

# Mobile STATCOM

*The worlds first fully Mobile STATCOM as a new  
Construction, Operations and Restoration tool for  
Dominion Energy*

CIGRE GOTF 2017



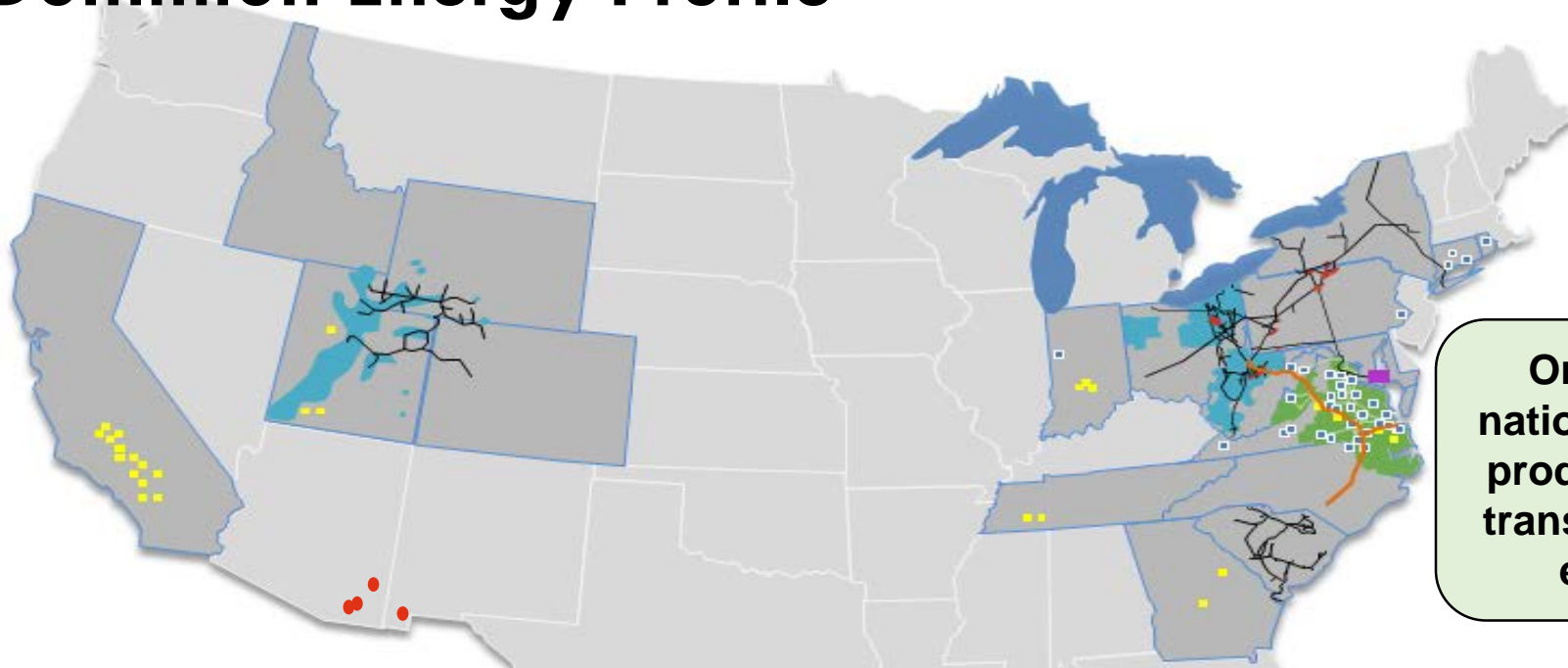
Presented by Mark McVey

Date October 23<sup>rd</sup> 2017



INTERNATIONAL COUNCIL  
ON LARGE ELECTRIC SYSTEMS

# Dominion Energy Profile



One of the nation's largest producers and transporters of energy.

26,200 MW of electric generation

(includes ~765 MW of solar generation)

6,600 miles of electric transmission

2.6 million electric customers in VA and NC

Atlantic Coast Pipeline (subject to regulatory approval)

15,000 miles of natural gas transmission, gathering and storage pipeline

1 trillion cubic feet of natural gas storage operated

Dominion Energy Cove Point LNG Facility

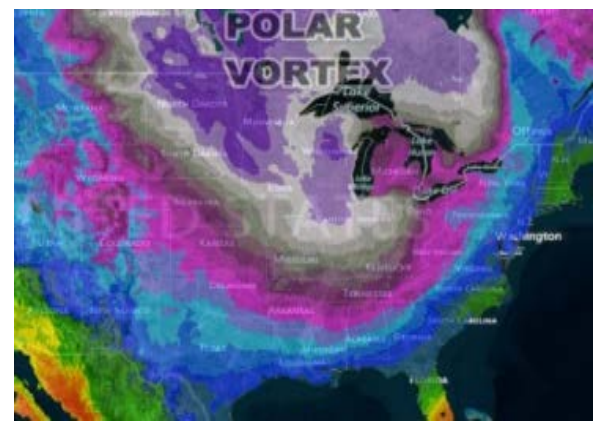
2.3 million natural gas customers in 5 states

1.4 million non-regulated retail customers in 17 states (not shown)

# Maintaining safety, reliability, and resiliency among today's Electric Grid challenges

- **Natural Events**

- Hurricanes, Tornadoes, Derecho Events



CIGRE SC B3









Magnetic Disturbances  
Quakes  
Vortex

- **Man-made Events**

- Terrorism (Physical/Cyber)
- Electromagnetic
- Copper Theft

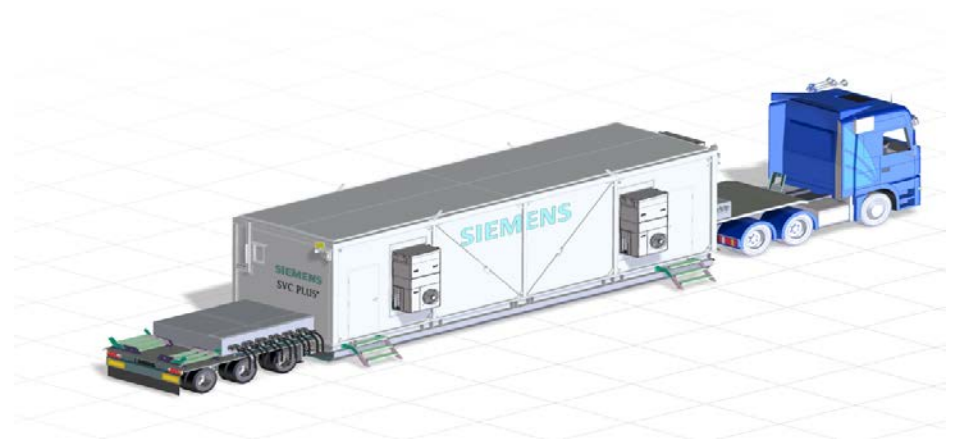


- **Changing location & mix of generation**

	Water		Wind		Solar
	Biomass		Fuel cell		Microgrid

# Deploying new technology to address operations - from daily events to extreme contingencies

- FACTS Devices on both the transmission and distribution systems
  - STATCOMS
  - SVCs
- Piloting a Distribution STATCOM to support the impacts of DG
- Increasing resiliency and operation with Mobile STATCOM



# Planning VS Construction & Operations

- In most cases planning studies worst case at peak load
- Studies Typically look at N-2
- Upgrading and Upgrading Projects have smaller windows
- Renewables in the Q are difficult to plan for
- Generation plants only have to give PJM 90 days notice
- Temporary High Speed Technologies Needed

# Transmission STATCOM Mobile Advantages

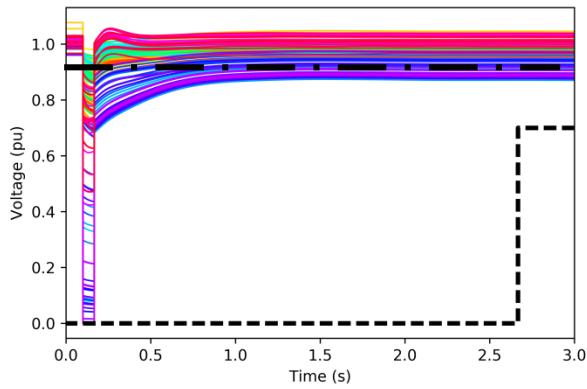
- Allows for Project Construction schedules to have expanded windows for construction by eliminating voltage violations
  - Eliminates mobilization and demobilization of contract resources
  - Allows for shorter construction schedules
  - Provides cost savings to ratepayers and stockholders
- Growing deployment of renewables and retirement of conventional generation in short timeframes creating additional VAR and dynamic stress on electric systems before projects can be implemented to resolve
  - STATCOM mobile allows opportunity to quickly resolve operating issue while long term solutions are constructed

# N-2 Results (During Line Reconductoring)

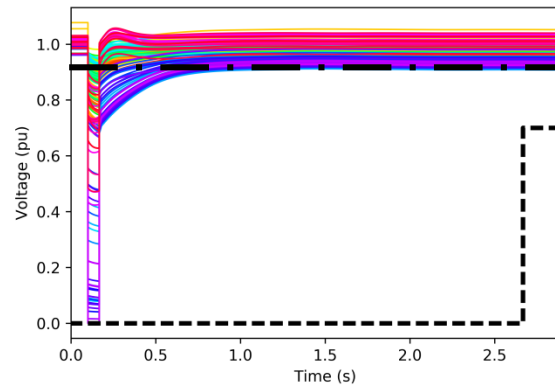
RegionALoad	1459.5+j367.2	1384.3+j348.3	1309.1+j329.4	1234+j310.5	1158.8+j291.5	1083.6+j272.6	1008.4+j253.7	933.2+j234.8	858+j215.9	782.8+j197	707.6+j178.1
Large Customer Load	35.1+j8	33.3+j7.6	31.5+j7.1	29.7+j6.7	27.9+j6.3	26.1+j5.9	24.2+j5.5	22.4+j5.1	20.6+j4.7	18.8+j4.3	17+j3.9
AddedDevice	20000 MW	19000 MW	18000 MW	17000 MW	16000 MW	15000 MW	14000 MW	13000 MW	12000 MW	11000 MW	10000 MW
LockTap0-Nodevice	45	28	10	None	None	None	None	None	None	None	None
LockTap0-Sub1-1stat-0cap	23	10	None	None	None	None	None	None	None	None	None
LockTap0-Sub1-2stat-0cap	16	None	None	None	None	None	None	None	None	None	None
LockTap0-Sub1-1stat-2cap	None	None	None	None	None	None	None	None	None	None	None
LockTap0-Sub1-2stat-2cap	None	None	None	None	None	None	None	None	None	None	None
LockTap0-Sub1-1stat-2cap_Sub2 115-1stat	None	None	None	None	None	None	None	None	None	None	None
LockTap0-Sub1-1stat-2cap_Sub2 230-1stat	None	None	None	None	None	None	None	None	None	None	None
LockTap0-Gen3ON	None	None	None	None	None	None	None	None	None	None	None
LockTap1-Nodevice	45	38	6	None	None	None	None	None	None	None	None
LockTap1-Sub1-1stat-0cap	39	13	None	None	None	None	None	None	None	None	None
LockTap1-Sub1-2stat-0cap	29	2	None	None	None	None	None	None	None	None	None
LockTap1-Sub1-1stat-2cap	None	None	None	None	None	None	None	None	None	None	None
LockTap1-Sub1-2stat-2cap	None	None	None	None	None	None	None	None	None	None	None
LockTap1-Sub1-1stat-2cap_Sub2 115-1stat	None	None	None	None	None	None	None	None	None	None	None
LockTap1-Sub2-1stat-2cap_Sub2 230-1stat	None	None	None	None	None	None	None	None	None	None	None
LockTap1-Gen3ON	None	None	None	None	None	None	None	None	None	None	None
RegionALoad	1459.5+j367.2	1384.3+j348.3	1309.1+j329.4	1234+j310.5	1158.8+j291.5	1083.6+j272.6	1008.4+j253.7	933.2+j234.8	858+j215.9	782.8+j197	707.6+j178.1
Large Customer Load	35.1+j8	33.3+j7.6	31.5+j7.1	29.7+j6.7	27.9+j6.3	26.1+j5.9	24.2+j5.5	22.4+j5.1	20.6+j4.7	18.8+j4.3	17+j3.9
AddedDevice	20000 MW	19000 MW	18000 MW	17000 MW	16000 MW	15000 MW	14000 MW	13000 MW	12000 MW	11000 MW	10000 MW
LockTap0-Nodevice	10	3	1	None	None	None	None	None	None	None	None
LockTap0-Sub1-1stat-0cap	5	2	1	None	None	None	None	None	None	None	None
LockTap0-Sub1-2stat-0cap	3	1	1	None	None	None	None	None	None	None	None
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LockTap1-Nodevice	8	3	1	None	None	None	None	None	None	None	None
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LockTap1-Sub1-2stat-0cap	3	1	1	None	None	None	None	None	None	None	None
LockTap1-Sub1-1stat-2cap	3	2	1	None	None	None	None	None	None	None	None
LockTap1-Sub1-2stat-2cap	3	1	1	None	None	None	None	None	None	None	None
LockTap1-Sub1-1stat-2cap_Sub2 115-1stat	3	1	1	None	None	None	None	None	None	None	None
LockTap1-Sub1-1stat-2cap_Sub2 230-1stat	3	1	1	None	None	None	None	None	None	None	None
LockTap1-Gen3ON	None	None	None	None	None	None	None	None	None	None	None



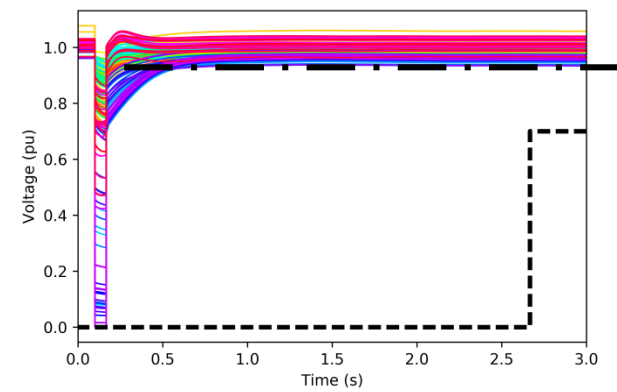
No Compensation



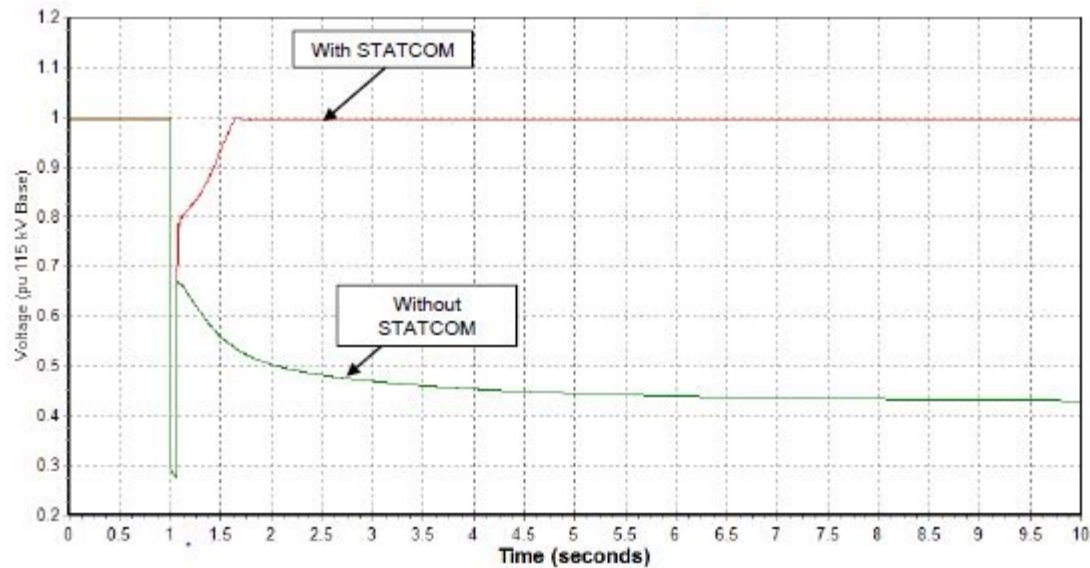
1 Statcom 0 Capbank



1 Statcom 2 Capbank

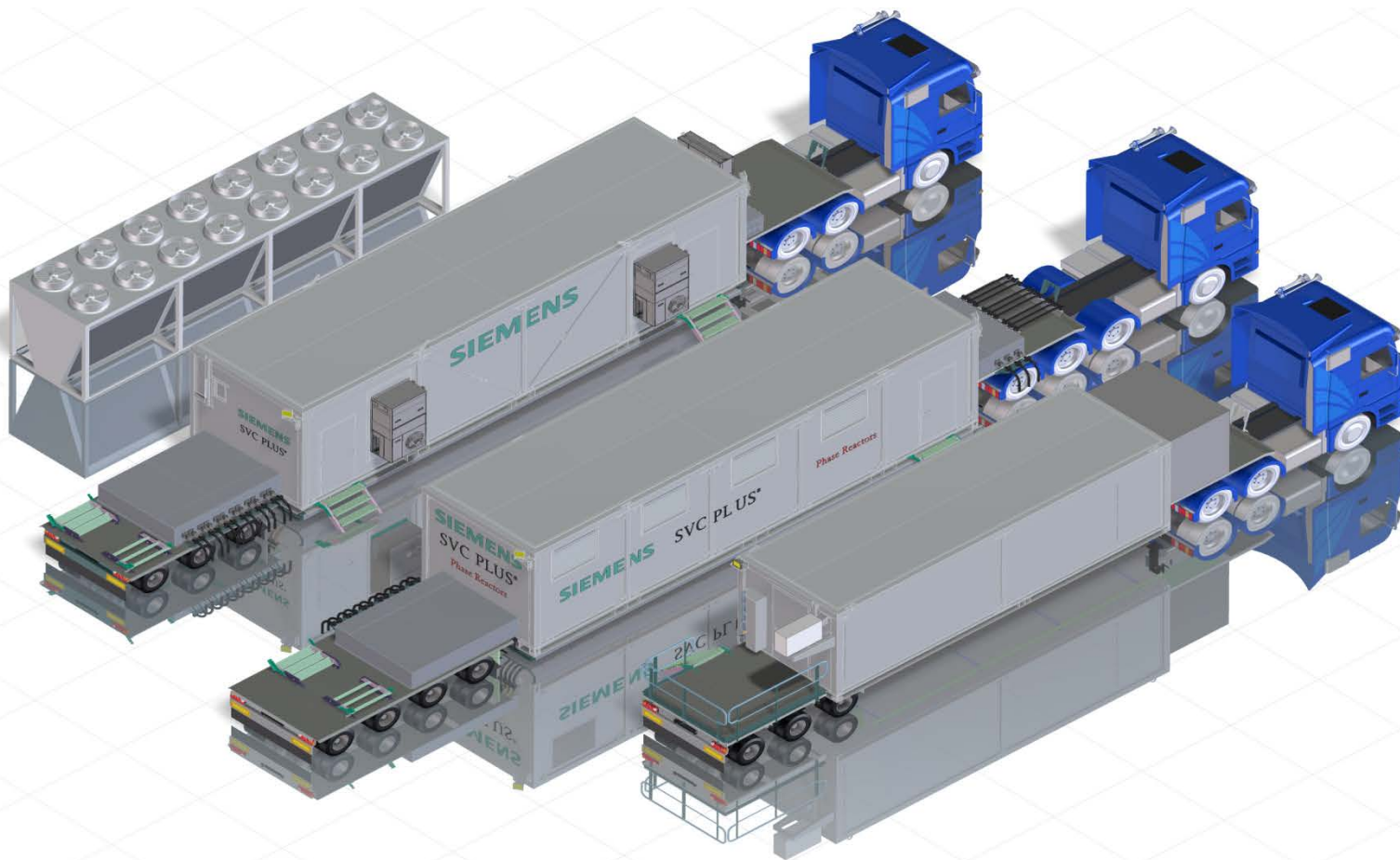


## Case Study Results Mobile STATCOM





# 50 MVAR Mobile STATCOM 125 % Overload 2 Seconds



# Main STATCOM Trailer Key Components

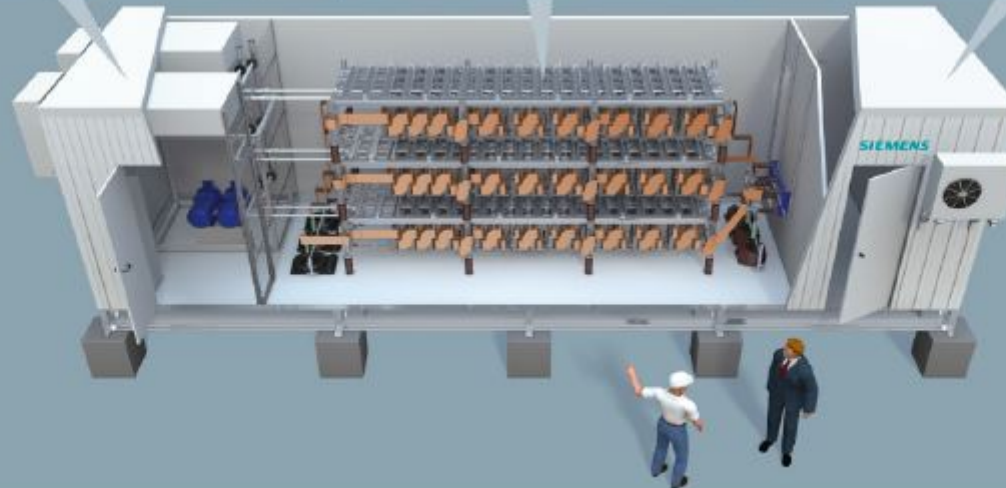
Cooling system



Converter



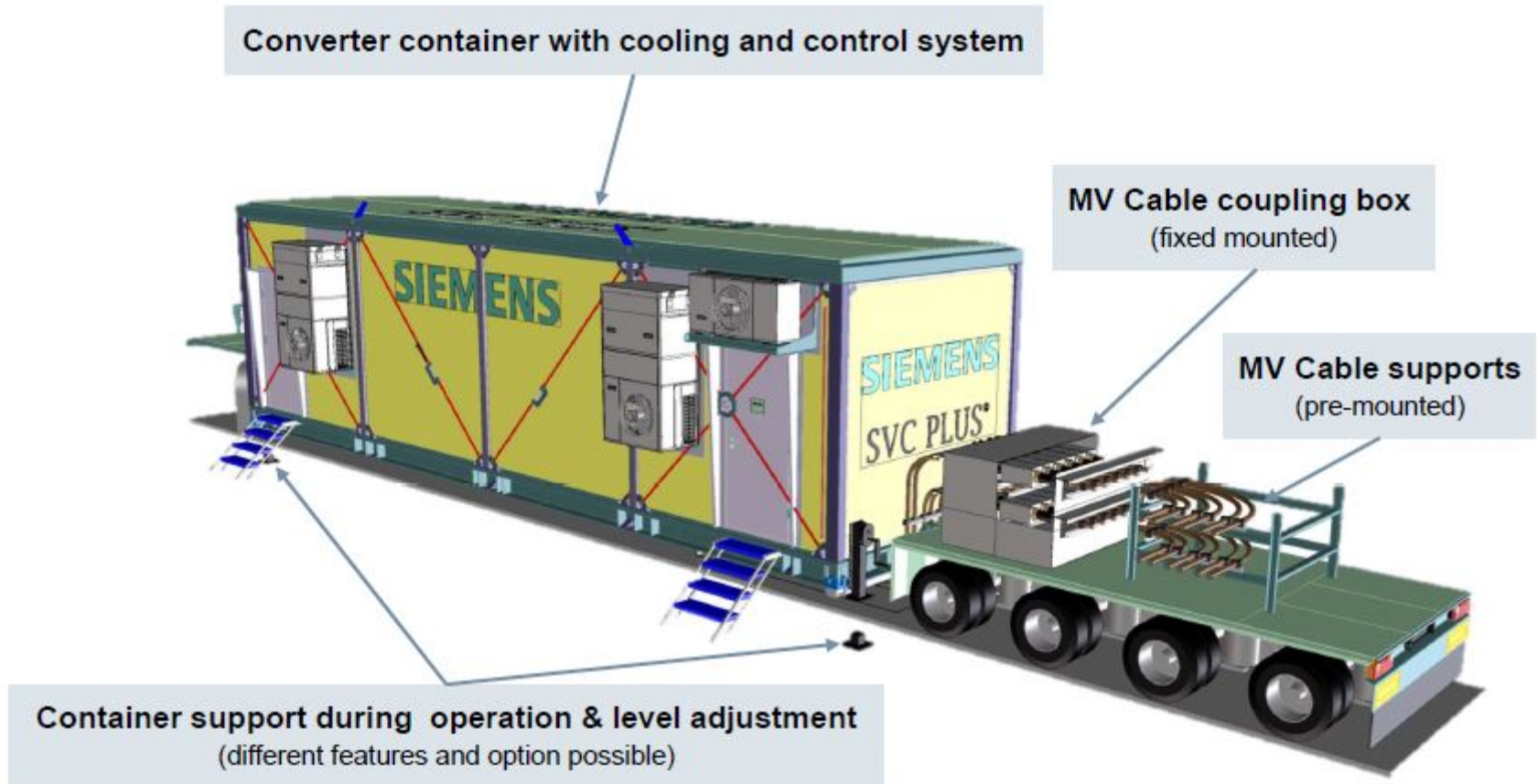
Control & Protection



Control and Protection specified by Siemens and Dominion

Cooling system and Heat Exchanger is flexible and type and style can be selected by the Customer

# Main STATCOM Trailer External





# Mobile equipment & Mobile substations Connecting to the Grid

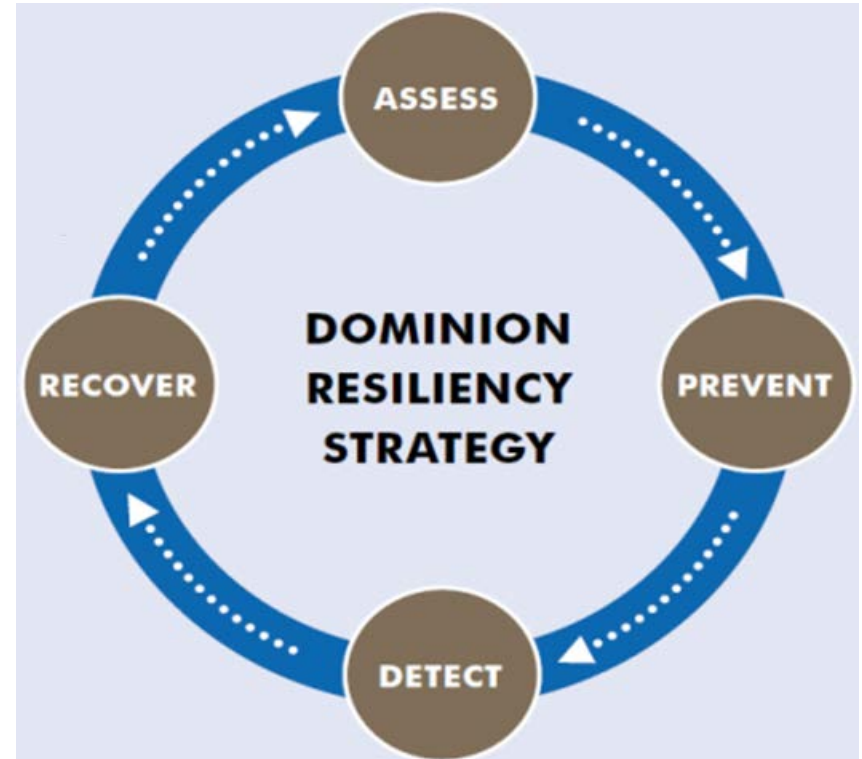
- Rapid restoration of service (equipment & design)
- Unusual/emergency system conditions



# Conclusions

With the challenges faced among transmission and distribution grids, new technologies such as Mobile STATCOM's, ensure:

- Reliability
- Power Quality
- Resiliency





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