Integration of 75MW Solar PV Plant: Transmission System Design Analysis

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Project Objectives

Design transmission system modifications to:

- Integrate 75 MW solar PV at NEWSOLAR substation
- Provide redundant transmission paths
- Resolve existing system violations
- Maintain stability under N-1 contingency
- Minimize total cost including 5-year loss reduction

Initial System Analysis

Base System Characteristics:

- Total load: 826.3 MW, 275.5 Mvar
- Generation: 837.7 MW from 10 generators
- System losses: 10.7 MW (1.3%)
- Reactive support: -122.5 Mvar from 9 switched shunts

Existing System Violations

Contingency	Flow	Limit	%
PINE138-PINE69 Xfmr:			
OAK69-BUCKEYE69	760.3	686.1	110.8
BUCKEYE69-APPLE69	454.2	418.4	108.6

Design Approach

- Evaluate all possible connection configurations
- Compare 69 kV vs 138 kV options
- Start with shortest distance solution
- Use least expensive conductors initially
- Upgrade components only as needed
- Consider loss reduction benefits

Candidate Solutions

19 possible configurations evaluated:

- 69 kV options: $5.94M - $12.23M
- 138 kV options: $14.37M - $19.42M
- Shortest path: NEWSOLAR to BUCKEYE69 & APPLE69 (12 km)
- Required upgrade: OAK69-BUCKEYE69 to Crow conductor

Selected Solution Cost Breakdown

Component	Cost (M$)
OAK-BUCKEYE Upgrade	3.87
NEWSOLAR-BUCKEYE Line	2.97
NEWSOLAR-APPLE Line	2.97
Loss Savings (0.9 MW)	-2.37
Total	**7.44**

Loss Reduction Analysis

- Base case losses: 10.7 MW
- New configuration: 9.8 MW
- Savings: 0.9 MW
- 5-year energy savings: 39,420 MWh
- Economic value: $2.37M at $60/MWh

Conclusions

- Optimal solution: 69 kV connections to BUCKEYE & APPLE
- OAK-BUCKEYE upgrade resolves contingency violations
- Total cost $7.44M including loss savings
- Meets all reliability and redundancy requirements
- Simple design facilitates implementation

Questions?

Thank you!!