

Impact of Distributed Energy Resources on Arc Flash Incident Energy

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Dominion Energy
PJM Ride-Through Workshop

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Agenda

- Introduction
- Assumption / Set-up
- Modeling Variables
- Variable Impacts
- Mitigation
- Conclusions



Introduction

- Overhead Line Distribution Energized Work
- NESC 410A3 – Employer is responsible to determine exposure.
- Personal Protection Equipment rating greater than the exposure
- $4 > \text{Arc Flash} - \text{cal/ cm}^2 < 8$



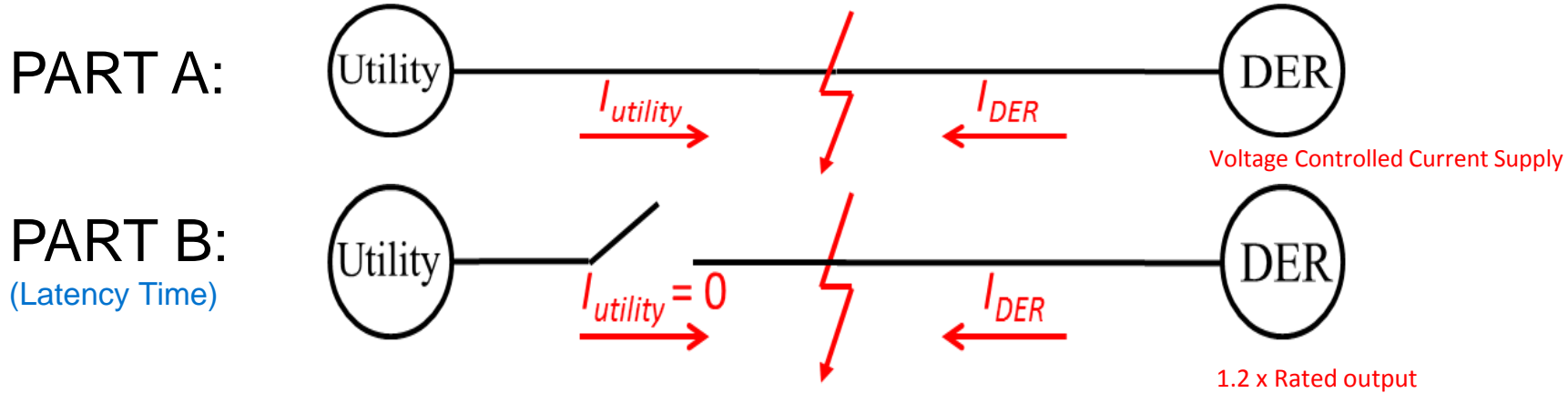
Effective Cover Up Performed on Overhead Lines
(Dominion Energy Training Facility)

Assumption/ Set-up

- Single phase-to-ground fault
- Bolted fault – no fault impedance added
- Open air fault
- Working distance – 15 in
- Arc gaps – follows NESC 410
- All 9 case studies: 34.5 kV
- Used ArcPro
- DER stays online after utility opens
- Fault is sustained

Assumption/ Set-up

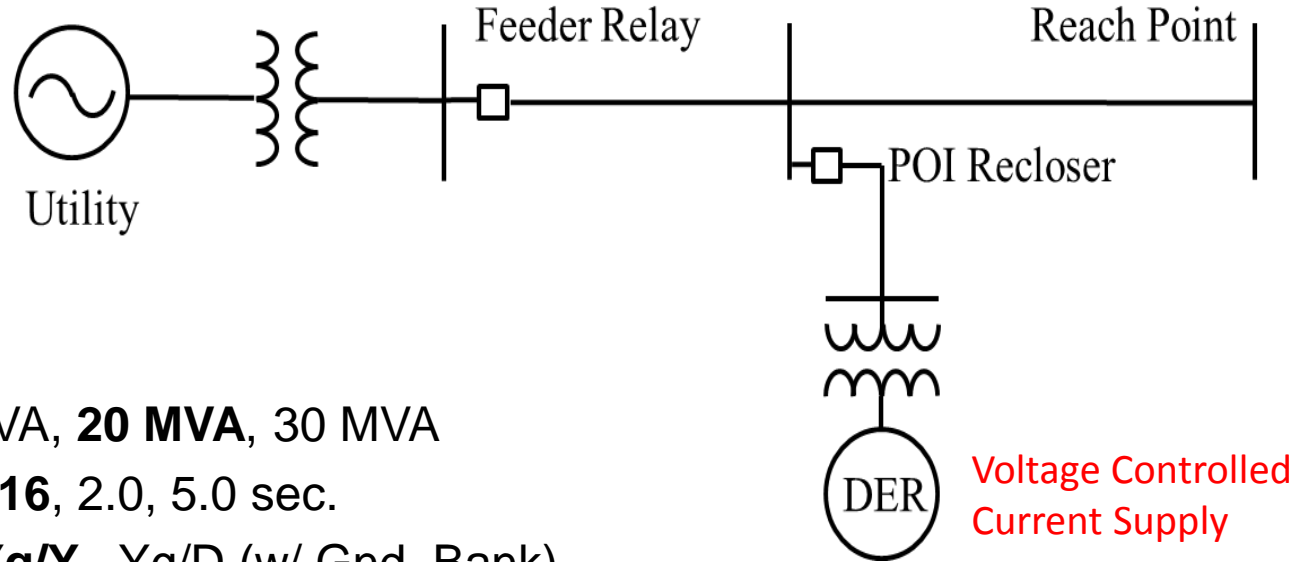
- DER Comes offline after utility is disconnected.



$$A + B = C$$

(Assumes a sustained arc)

Modeling Variables

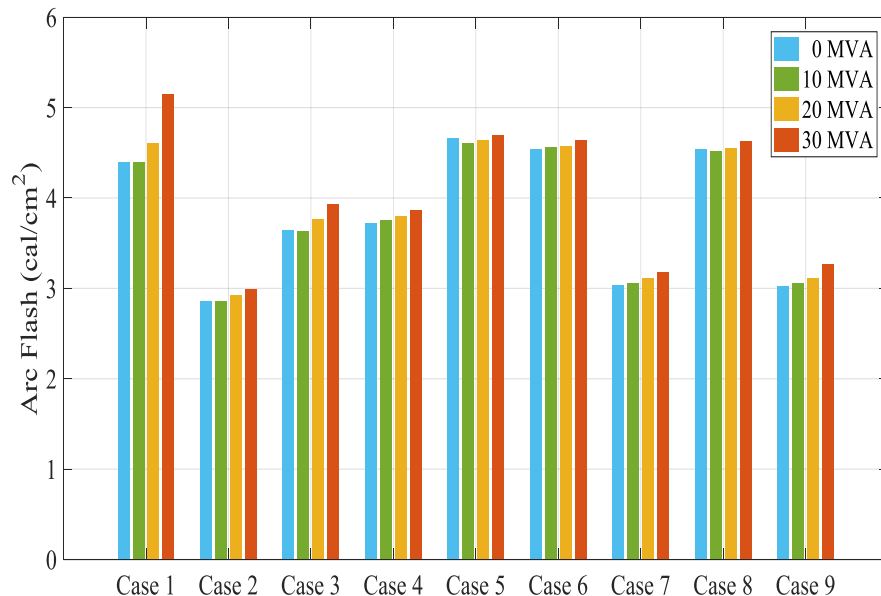


- DER Size: 10 MVA, **20 MVA**, 30 MVA
- DER Latency: **0.16**, 2.0, 5.0 sec.
- DER GSU Tx.: **Yg/Y** , Yg/D (w/ Gnd. Bank)

DER Viable Impact: **Size**

Fixed: Latency – 0.160 s & GSU – Yg/Y

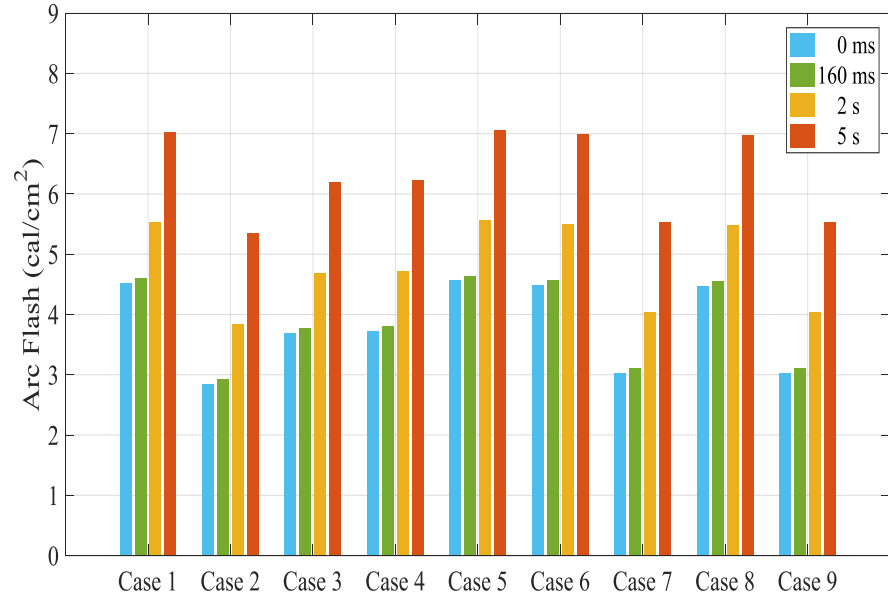
- 30 MVA - 5.70% increase
- 20 MVA - 2.13% increase
- 10 MVA – 0.20% increase
- Case 1's 30 MVA study causes 17.18% increase



DER Viable Impact: **Latency Time**

Fixed: Size – 20MVA & GSU – Yg/Y

- 0.160s - 2.7% increase
- 2 s - 27.0 % increase
- 5 s - 67.7 % increase

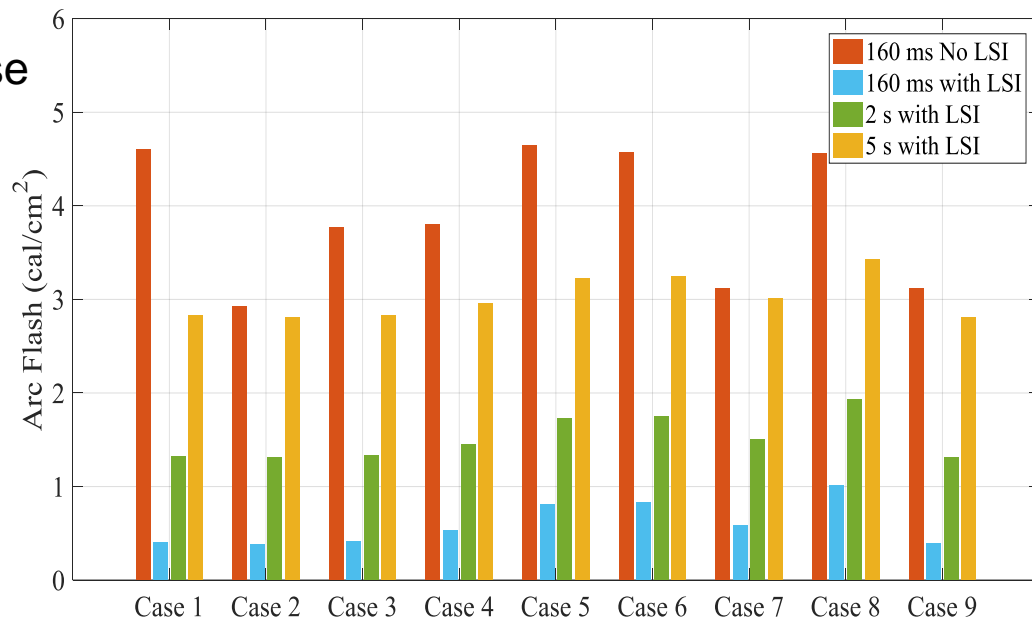


DER Mitigation: Low Set Instantaneous (LSI)

- 160 ms – 15.13 % of the base case
- 2 s – 39.48% of the base case
- 5 s – 79.19% of the base case

Cons:

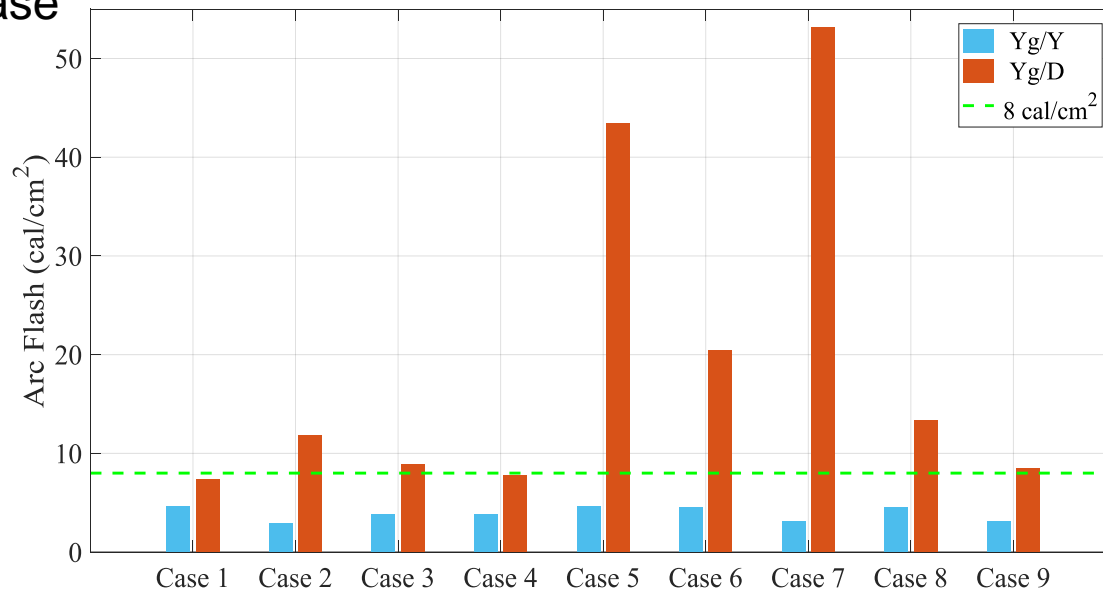
- Protection coordination is sacrificed at the expense of safety



DER Viable Impact: Transformer Config.

Fixed: Size – 20MVA & Latency – 0.160 s

- Yg/ D - 418 % increase

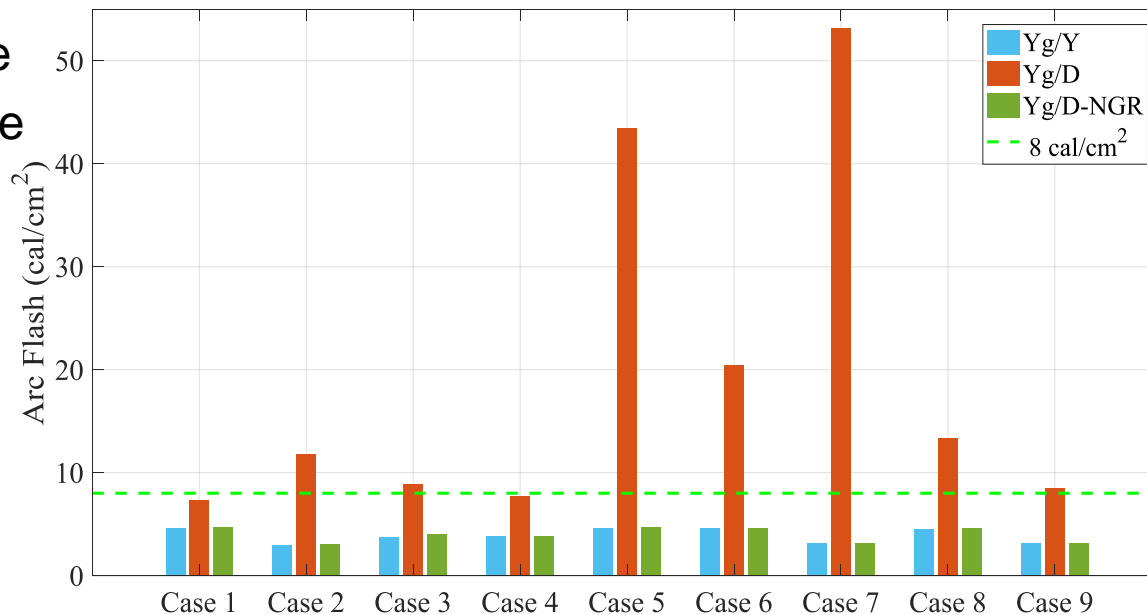


DER Mitigation: **NGR**

- Yg/D - 418 % increase
- w/ NGR - 2.42 % increase

Cons:

- Can be inadvertently bypassed
- Will de-sensitize ground settings



Conclusion

- Increased DER MVA size increases exposure:
(10 MVA) 0.20%, (20 MVA) 2.13%, (30 MVA) 5.70%
- Longer ride-through times will substantially increase exposure:
Approx. **14% increase in Cal / cm²** for each (1s) second of Latency @ 34.5 kV and 20MW
- Transfer Trip: Preferred to control exposure from DER
- Yg / D requires NGR to manage exposure: (Yg-Y is preferred)
- Low Set INST. decreases exposure in (Part A) by sacrificing downline coordination

Why we care....



Dominion Energy Crew