A NEW RISK ASSESSMENT AND MANAGEMENT PARADIGM (NewRAMP) IN ELECTRICITY MARKETS

Boston University (Boston, MA) Prime Recipient of \$3M ARPA E Award

PROJECT SUMMARY

The proposed work offers a New Risk Assessment and Management Paradigm (NewRAMP) in the evolving electric power sector. NewRAMP develops innovative approaches for quantifying the risk of individual assets based on their performance and ability to deliver on their assumed obligations and translates this risk to the system-level while proposing novel methodologies for procuring a portfolio of risky assets in a manner that increases the social welfare and improves system reliability.

By synthesizing ideas and theories from finance and insurance, operations research, power system engineering and electricity market design, NewRAMP offers ground-breaking methodologies constituting a risk-driven paradigm promising to achieve higher adoption of stochastic resources and a more efficient and reliable system operation. As such, it contributes to reducing imported energy, reducing energy-related emissions, and improving energy efficiency.

We will develop a web-based platform employing parallel computation to provide proof-ofconcept that NewRAMP:

- can manage system and individual asset risk in a manner far superior to current practice as measured on solid metrics applied on the Southwest Power Pool (SPP) territory, and
- is acceptable to stakeholders.

In addition to current SPP system and asset conditions, we will evaluate future system scenarios to test our new paradigm's ability to include reserves from storage like distributed energy resources whose role will increase in importance as non-dispatchable renewable generation dominates the supply side at the expense of retiring conventional generation and transportation electrification is adopted on a massive scale.

NewRAMP's objectives include the investigation of new efficient day ahead and intraday power market clearing rules that:

- Select a *system reliability preserving portfolio of assets* by balancing individual asset bids/offers against the risk quantified by both their historic performance and their day-ahead stochastic spatiotemporal weather forecasts/contingencies impacting their ability to deliver on their energy and/or capacity promises,
- Prices Renewable Generation, Distributed Energy Resources and other Flexible Prosumers in a manner that reflects the burden that their risk imposes on endogenously determined system reserve requirements, and
- Can be evaluated and transferred to practice in one or more Pilot studies that may be approved by ARPA-E and carried out in a second phase following the three year performance of this project

Boston University has put together an interdisciplinary team of researchers from its College of Engineering and the School of Management, along with uniquely qualified experts from Harvard University and the Massachusetts Institute of Technology, and has secured industry collaboration and support from the Brattle Group and the Southwest Power Pool (SPP). Principal Investigators and Senior Personnel include:

-Panagiotis Andrianesis, CoI, panosa@bu.edu
-Dimitris Bertsimas, CoI, <u>dbertsim@mit.edu</u>
-Michael Caramanis, PI, mcaraman@bu.edu
-Jay Caspary, Senior Personnel, jcaspary@spp.org
-Christos Cassandras, CoI, cgc@bu.edu
-Philip Hanser, Senior Personnel, Philip.Hanser@Brattle,com
-William Hogan, CoI, William_Hogan@harvard.edu
-Nalin Kulatilaka, Senior Personnel, nalink@bu.edu
-John Liagouris, Senior Personnel, liagos@bu.edu
-Yannis Paschalidis, CoI, yannisp@bu.edu
-James Read, Senior Personnel, James.Read@brattle.com
-Pablo Ruiz, CoI, paruiz@bu.edu

Project Findings and Related Material are available at

http://www.bu.edu/pcms/caramanis/NewRAMP.pdf

Information on Recent Workshop on Network Economics can be accessed at:

http://www.bu.edu/systems/distribution-network-economics-workshop-november-7-8-2019/

http://www.bu.edu/systems/distribution-network-economics-november-7-2019-agenda-day-1/

http://www.bu.edu/systems/distribution-network-economics-november-8-2019-agenda-day-2/

http://www.bu.edu/systems/distribution-network-economics-workshop-participant-biographies/