Planning for Grid Integration of sCO₂ Power Cycles using Capacity Expansion Models

Jeffrey A. Bennett¹, Claire Trevisan¹, Andres F. Clarens¹, Joseph DeCarolis²
¹ – Civil and Environmental Engineering, University of Virginia, Charlottesville, VA
²– North Carolina State University, Raleigh, NC

Background
- Supercritical carbon dioxide (sCO₂) power cycles offer high efficiencies of ~50% and a compact footprint
- sCO₂ power plants are being developed for a range of scales and fuel types
- Puerto Rico’s electric grid is still recovering from Hurricane Maria, and is in need of more resilient power production
- A capacity expansion model was built in TEMOA [1] to represent Puerto Rico’s electricity supply and demand

Goals
- Investigate sCO₂ characteristics for successful deployment into existing and future energy mix
- Investigate demand for distributed sCO₂ power plants to increase resilience against future hurricanes

Distributed sCO₂ Power Plant
- Natural gas fired
- Efficiency: 50% [2]
- Investment Cost: 1000 $/kW [2]
- Ramp rate: Start-up/shutdown in 1 hour

“Duck Curve”
As more solar power comes online, other power plants will need to quickly ramp production to meet demand

Conclusions
- Predicted sCO₂ efficiencies and investment costs fit well with current energy mix
- sCO₂ plant ramp rates above 8 hours will result in increased deployment
- Distributed sCO₂ plants are attractive for Puerto Rico if transmission costs increase

References