



i-PCGRID Workshop 2016

Alternative Solution to Support Rebuilding of Transmission Infrastructure

March 2016

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Managing Overloads and Congestion During Construction

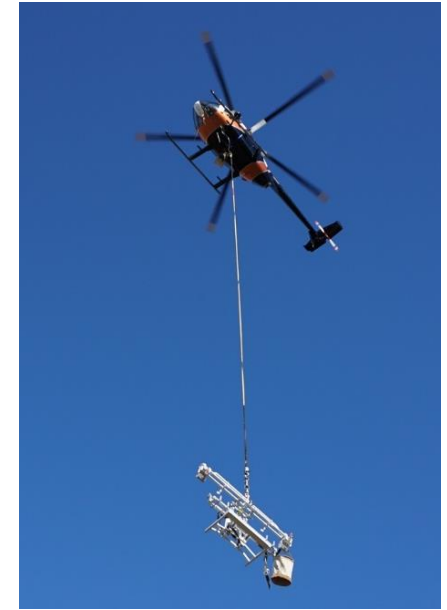
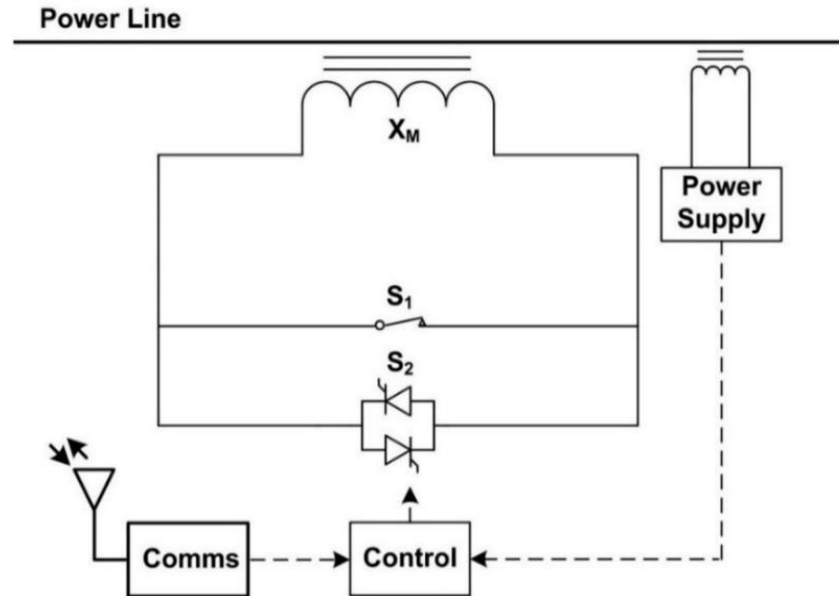
Upgrading (by reconductoring or rebuilding) transmission lines can require removal of the lines for extended periods of time.

Issue: Still need to maintain system performance during construction.

Typical solutions:

- Perform the upgrades only during low loading periods
 - Can increase the construction period
- Out-of-merit re-dispatch of existing generators
 - Can be expensive
- Build temporary line to carry the load
 - Can be expensive
- Contract for demand-side response
 - May not always be feasible or effective

Installation of the PowerLine Guardian



- Clamshell construction – two halves secured together with a torque wrench
- Rapid deployment: 6 units/tower in <1 hour (de-energized)
- Reduced/eliminated permitting requirements and no new easements or right-of-ways needed
- Patented installation tool
- Energized installation under development
- Re-deployable



Case Study Background

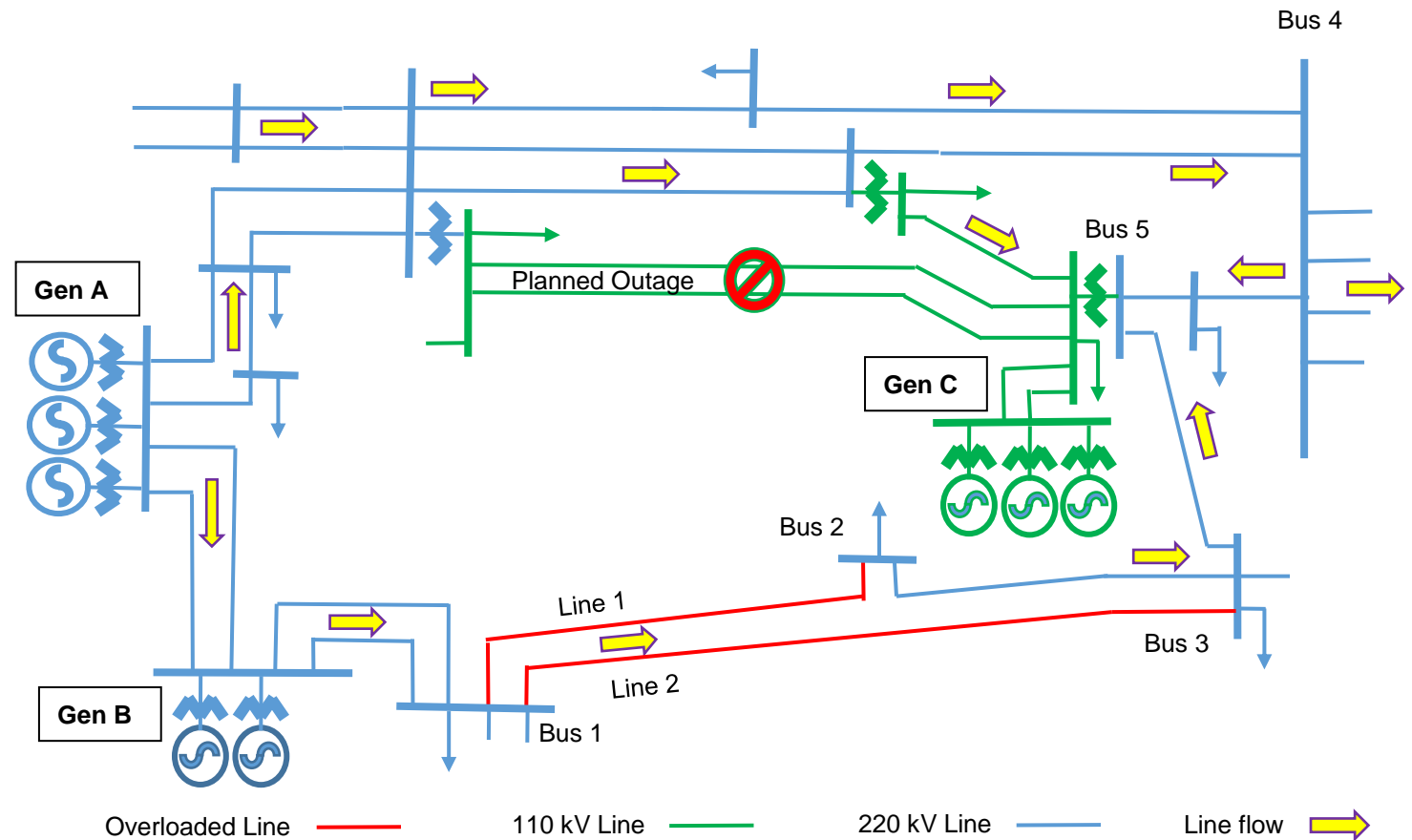
Need: Remove two, 70-mile 110 kV lines on poles to rebuild into two 220 kV lines on towers

Load centers: East of Bus 4 and at Bus 5

Generation: Gen A (Hydro), Gen B (Hydro), Gen C (Gas-fired)

Operation Details:

- Gen A and B are dispatched first during May – August
- Cost of Gen C is \$70/MWh higher than Gen A and Gen B
- Gen C minimum generation = 50 MW
- Gen C can go from cold start to full load in 6 hours; Once up, Gen C will need to be on-line for at least 8 hours



Case Study

Problem: Potential overloads under normal operating conditions during construction period. Overloads on

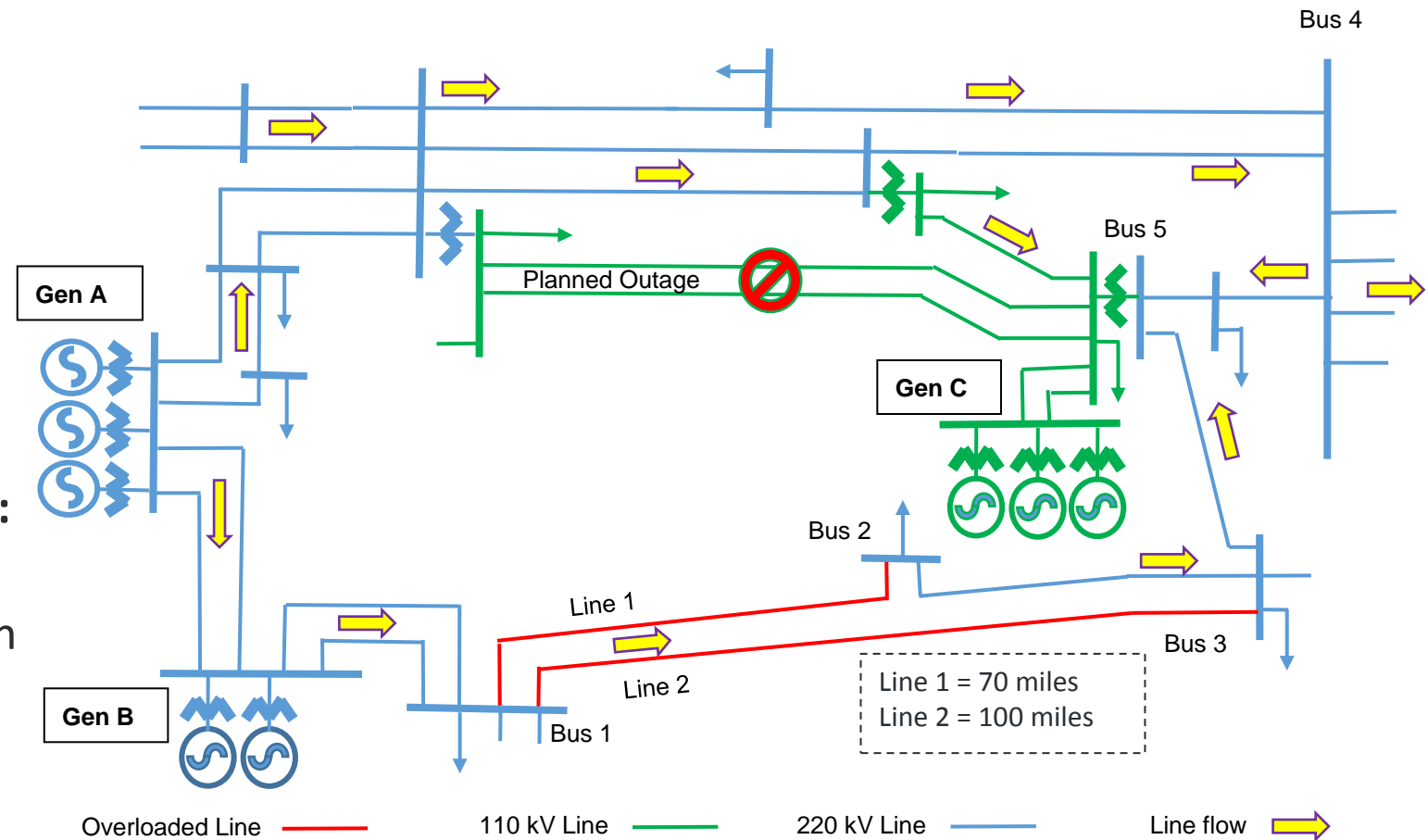
- Line 1 during “Normal” peak load conditions
- Line 1 or Line 2 on outage of the parallel line

1. Solution needs to be implementable at start of construction

2. Don't anticipate any voltage or stability problems

Alternative Solutions:

1. Out-of-merit generation dispatch
2. Install D-FACTS on Lines 1 and 2



Evaluation of Alternative Solutions

Alternative 1

Out-of-Merit Dispatch needed for 4 months (May – August) to avoid overloads

Alternative 2

Deploy D-FACTS on Lines 1 and 2 for one year.

- Carrying cost of installing 2,334 D-FACTS devices on Lines 1 and 2 for one year
= between \$2.3 million and \$6.2 million
- Carrying cost over 3.5 years construction period
= between \$8.2 and \$21.8 million
- Savings of avoiding out-of-merit dispatch for one year
= \$17.2 million
- Savings during the 3.5 years construction period
= between \$51.5 million and \$60.1 million

Over the 3.5 years construction period,
Alternative 2 provides savings of ~\$40.9 million relative to Alternative 1

Generation Dispatch and Line Loadings with and without D-FACTS

Gen Plant	Minimize Production Cost		Alternative 1		Alternative 2		
	Gen Dispatch (MW)		Gen Dispatch w/o D-FACTS (MW)		Gen Dispatch w/ D-FACTS (MW)		Saving for 4 months
A	281		150		281		
B	364		240		364		
Sub-Total	645		390		645		
C	496		750		496		
Sub-Total	496		750		496		
							(\$17,180,800)
Line	Line Loading		Loading w/o D-FACTS		Loading w/ D-FACTS		# of D-FACTS Units
	MVA	% of Rating	MVA	% of Rating	MVA	% of Rating	
Line 1 (Base Case)	388.8	105	323.4	87	363.2	98	1,070
Line 2 (Loss of Line 1)	502.5	120	417.9	100	419.9	100	1,188
Line 1 (Loss of Line 2)	529.3	118	441.0	98	450.0	100	1,146
Total number of D-FACTS Units Needed assuming pre-contingency dispatch							2,334

Note: Red font indicates overloads

Assume Gen C generates an additional 254 MW for 8 hours a day and an additional 50 MW for 16 hours a day on weekdays from May through August.

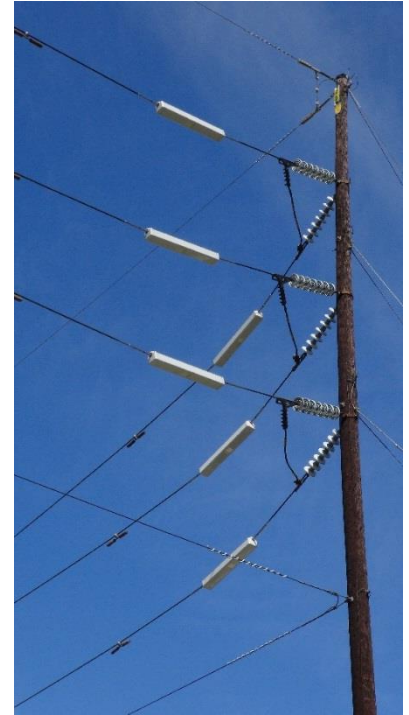
Conclusions

- D-FACTS devices can be useful in supporting construction needed to reinforce the system
- The D-FACTS devices are redeployable, they can be moved and reused in other areas of need when construction is complete.
- The data collected by the D-FACTS devices (such as current, temperature, sag angle) can also help improve visibility for real-time operations.

Questions?



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