

TSDOS

TRANSMISSION &
SUBSTATION
DESIGN &
OPERATION
SYMPOSIUM



THE UNIVERSITY OF TEXAS AT ARLINGTON

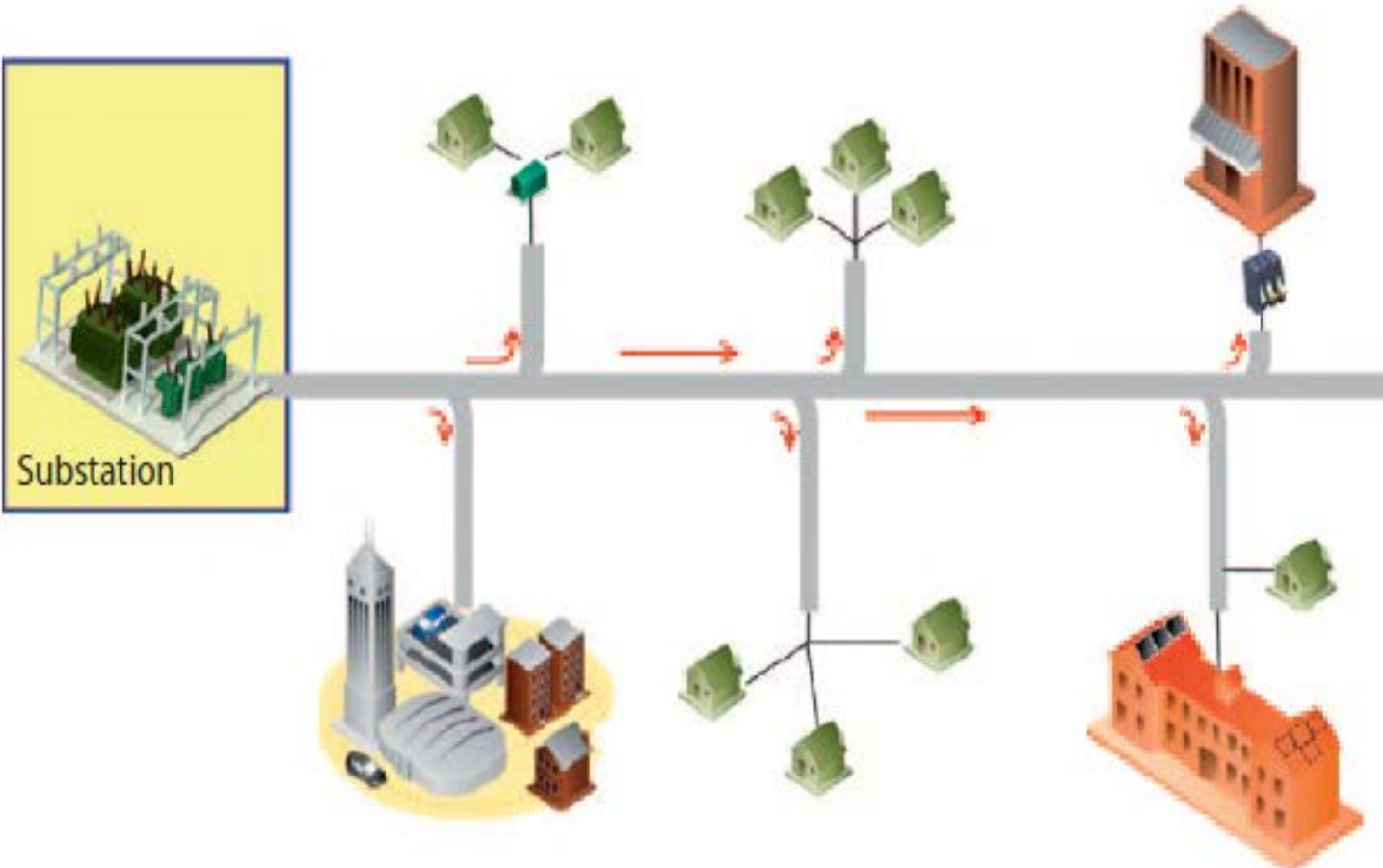
Microgrids, Distributed Energy Resources & Smart Grids Changing Planning, Design and Operations of the Power System

Kenneth A. Donohoo

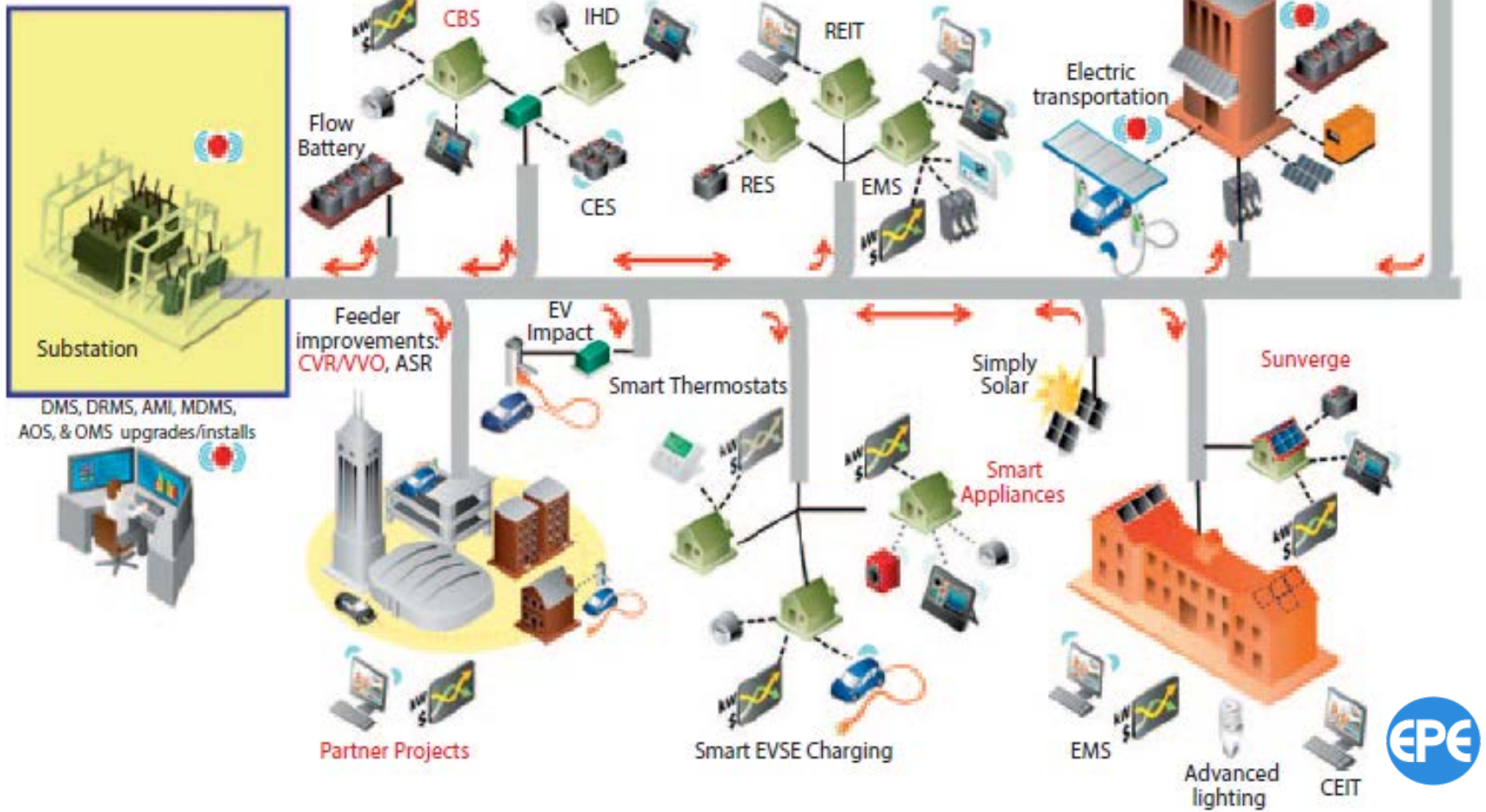
Darrell Thornley



TRADITIONAL GRID



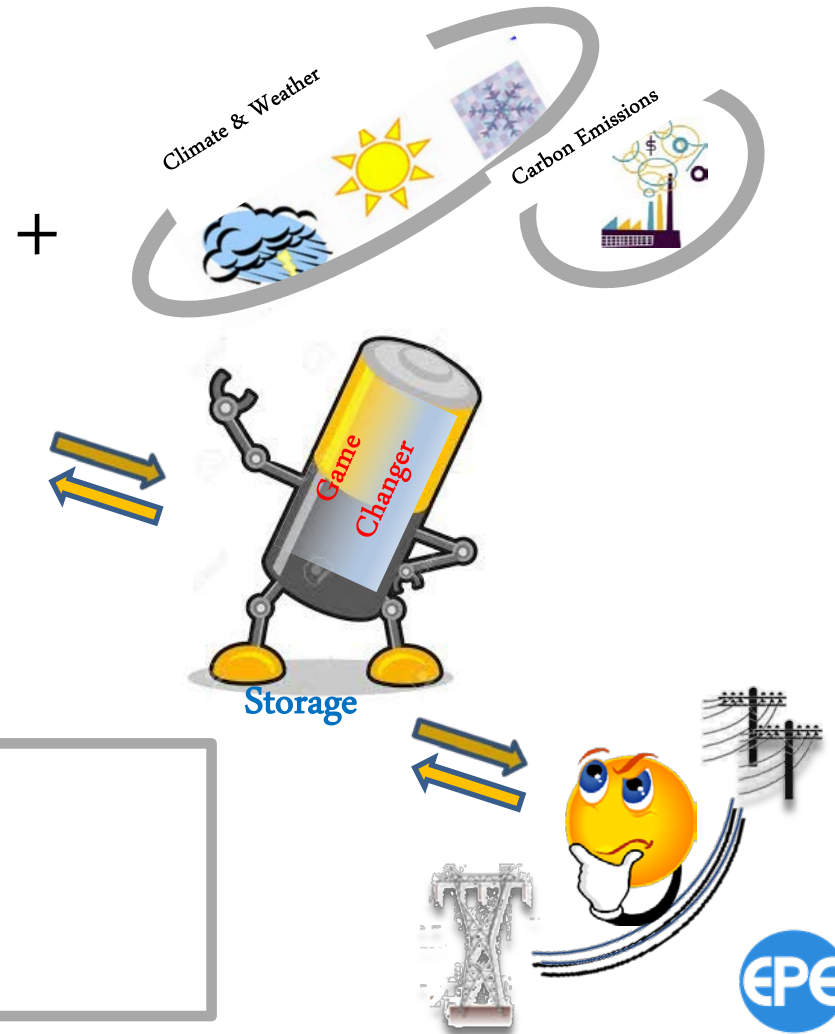
IMMINENT GRID



SMART GRID



+



SECURE MICROGRID® DEVELOPMENT PROCESS

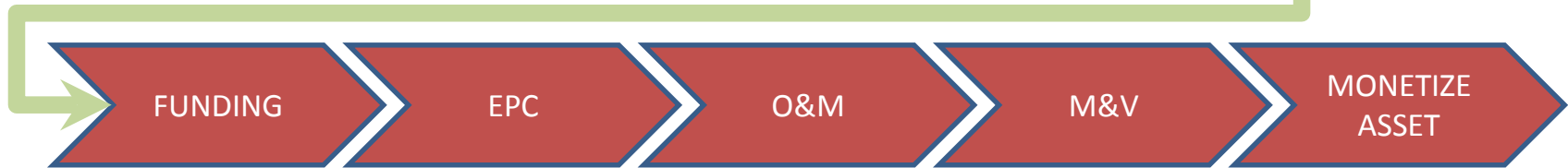
US PATENT #9,026,260



PROJECT DEVELOPMENT



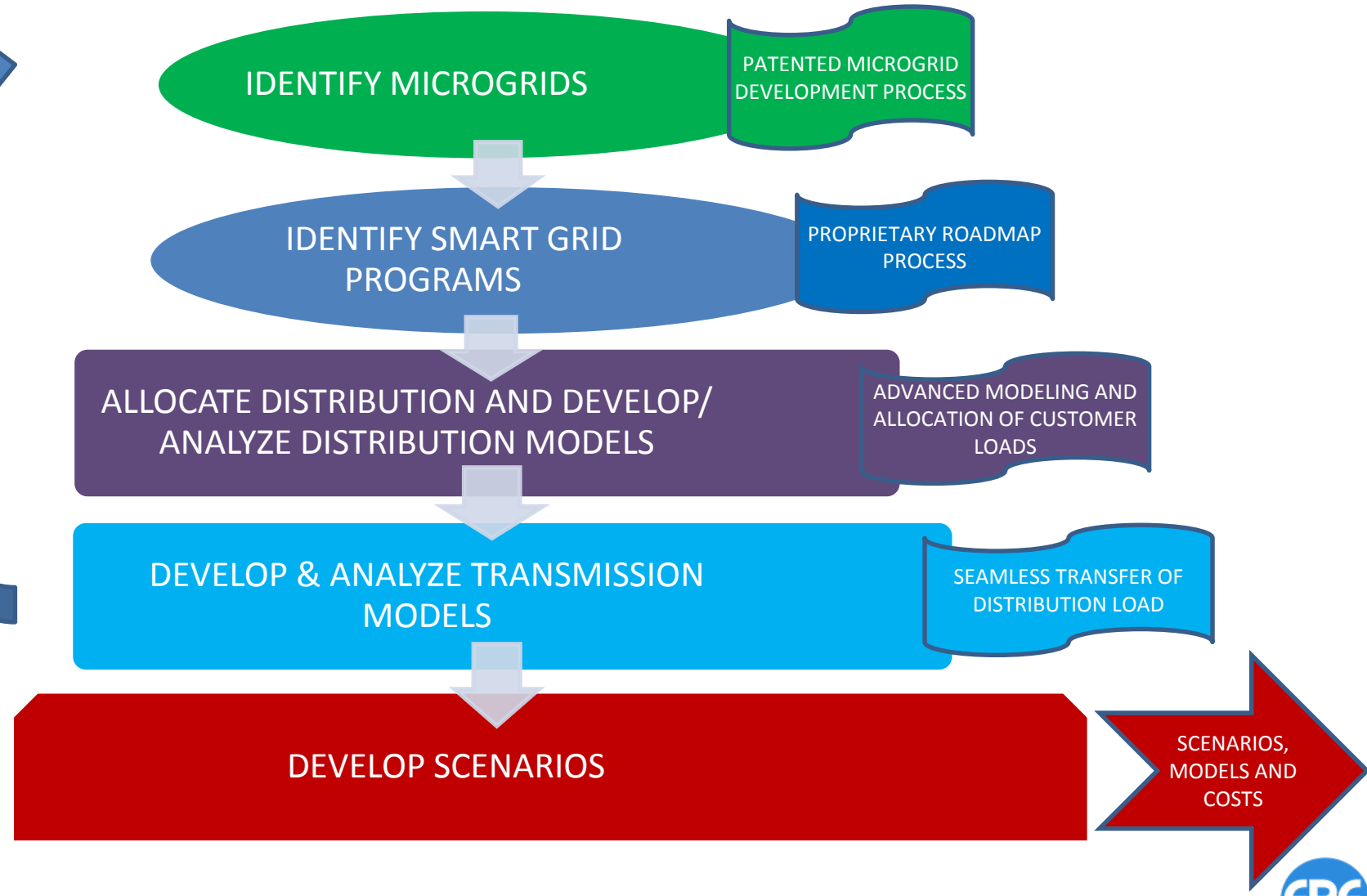
TECHNOLOGY PROVIDERS



PROJECT DELIVERY

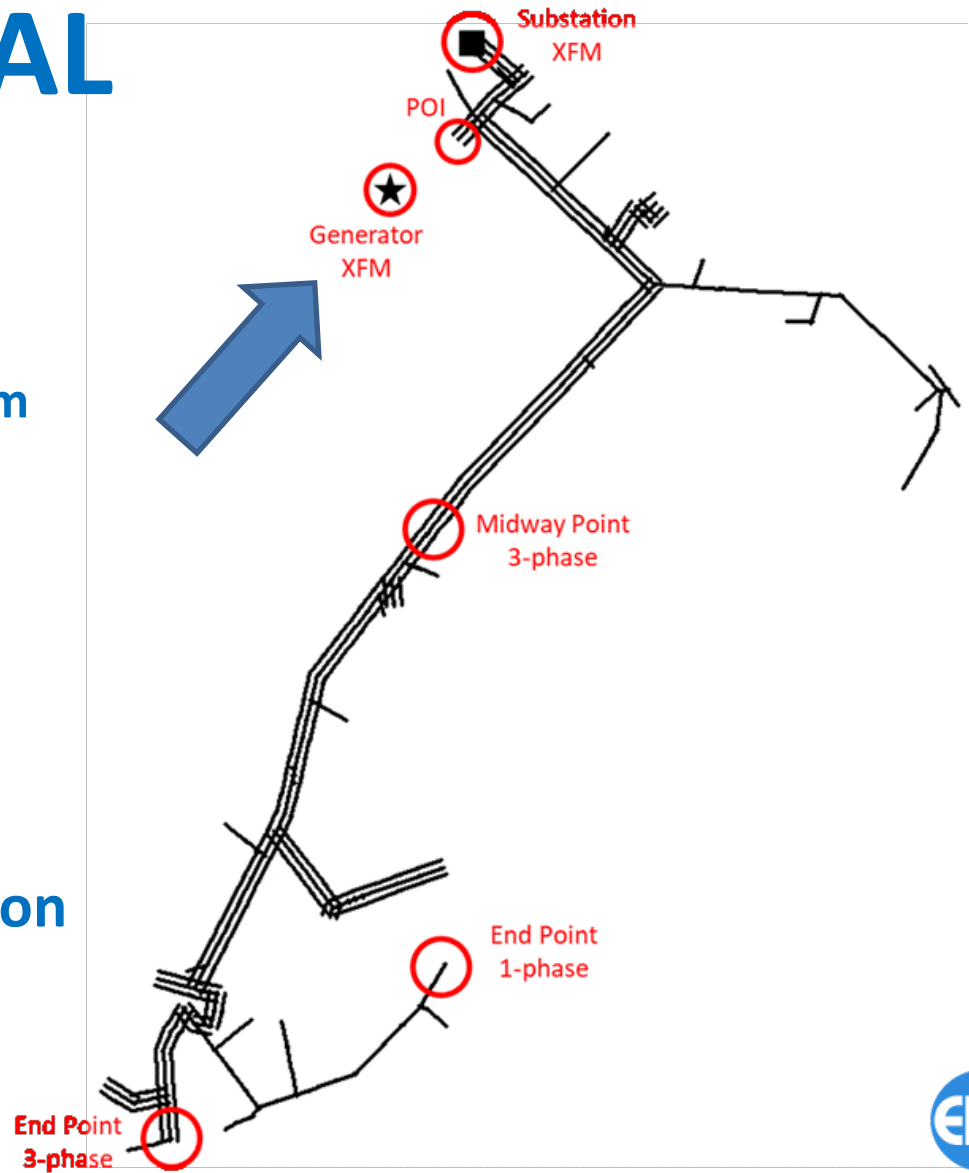


ITERATE



OPERATIONAL MICORGRID

- Load Levels
 - Maximum & Minimum
- Generation Levels
 - Zero to 10 MW
- Power Flow
 - T & D
- Voltage Impact
- Short Circuit
- Protection Coordination
- ARC Flash
- Operations



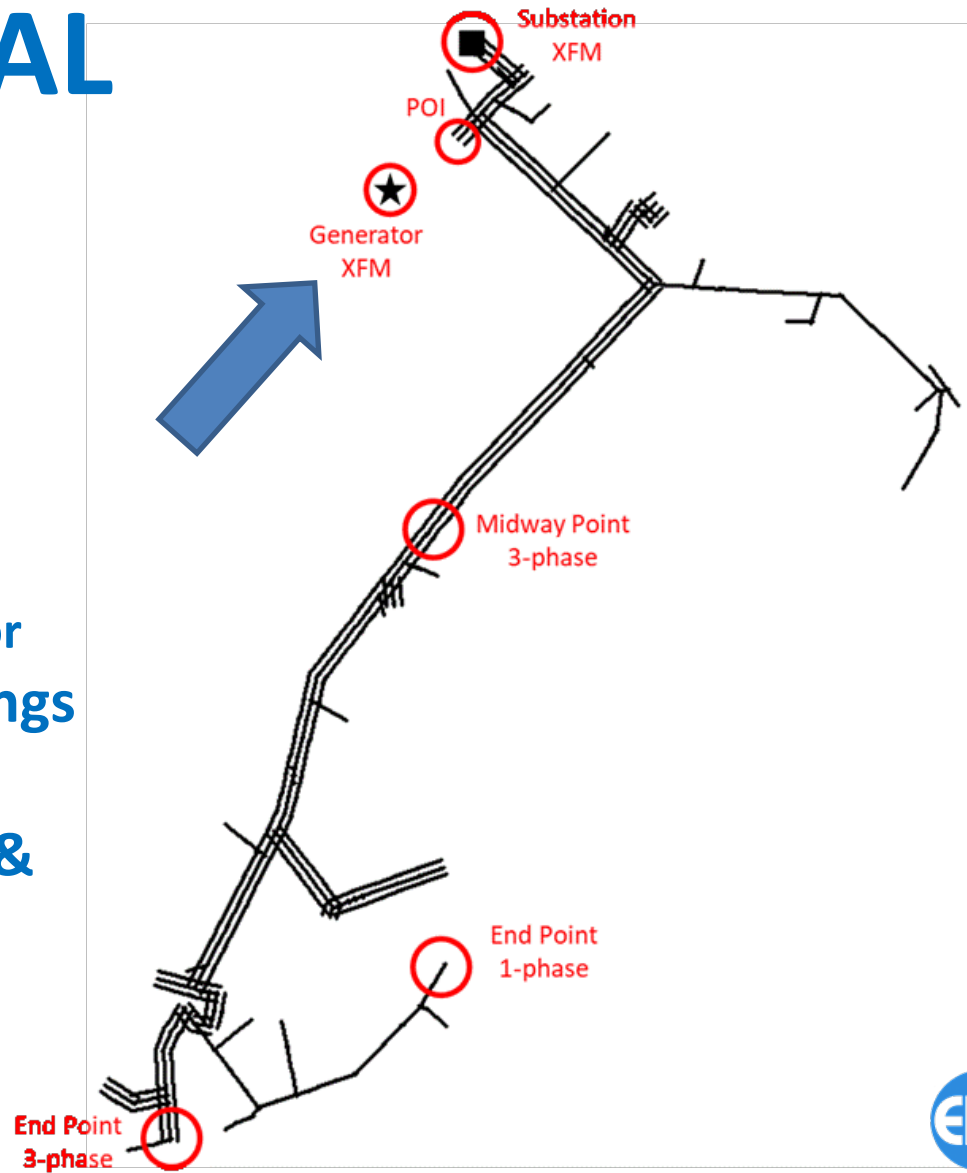
SCENARIOS

Case #	Case Used	Max Load	Min Load	LTC	No LTC	6 Gen Units Online	2 Gen Units Online	6 Gen Units Offline	2 Gen Units Offline	A&M Load and Gen Units Offline	A&M Load and Gen Units Online
0 – MaxL		x		x							
0 – MinL			x	x							
1	0 – MaxL	x			x	x					
2	0 – MinL		x		x	x					
3	0 – MaxL	x		x		x					
4	0 – MinL		x	x		x					
5	0 – MaxL	x		x						x	
6	0 – MinL		x	x						x	
7	0 – MaxL	x		x			x				
8	0 – MinL		x	x			x				
9	0 – MaxL	x			x		x				
10	0 – MinL		x		x		x				
11	3	x			x					x	
12	4		x		x					x	
13	5	x			x	x					x
14	6		x		x	x					x
15	3	x			x			x			
16	4		x		x			x			
17	7	x			x				x		
18	8		x		x				x		



OPERATIONAL MICORGRID

- No Thermal Loading Issues
- Voltage Violations Identified
 - Consider Power Factor
- No Fault Current Ratings Exceeded
- Protection Additions & Changes
- ARC Flash Increased

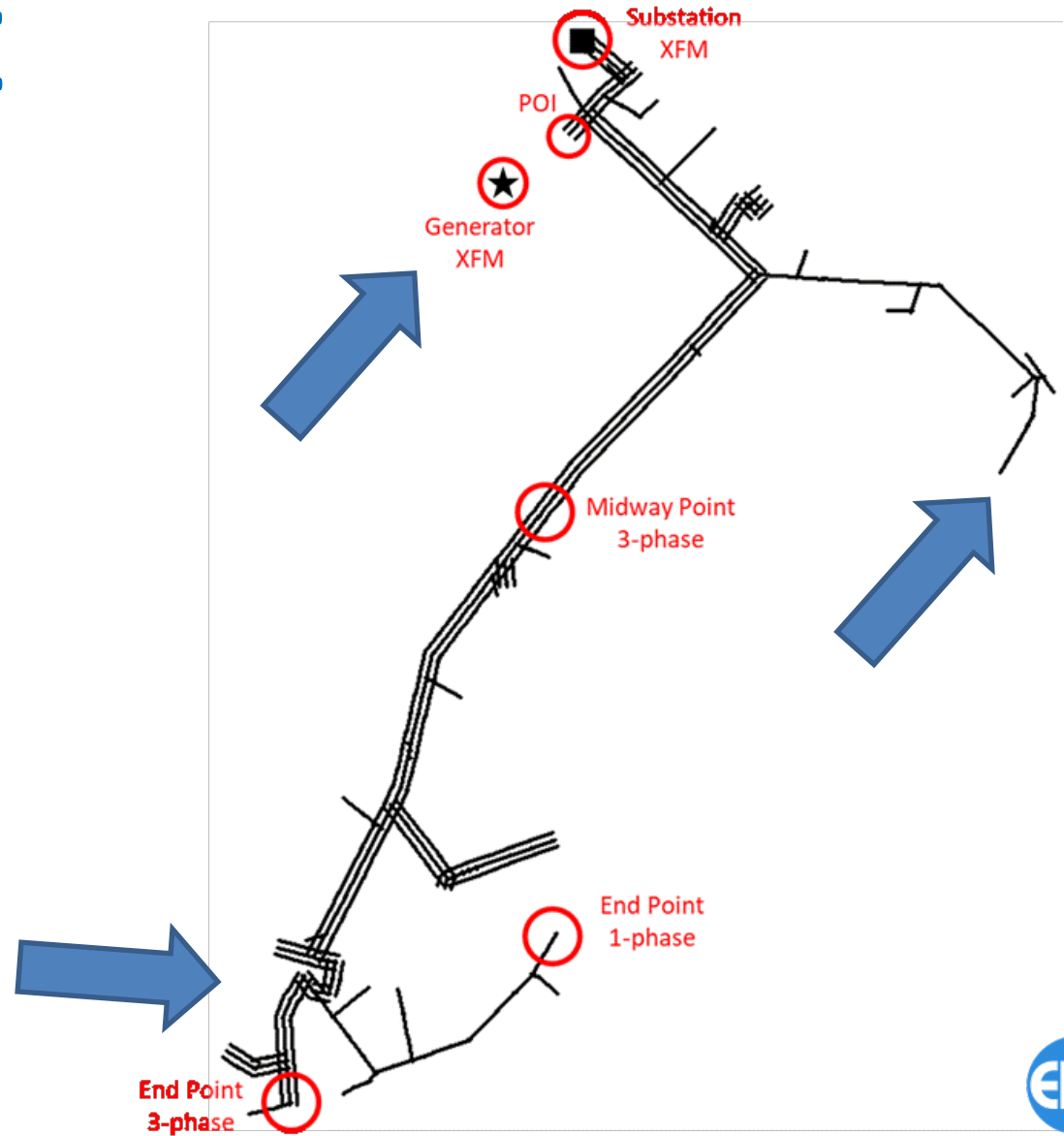


- **Energy source on distribution feeder**
 - Faults, dangerous conditions, circuit maintenance, reconfiguration & single phase operation
 - Transmission operations
- **Opening and closing of circuits a concern**
 - Islanding; customers energized with energy source
 - Out of phase operations
- **Out of phase closing**
 - Transient can be damaging to utility and customers
 - Very high transient voltages
 - Transient torques on motors
 - High inrush currents
 - Operation of protective devices
 - Fail surge arresters
 - Due to adverse impacts usually not acceptable
- **Increase coordination & communication**
- **Procedure for returning Microgrid to system**

SAFETY



MULTIPLE SOURCES



QUESTIONS & DISCUSSION

