WASHINGTON STATE
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Scalable Multi-Period Optimal Power Flow
for Active Power Distribution Systems

or simply, Scalable MP-OPF in ADS

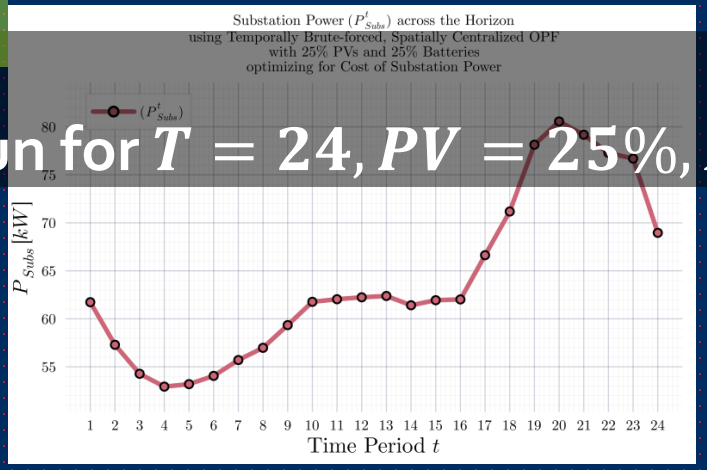
Aryan Ritwajeet Jha

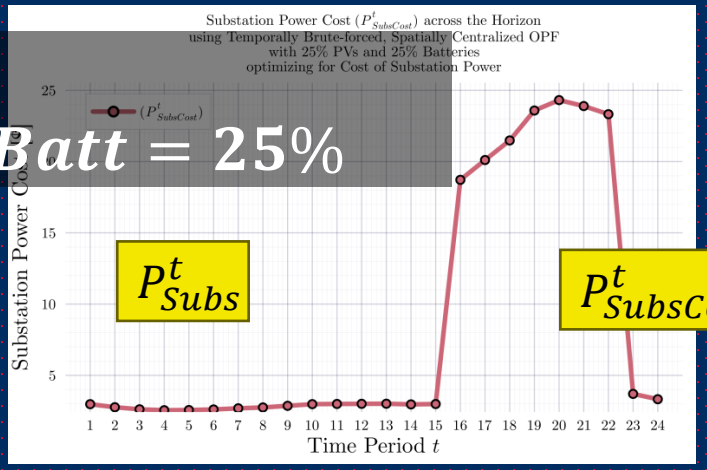
Graduate Research Assistant

Washington State University

OpenDSS Def Profiles | Substation Power Cost

ADS10_1ph: MPCOPF Run for $T = 24, PV = 25\%, Batt = 25\%$



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1. Machine ID: etrl309-aryan
2. Horizon Duration: 24
3. Nature of Simulation: Temporally Brute-forced, Spatially Centralized
4. Objective: Cost of Substation Power
5. GED Configuration: pv_25_batt_25
6. Maximum Substation Power Allowed: Inf kW
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MPCOPF Simulation Results

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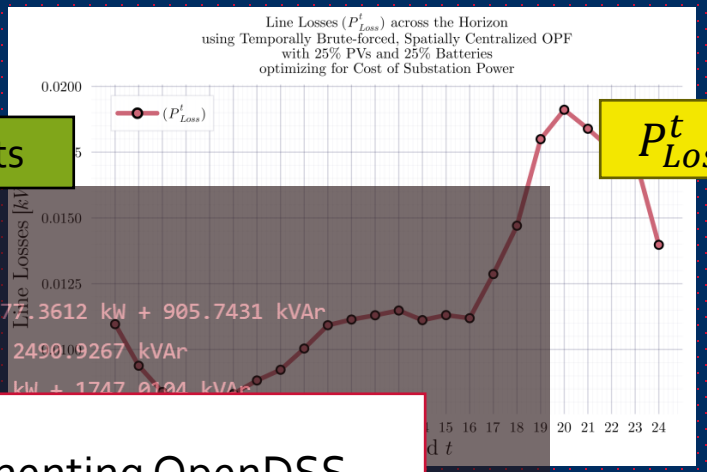
Full 24 Hour Horizon
7. Horizon Total Cost of Substation Power: $ 204.74
8. Horizon Total Line Loss: 0.29 kW
9. Horizon Total Substation Power: 1537.94 kW + 512.25 kVAr
10. Horizon Total Load: 1591.0 kW + 795.66 kVAr
11. Horizon Total Generation: 53.35 kW + 283.88 kVAr
12. Horizon Total Static Capacitor Reactive Power Generation: 0.0 kVAr
13. Horizon Total Substation Power Cost: $204.74
14. Horizon Total PV Generation: 55.22 kW + 174.87 kVAr
15. Horizon Total Battery Generation: -1.87 kW + 109.0 kVAr
16. Horizon Total Battery Transaction Magnitude: 36.44 kW + 109.0 kVAr
17. Horizon Total SCD Observed: 0.0 kW
18. Horizon-end Battery Energy Deviation from Reference: 0.0 kWh
19. Horizon-Total All time Substation Power Peak: 80.56 kW
20. Number of Macro-Iterations: 1
21. Simulation Time: 0.84 s
22. Time to solve with sequential (non-parallel) computation: 0.84 s
23. Time to solve if OPF computation parallelized: 0.84 s
```

Objective

$P_{SubsPeak}$

Timings



OpenDSS Powerflow Results

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Hour: Full 5 Hour Horizon
Horizon Line Loss: 83.1666 kW
Horizon Total Substation Power: 4477.3612 kW + 905.7431 kVAr
Horizon Total Load: 4527.1627 kW + 2490.9267 kVAr
Horizon Total Generation: 132.9676 kW + 1747.0104 kVAr
Horizon Period (hourly time-steps): 5 h
GED Penetration: 10% PVs + 15% Batteries
Maximum All Time Voltage Discrepancy: 0.00016693 pu
Maximum All Time Line Loss Discrepancy: 0.016237 kW
Maximum All Time Substation Borrowed Real Power Discrepancy: 0.33686 kW
Maximum All Time Substation Borrowed Reactive Power Discrepancy: 0.88518 kVAr
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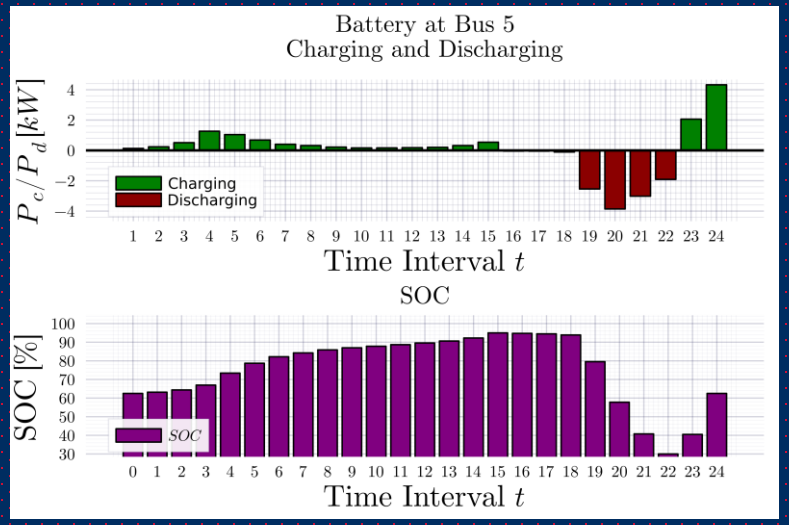
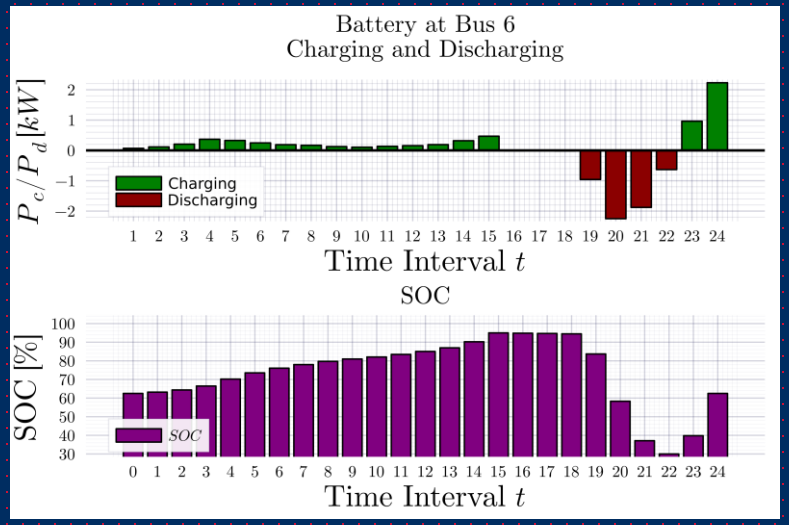
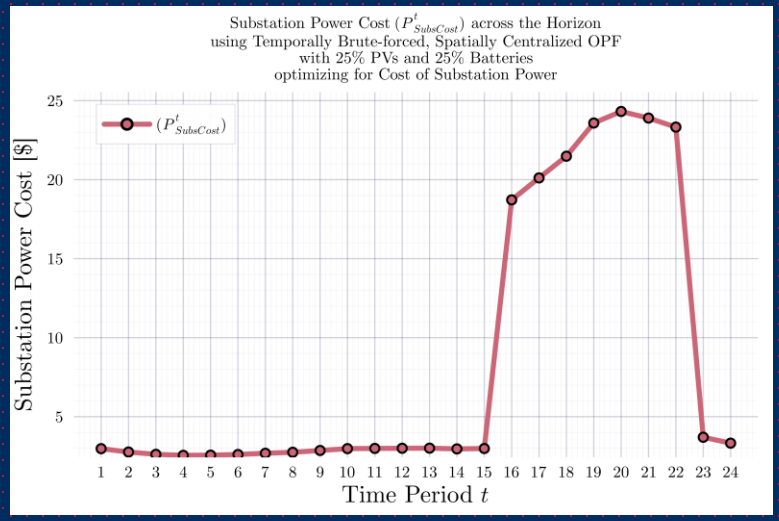
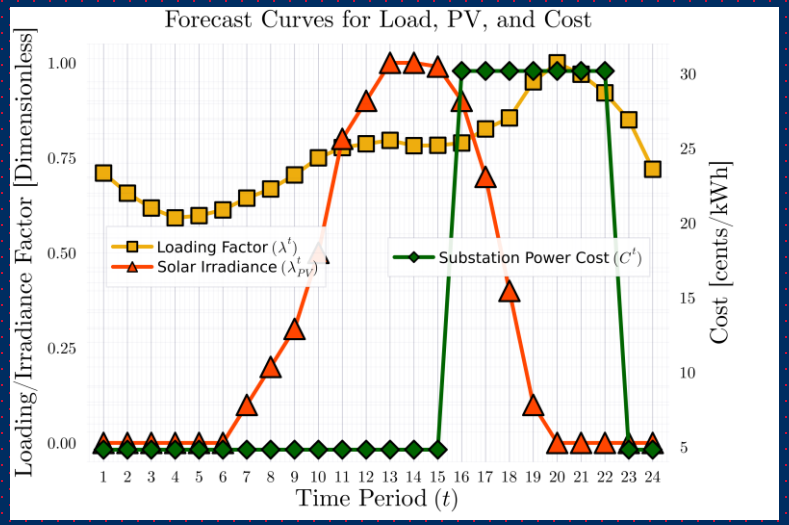
Currently implementing OpenDSS verification scripts...

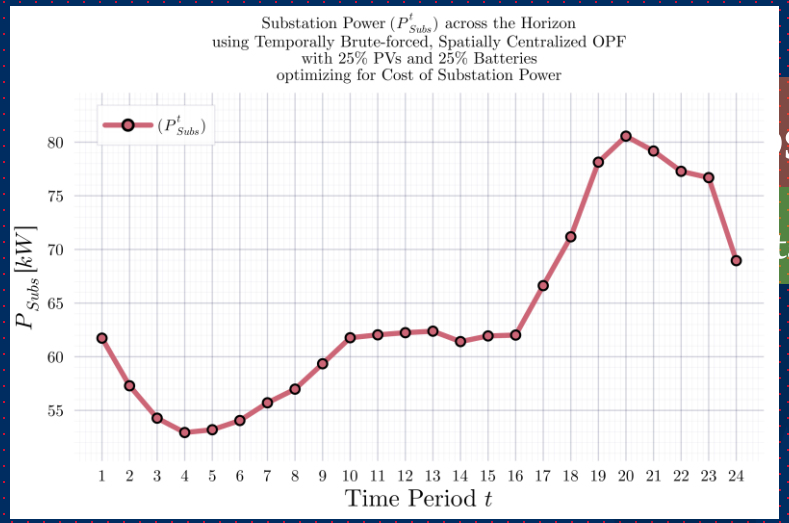
ADS10_1ph: MPCOPF Run for $T = 24, PV = 25\%, Batt = 25\%$

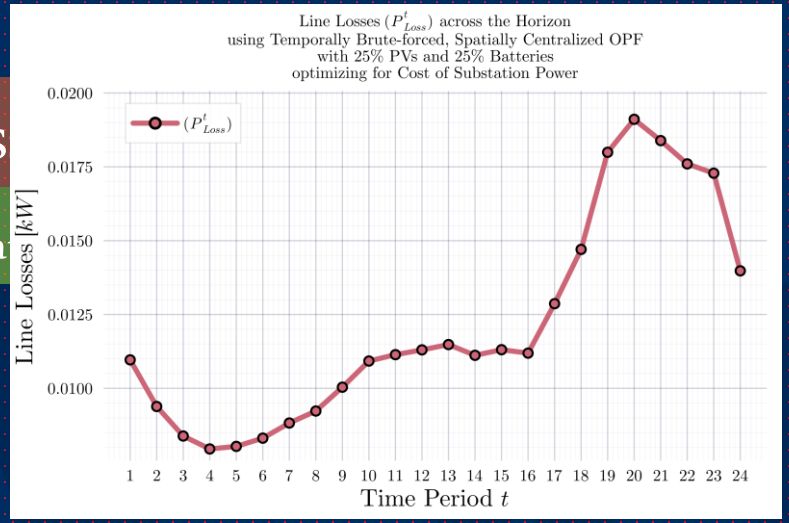






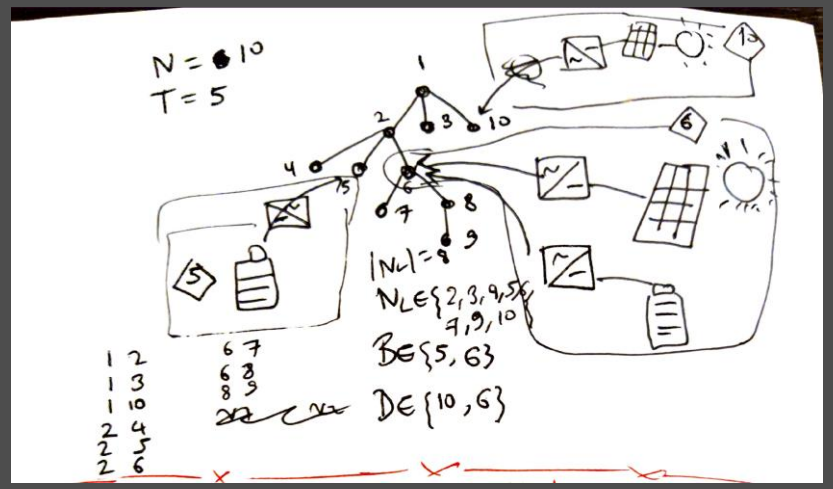






New MPOPF Implementation Progress

- 'New' because now it is being done in a new codebase which:
  - Is easy to work with, is simple to modify and debug
  - Uses OpenDSS .dss files for modelling all components
  - (To do) Post Optimization uses OpenDSSDirect to verify optimization simulation.



ADS10_1ph with 8 Loads, 2 PVs and 2 Batteries