A. Simulation Results

The Test System

1) Comparison between MPCOPF and MPDOPF: In this section, comparative analyses are carried out between MPCOPF and MPDOPF considering 5-hour time steps.

TABLE I: Comparative analyses between MPCOPF and MPDOPF - 20% PVs and 30% Batteries for a 5-hour

Metric	MPCOPF	MPDOPF
Substation power cost ($)	576.31	576.30
Substation real power (kW)	4308.28	4308.14
Line loss (kW)	75.99	76.12
Substation reactive power (kVAR)	574.18	656.24
PV reactive power (kVAR)	116.92	160.64
Battery reactive power (kVAR)	202.73	76.01
Number of Iterations	-	5
Total Simulation Time (s)	521.25	49.87

Further, here the

TABLE II: ACOPF feasibility analyses - 20% PVs and 30% Batteries for a 5-hour Horizon

Metric	MPDOPF	OpenDSS
Full horizon		
Substation real power (kW)	4308.14	4308.35
Line loss (kW)	76.12	76.09
Substation reactive power (kVAR)	656.24	652.49
Max. all-time discrepancy		
Voltage (pu)	0.0002	
Line loss (kW)	0.0139	
Substation power (kW)	0.3431	

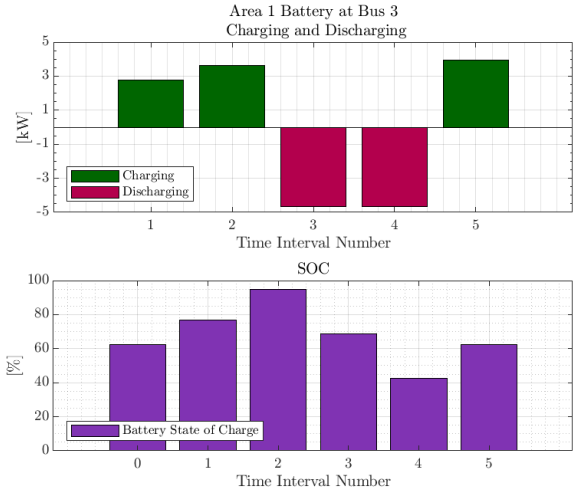

Fig. 1: Charging-Discharging and SOC graphs for Battery at Bus 3 located in Area 1 obtained via MultiPeriodENApp

Boundary Variable Plots are too tall, make them slightly shorter, like 25% of the page only.

B. Scalability Analysis

To demonstrate the effectiveness of the proposed algorithm over a bigger horizon to demonstrate scalability, simulations were run for a 10 time-period horizon. Figure 4 shows the forecasted profiles for load, solar irradiance and cost of substation power over the horizon.

1) Comparison between MPCOPF and MPDOPF: In this section, comparative analyses are carried out between MPCOPF and MPDOPF considering 10-hour time steps with 20% PV penetration and 30% battery penetration.

Do you want PV Real Power in the table too? (Not controllable, so nothing to compare)

TABLE III: Comparative analyses between MPCOPF and MPDOPF - 20% PVs and 30% Batteries for a 10-hour Horizon

Metric	MPCOPF	MPDOPF
Substation power cost ($)	1197.87	1197.87
Substation real power (kW)	8544.28	8544.04
Line loss (kW)	148.67	148.94
Substation reactive power (kVAR)	1092.39	1252.03
PV reactive power (kVAR)	222.59	139.81
Battery reactive power (kVAR)	388.52	310.94
Number of Iterations	-	5
Total Simulation Time (s)	4620.73	358.69

Further, here the

TABLE IV: ACOPF feasibility analyses - 20% PVs and 30% Batteries for a 10-hour Horizon

Metric	MPDOPF	OpenDSS
Full horizon		
Substation real power (kW)	8544.04	8544.40
Line loss (kW)	148.94	148.87
Substation reactive power (kVAR)	1252.03	1243.36
Max. all-time discrepancy		
Voltage (pu)	0.0002	
Line loss (kW)	0.0132	
Substation power (kW)	0.4002	

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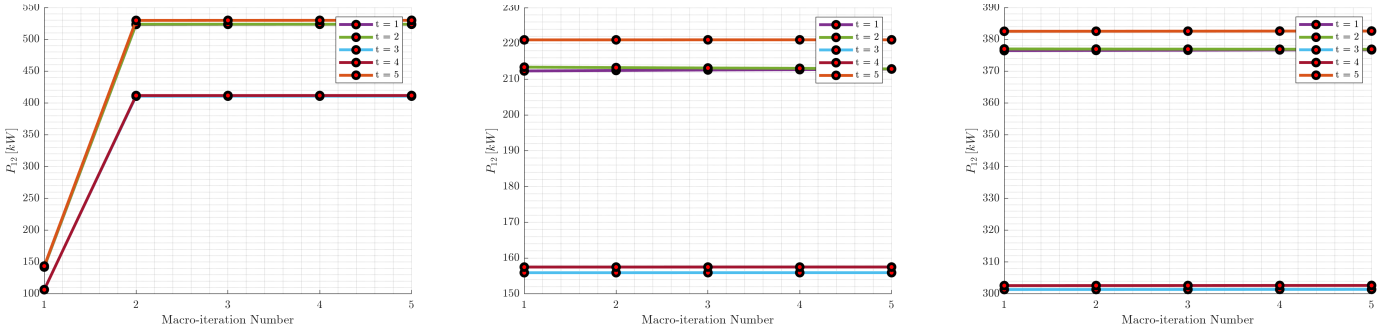
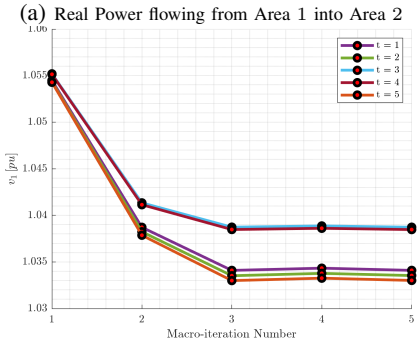


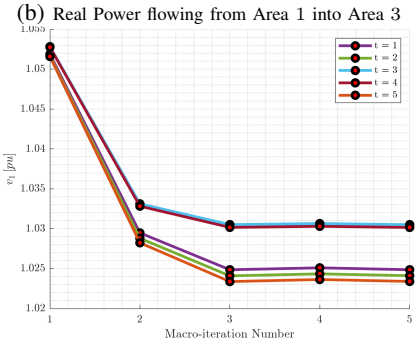
(a) Real Power flowing from Area 1 into Area 2

(b) Real Power flowing from Area 1 into Area 3

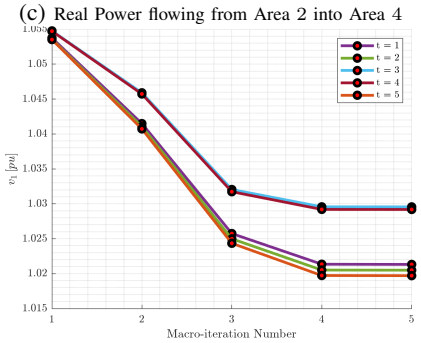
(c) Real Power flowing from Area 2 into Area 4



(d) Voltage at the PoI of Area 1 and Area 2



(e) Voltage at the PoI of Area 1 and Area 3



(f) Voltage at the PoI of Area 2 and Area 4

Fig. 2: Convergence of Boundary variables with every iteration. Each plot represents a particular variable exchanged between a pair of connected areas. Each line graph within a plot represents a particular time period.

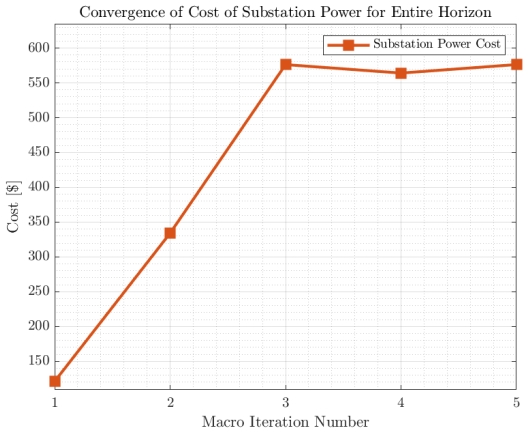


Fig. 3: Convergence of Objective Function Value with each iteration

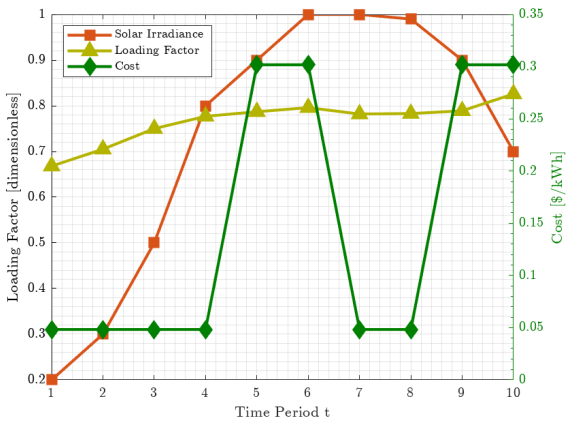


Fig. 4: Forecasts for Demand Power, Irradiance and Cost of Substation Power over a 10 Hour Horizon

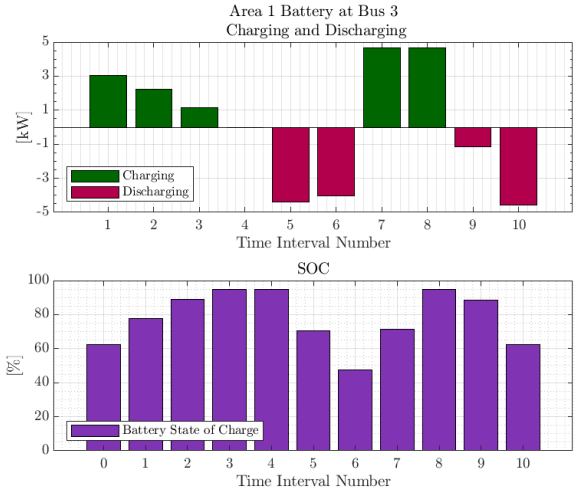


Fig. 5: Charging-Discharging and SOC graphs for Battery at Bus 3 located in Area 1 obtained via MultiPeriodENApp