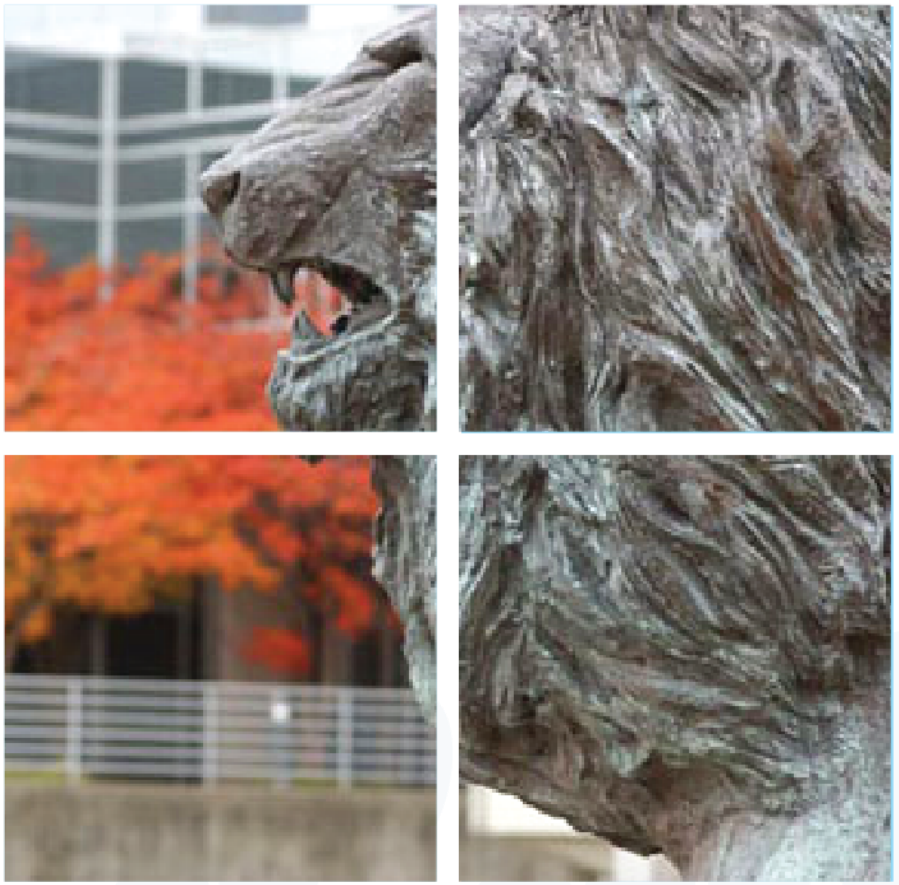
OLD DOMINION
UNIVERSITY
IDEA FUSION



CIGRE GOTF

Cleveland OH
October 23, 2017

A Simulation-Based Energy Management Game

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Nathapon 'Max' Siangchokyoo*
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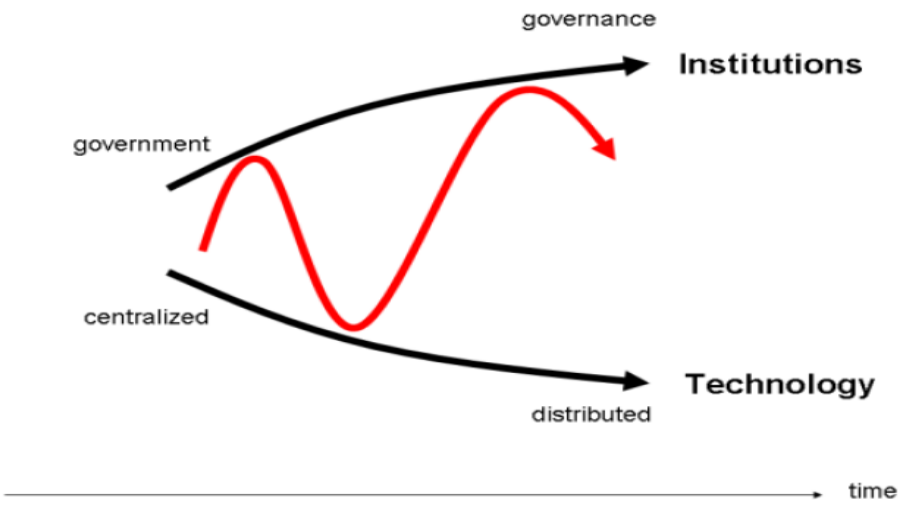
Outline

- Gaming in power infrastructure planning
- Simulation Engine
- Play Mechanism
- User Interface

Research Interest

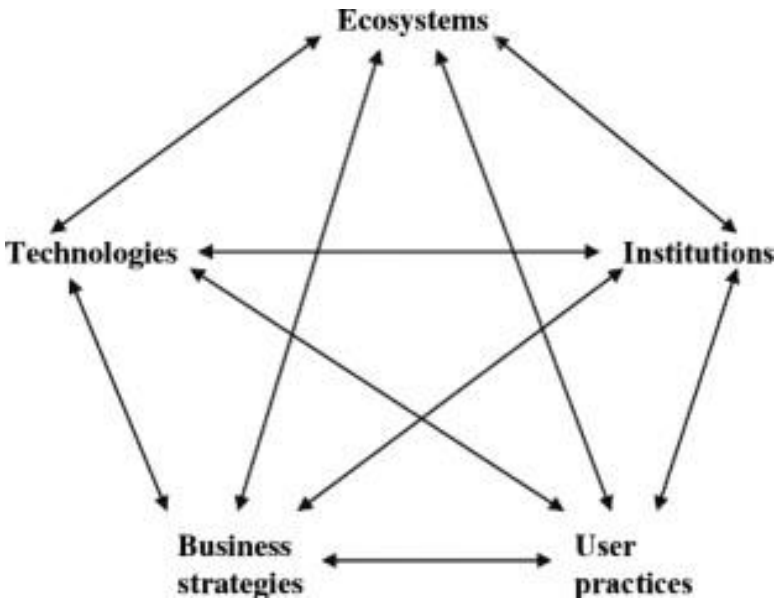
1. Understand how infrastructure systems co-evolve with Society (populations, policy, institutions, economy, etc.) and Nature (resources, ecosystems).
2. Understand how to best influence this co-evolution



Finger et. al 2010

Research Interest

- Today's power sector is an extreme example of a co-evolving complex dynamic system in transition, characterized by path dependency, learning and adaptation, institutional changes, technological innovation, consumption pattern changes, etc.



Bale et al, 2015

Gaming in power infrastructure planning

GAMING: THE FUTURE'S LANGUAGE

by

Richard D. Duke

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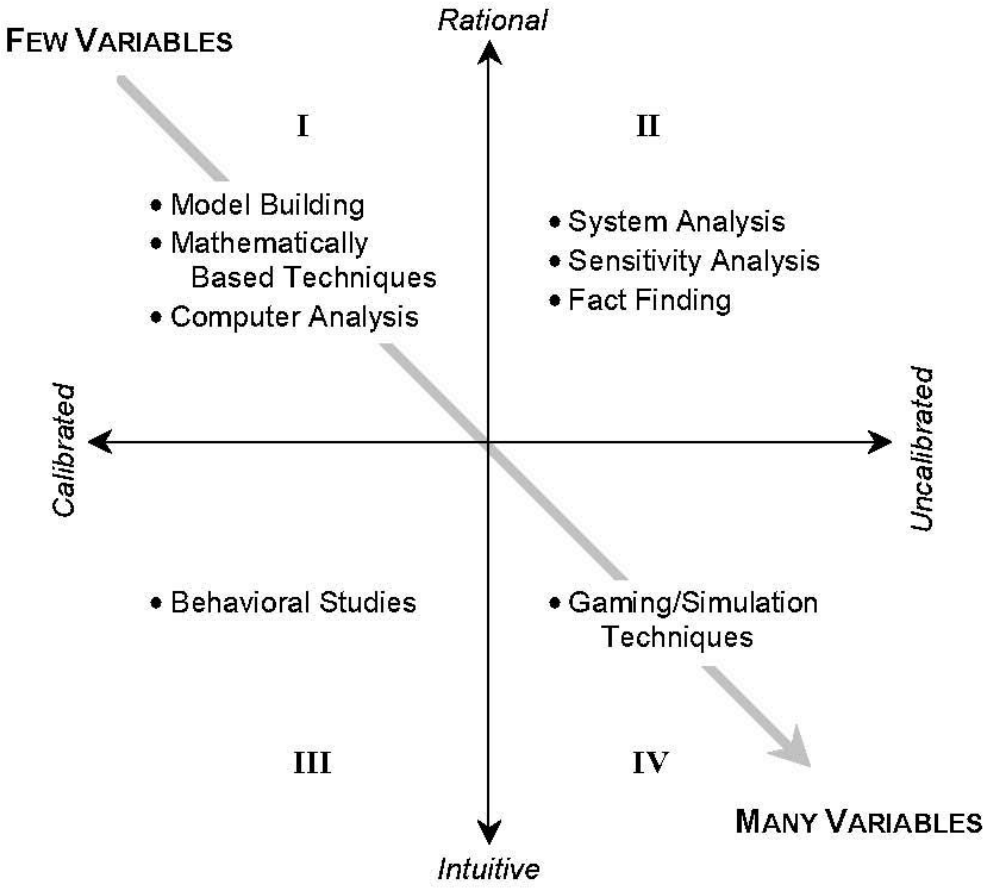
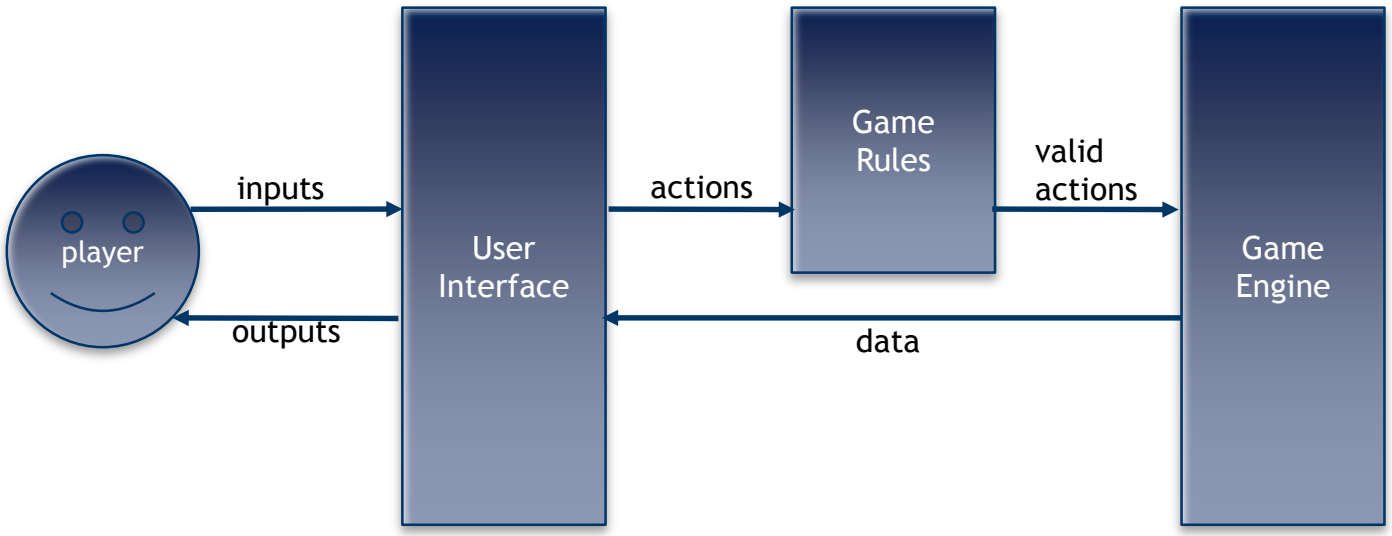


Structure of a game

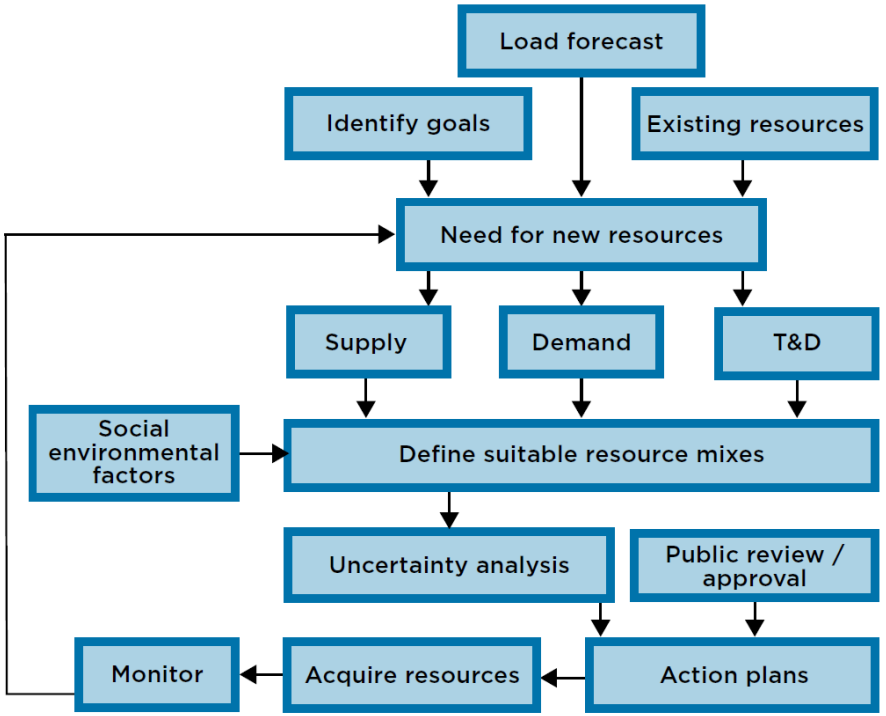


Spark!

- Player: Student, Policy Maker, Utility Manager
- Goal: Incrementally build a long term grid expansion plan under uncertain regulatory, fuel and technology forecast regimes with cost, reliability and sustainability constraints
- Actions: build, expand, retire generator/storage/transmission

Spark! Game Mechanics

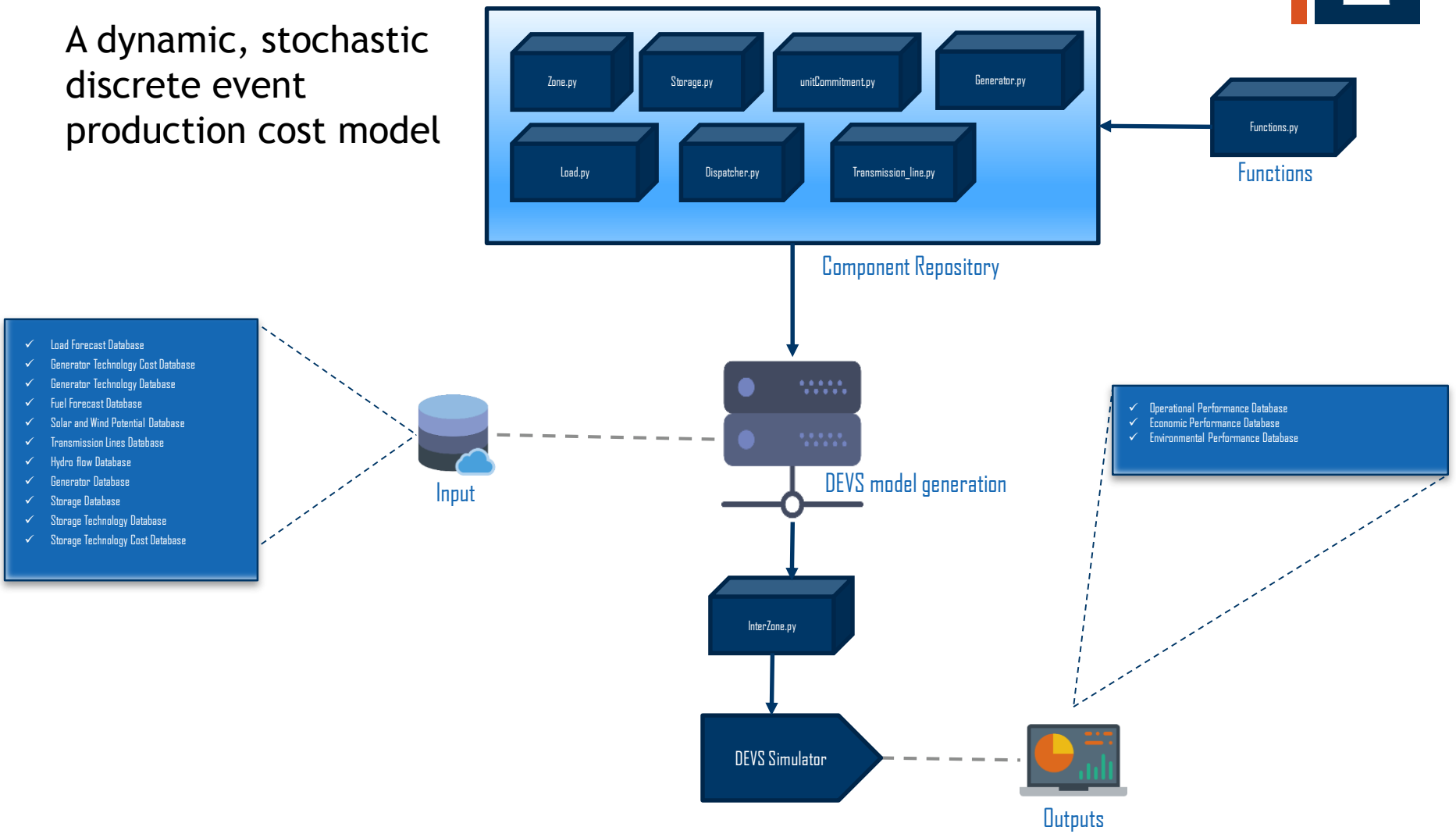
- The game mechanics simulate a yearly IRP process



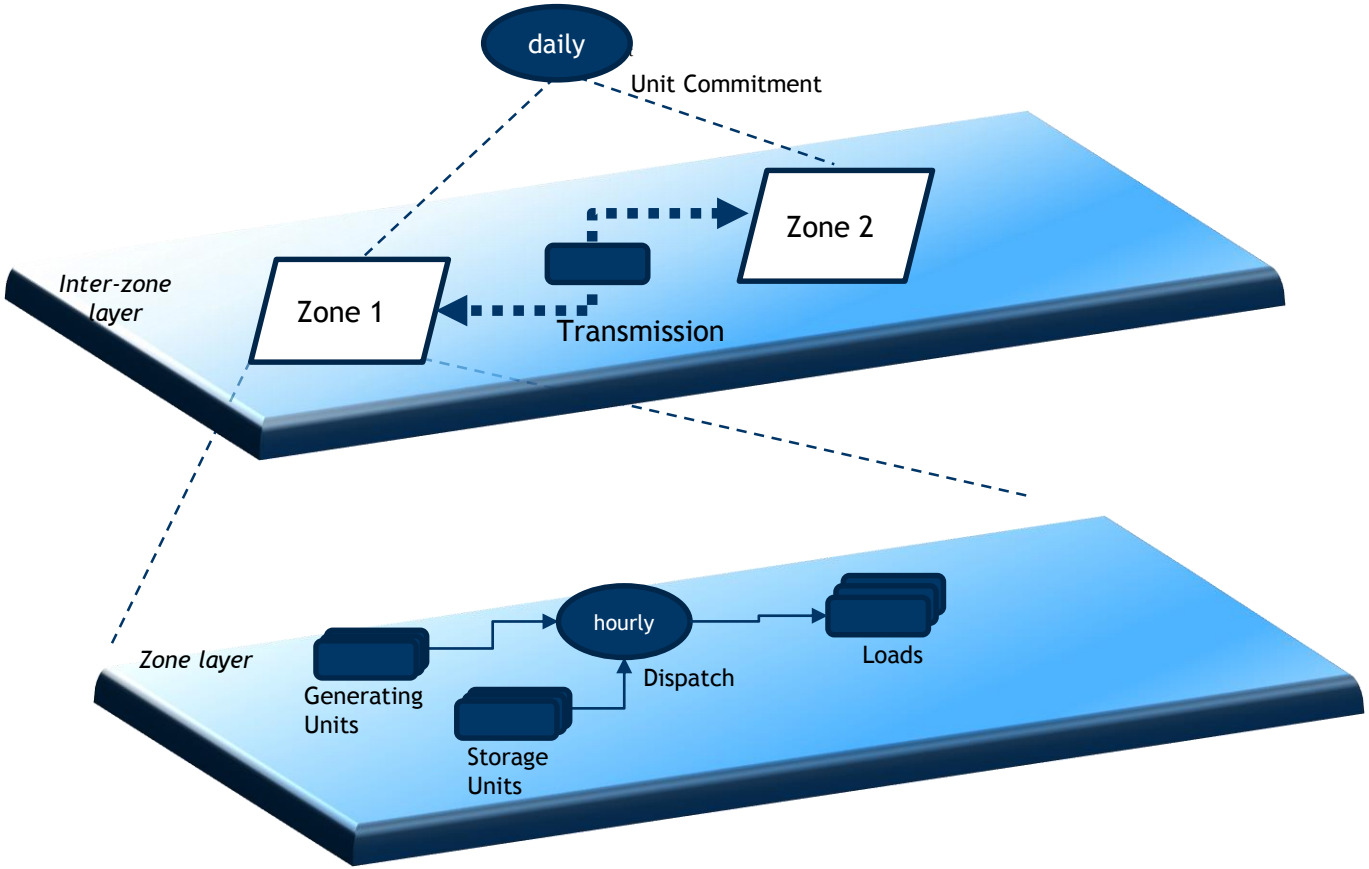
Source: Wilson and Biewald, 2013

Spark! Simulation Engine

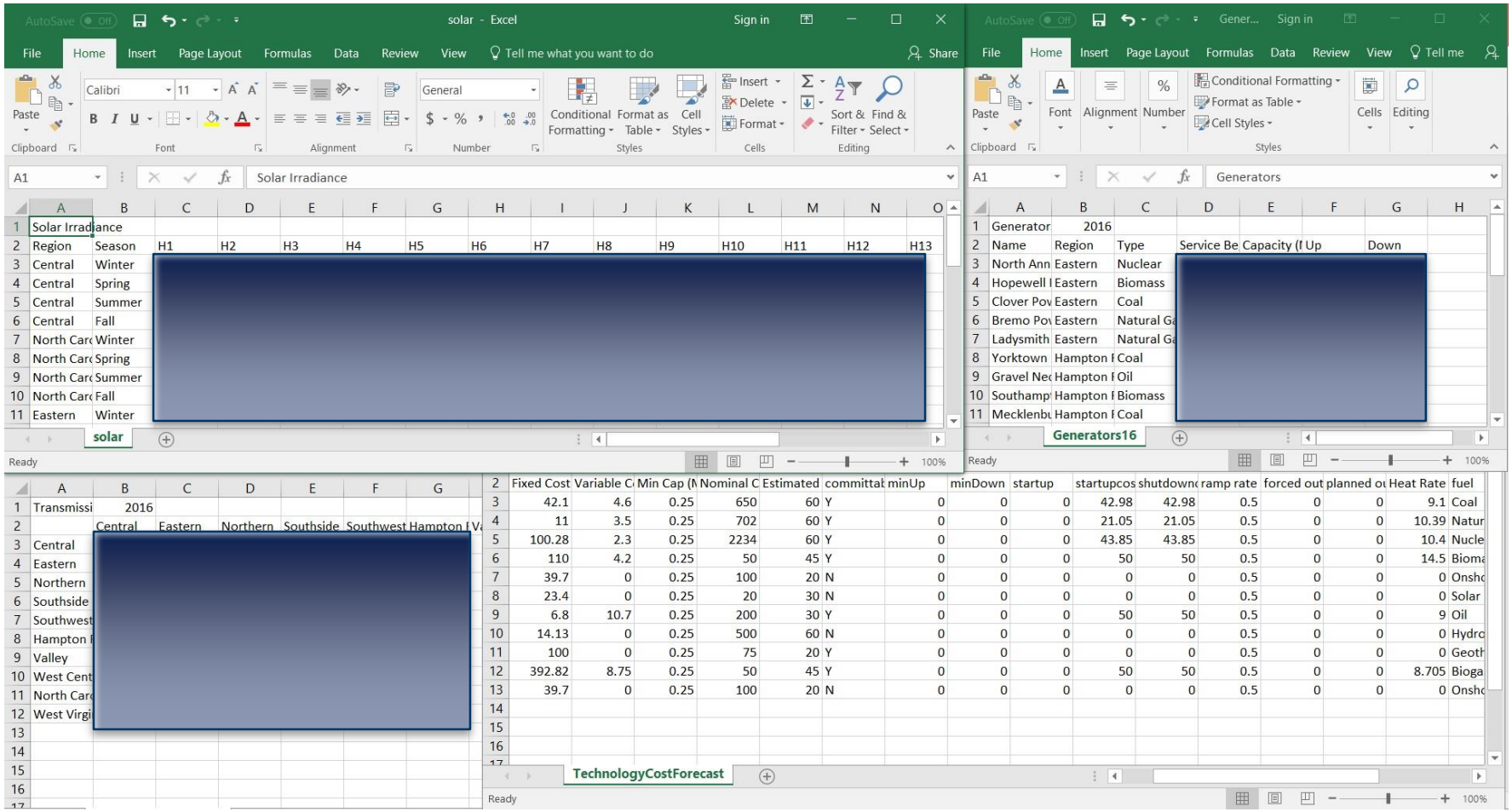
A dynamic, stochastic discrete event production cost model



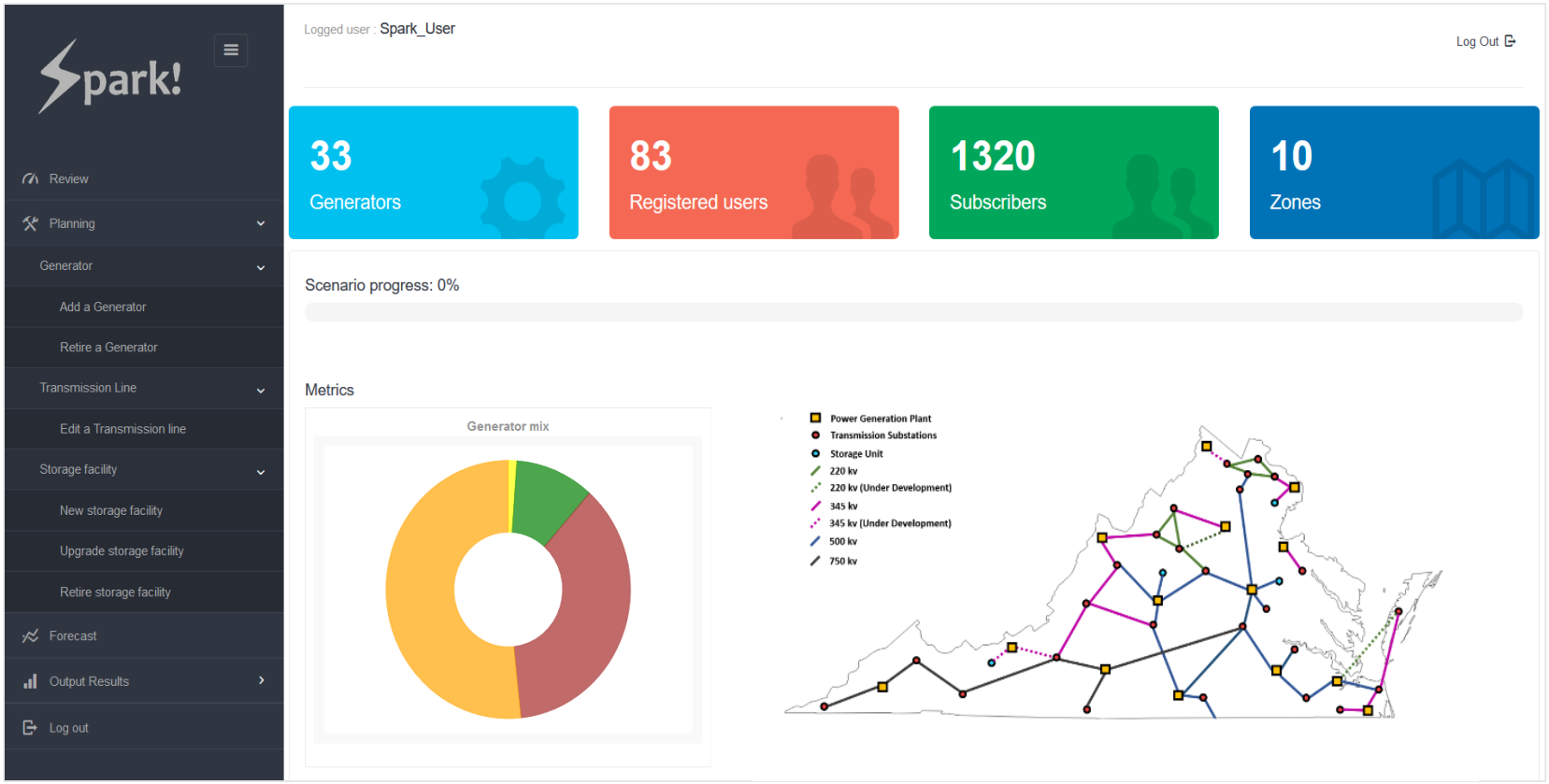
Spark! Simulation Engine



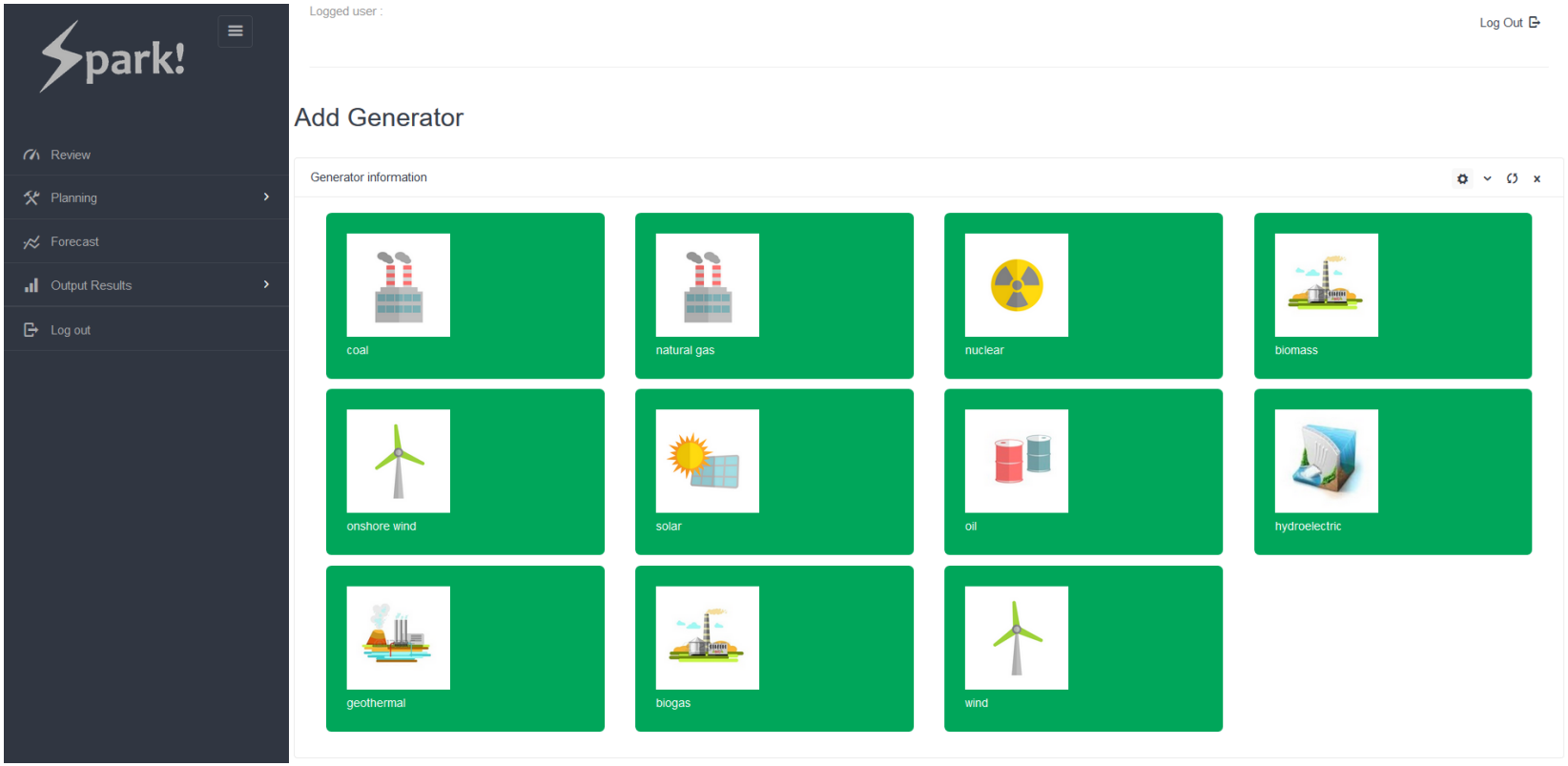
Spark! Simulation Input



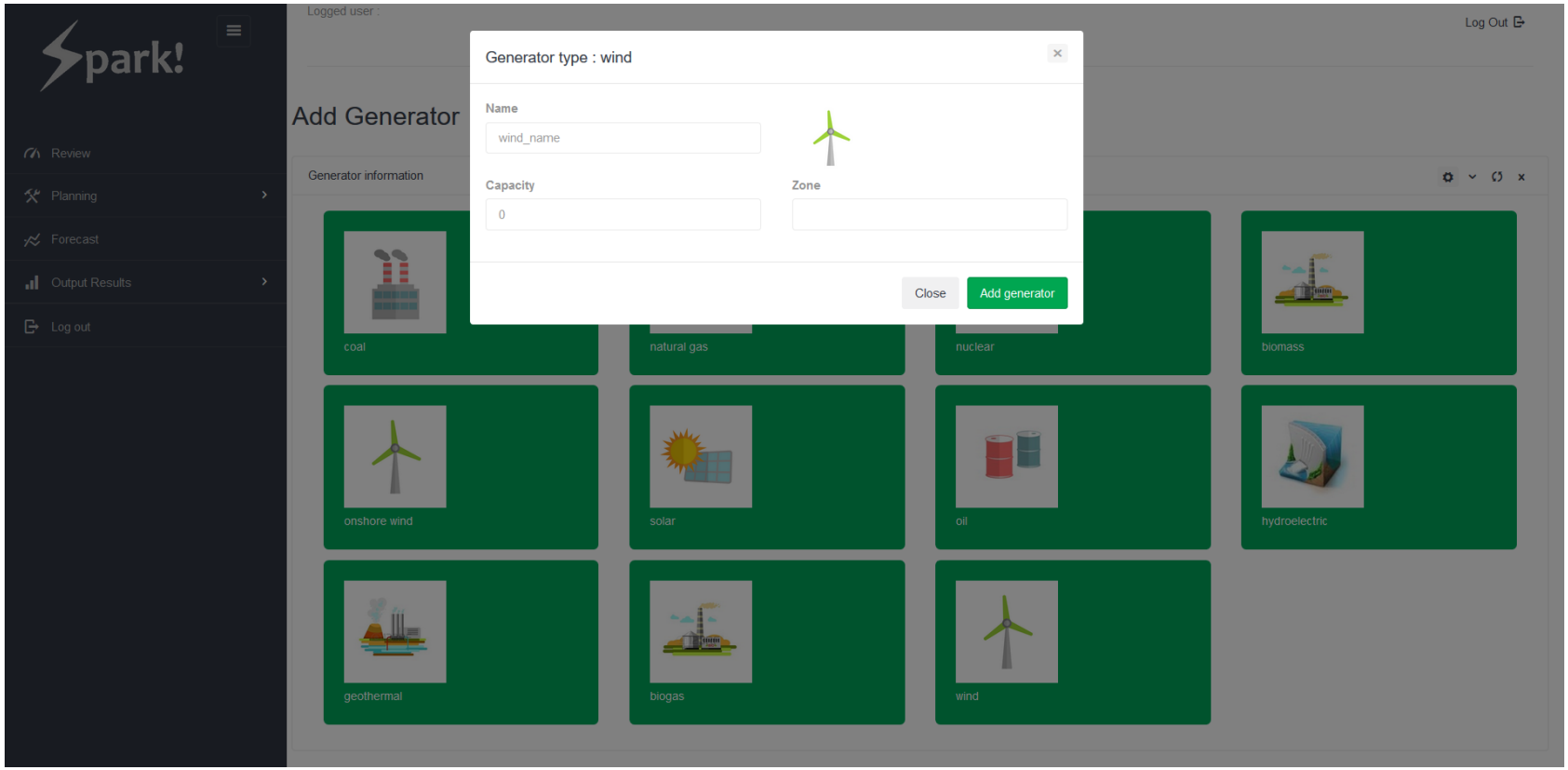
Spark! User Interface



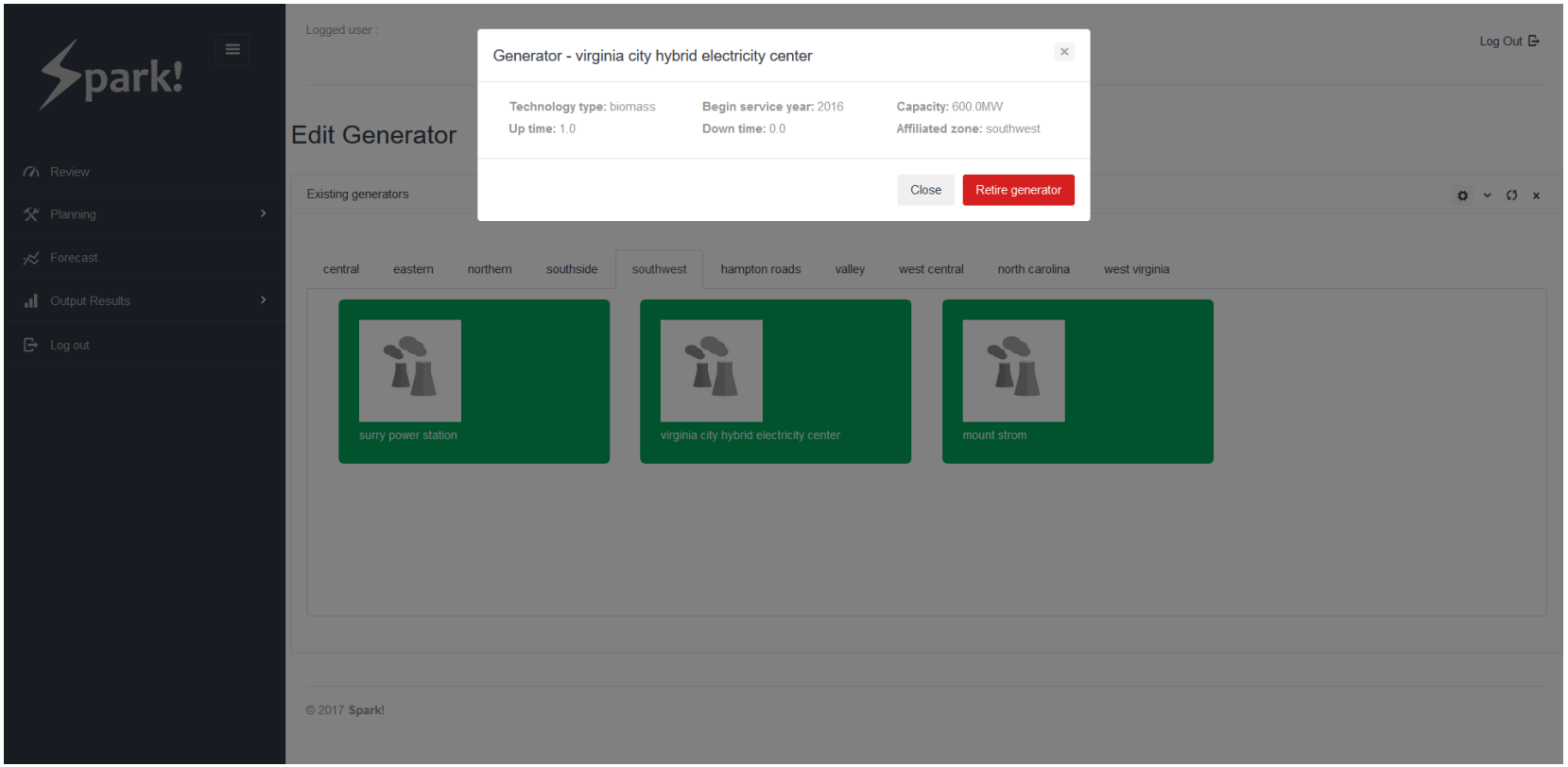
Spark! User Interface



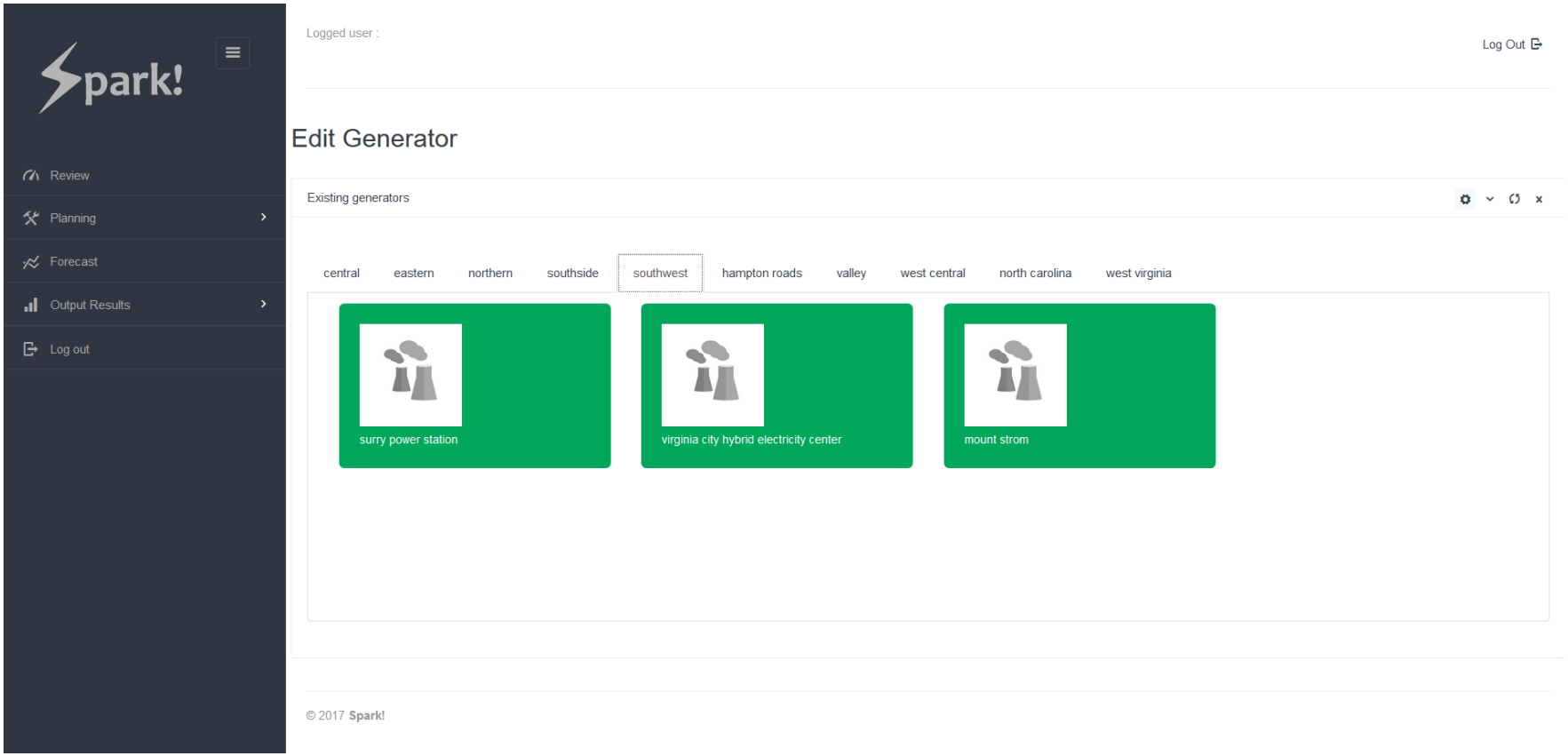
Spark! User Interface



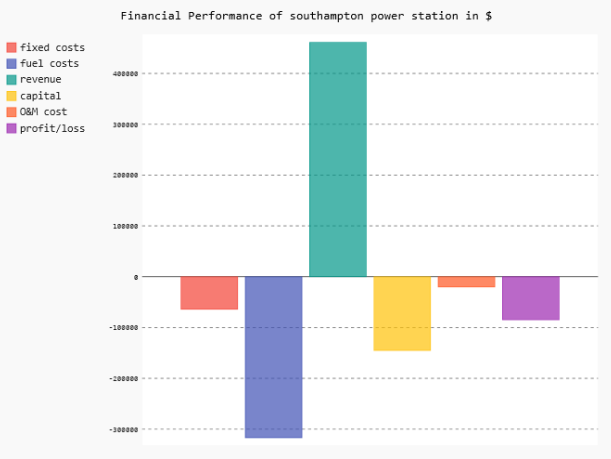
Spark! User Interface

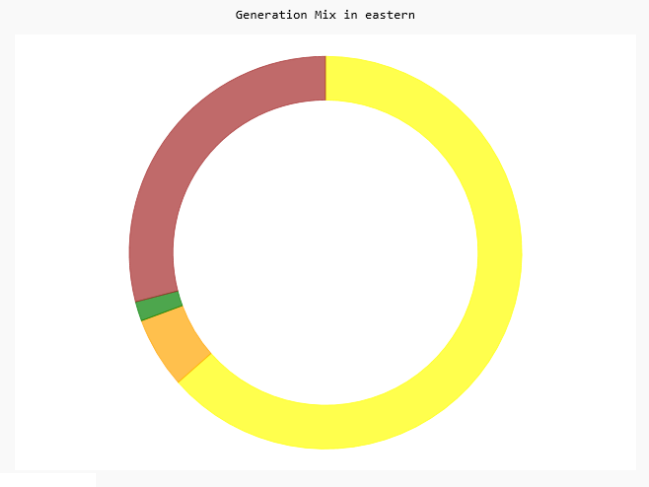


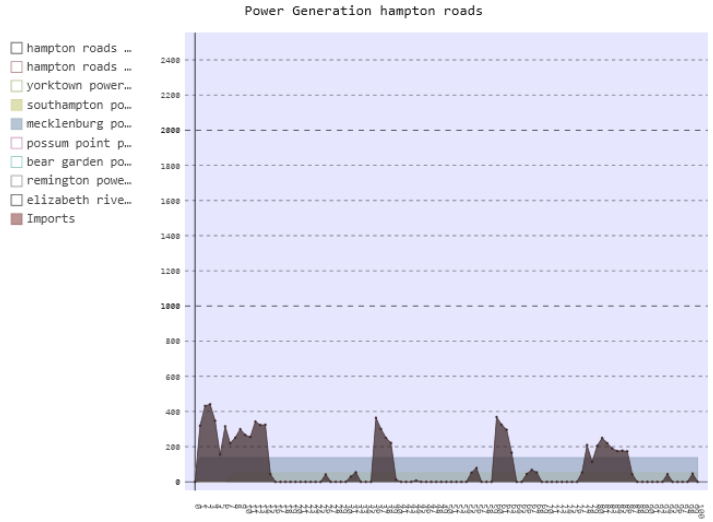
Spark! User Interface

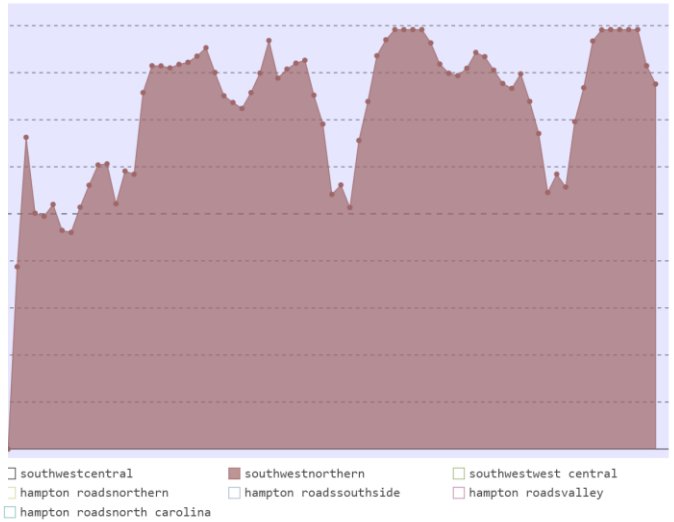


Typical outputs









Summary

- We have developed a gaming application for power sector infrastructure planning.
- The game has potential application in training, policy analysis, public relations.
- Future steps involves launching an online game challenge for the 2050 US Grid
- **Thanks to the Dominion Educational Fund for the initial funding of this effort !**
- We welcome requests for collaboration, use, sponsorship to develop this game further