Control of Line Pack in Natural Gas System of Israel: Balancing Limited Resources under Uncertainty

Criston Hyett, Laurent Pagnier, Jean Alisse, Lilah Saban, Igal Goldshtein, Misha Chertkov

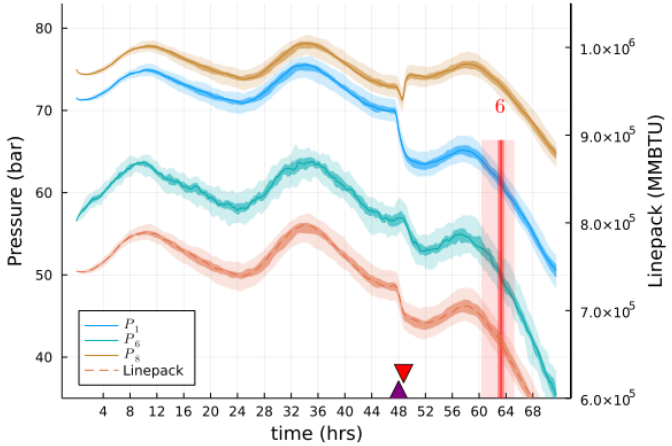
The University of Arizona & NOGA Israel

September 4, 2023

Project Goals

- Operations-aware modeling and simulation of a reduced model of Israel's natural gas network.
  - Flux control at inlet nodes
  - Realistic initial conditions
  - Assessing relevant challenges
    - Robustness in the case of uncertain PV generation
    - Robustness in the case of an insult to the system
- Model & open-source tool development
  - Solver suite specifically suited to the needs of natural gas networks
  - Advanced automatic controls
  - Monte-Carlo/Uncertainty Quantification

Results: Scenario 5



Linepack and pressures for insult at hour 48, implementing a max-flow control on the remaining supply at node 8. $\tau = 14.17 \pm 4.07$ hrs

Next Steps

- Better UQ: Stochastic Finite Volumes(?)
- Higher order method and efficient implementation to allow for parallelization and acceleration.
- Advanced automatic controls
  - This would mimick some actual protocol, and allow you to make statements such as, "with 95% confidence, using protocol A, the natural gas system is robust to an insult of type B"
- Simulation and optimization of the joint power and gas grids, under uncertainty.