications involving hybrid energy sources, and was tested in experimental settings both under normal and fault states.

The monitoring and optimization of renewable data sources is another important aspect of smart grids research. This special issue includes three articles focused on

M. Carvalho (✉)
Florida Institute of Technology, Melbourne, FL, USA
e-mail: mcarvalho@fit.edu

V. Pappu
University of Florida, Gainesville, FL, USA

this problem. First, a cooperative control for self-organizing microgrids is proposed using a Stackelberg game formulation for the optimal dispatch of distributed renewable energy between individual microgrids.

Another article proposes a multi agent-based approach for the control of energy storage devices to optimize the use of intermittent renewable energy sources. The article proposes a reinforcement learning approach to allow agents to properly adapt and respond to transients in the renewable energy sources, optimally allocating the state of the batteries to reduce the overall energy costs.

From the perspective of energy management in large-scale organizations, another paper included in this special issue introduces the combined use of renewable energy sources, static energy sources, and Plug-in Hybrid Electrical Vehicles to minimize overall energy costs. The authors propose a mixed integer linear programming (MILP) formulation to optimize the temporal allocation of resources, and discuss their approach on a case study developed at the Oak Ridge National Laboratory (ORNL) campus.

From a systems reliability perspective, we have also included an article focused on the optimal intentional islanding of power grids. The approach users graph-partitioning methods to form islands in the power grid, and optimal power flow models to minimize the load shedding cost.

And finally, we have also included an article addressing the issue of classification of distributed data streams for Smart Grids. The article proposes the use of proximal support vector machines for the distributed classification of data traffic.

Combined, these articles address some of the many important aspects in smart grids control and optimization research. We would like to express our gratitude to all the reviewers and contributing authors for offering their expertise, and providing the valuable material used to compose this special issue. We are thankful for being able to make a contribution to help advance and share the state of the art in this important research area.

Guest Editors