POWERSIDE®

Flash Talk

Nick Nakamura - Powerside

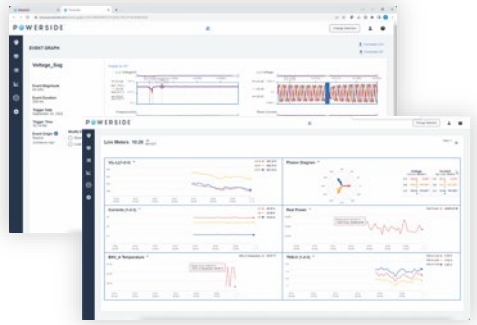
NASPI *Novel Applications for Synchronized Power Instrumentation*

A DOE-EPRI Joint Initiative

POWERSIDE®

We Assist our Customers in Solving & Avoiding Problems From PQ Issues

microPMUs & PQ Analyzers
(Monitoring Devices)



Reporting & Analytics Platform
(QubeScan & PQView)

PQ Studies & Services

PQ Correction Equipment
(Harmonic Filters & Capacitor Banks)

Mission: *We apply our deep power quality expertise to help customers achieve exceptional visibility, reliability, and efficiency in their electrical systems. Through collaborative partnerships, we deliver solutions tailored to their needs.*

Case Study

Data Center 1.5GW Load Transfer & Resulting BES Instability

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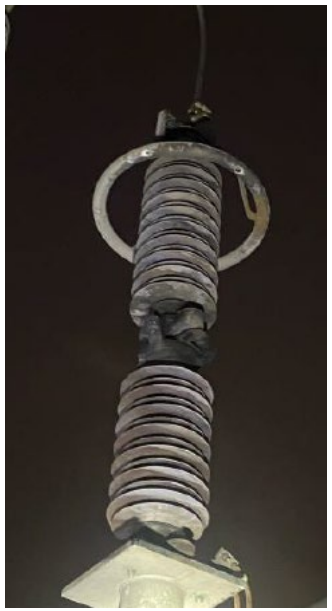
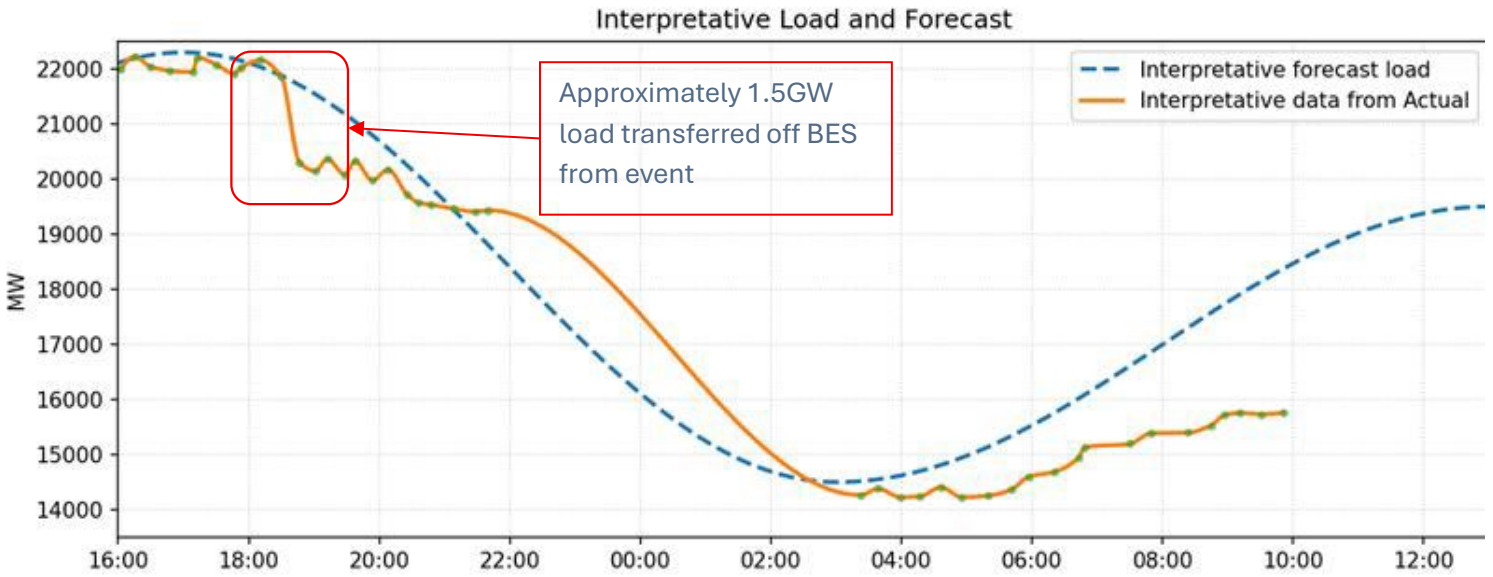
Data Center 1.5GW Transfer & Resulting Instability on BES

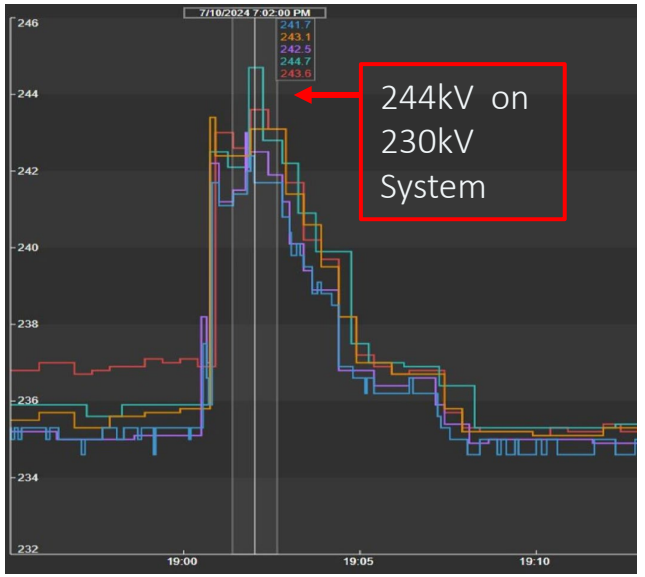
- A transmission lightning arrestor failed on a bus serving 70 Data Centers, initiating a reclose-to-lockout
- Data Centers had varied responses to the event & several sustained transfer on backup generation
- The sustained transfer resulted in 1.5GW BES load loss & subsequent sustained overvoltage for 7 minutes
  - Utility immediately removed nine 230kV cap banks and 1400 MVARs to stabilize BES voltage



Failed Lightning Arrestor



1.5GW of Load Loss from Data Center Transfer

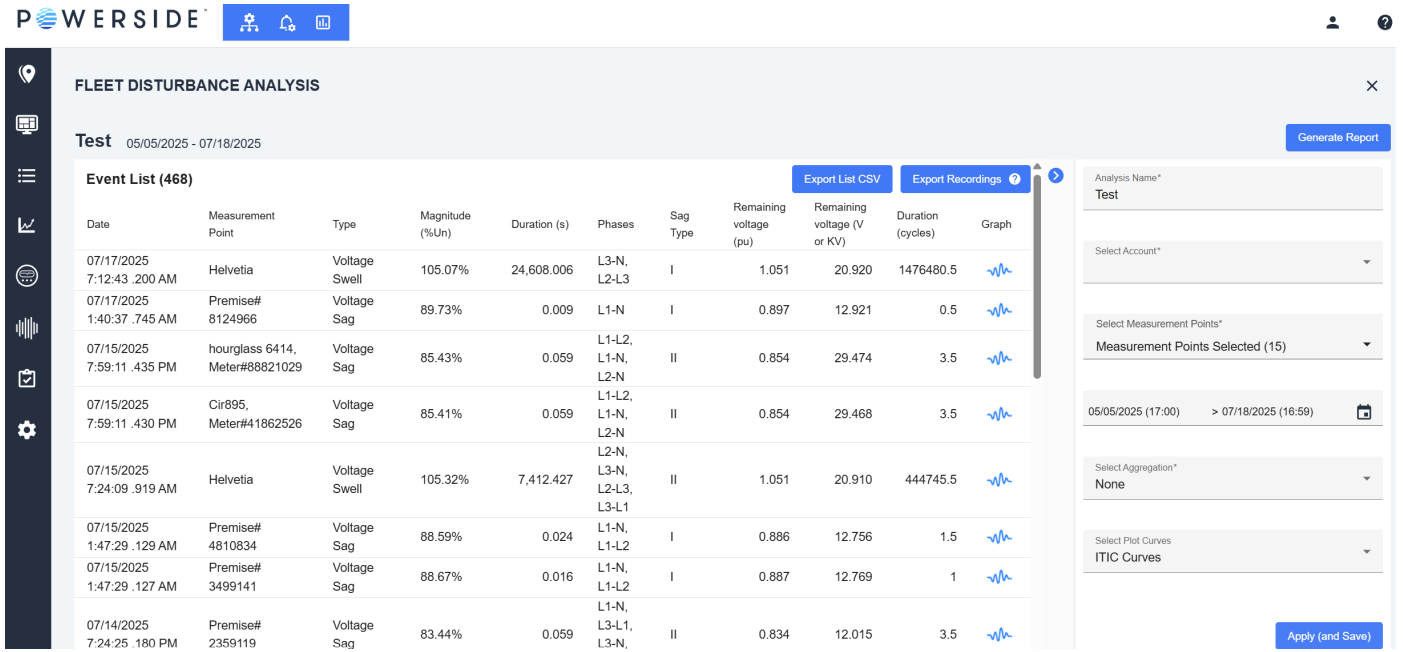


Resulting Overvoltage on BES

Monitoring Installed During the Event

- DFRs & PMUs at bus level substantiated event - insufficient to diagnose data center behavior causing transfer
- 29 of the 70 impacted Data Centers had PQube 3 monitors installed at the feeder level
- Because the issue involved varied Data Center response to fault, analysis was needed at the Data Center circuit level.
  - **Utility: “The power quality monitors at feeder level provided the best insight into data center’s behavior”**
  - Qubescan Fleet Disturbance Analysis was applied to collect and aggregate data from the 29 Data Centers

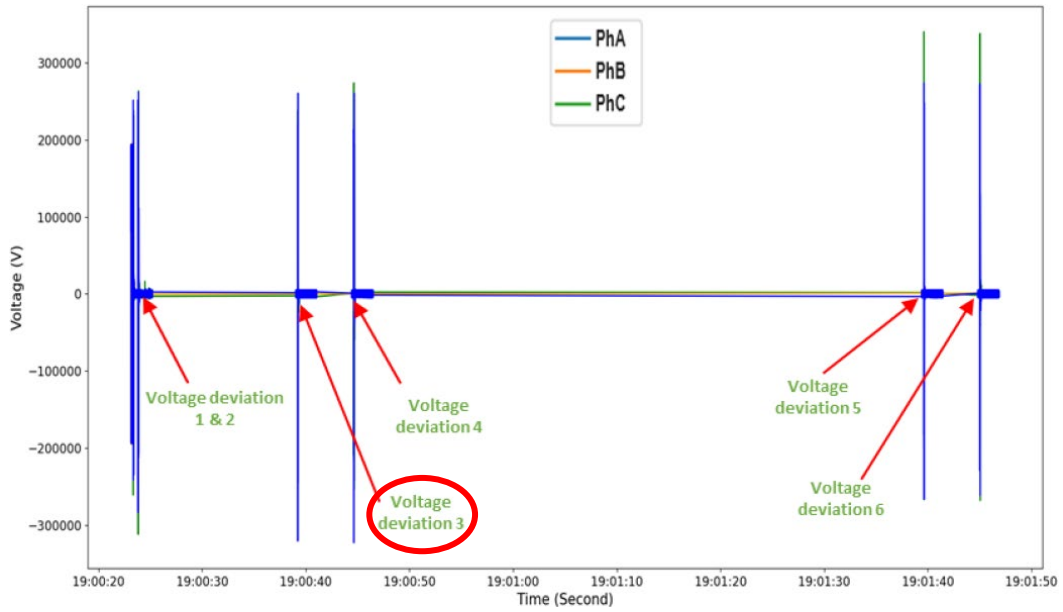
PQube 3 PQ Monitor Data Center Installation



Qubescan Fleet Disturbance Analysis Applied to Determine Data Center Response

Data Center Response Inconsistency

- 29 of 70 Data Centers had permanent Power Quality Monitoring
  - 10 **sustained** transfer after 3rd voltage deviation (circled red below)
  - 7 transferred initially and recovered
  - 12 rode thru the event and did not impact BES
- PQ data provided insights into **transfer & recovery inconsistency** among the impacted Data Centers monitored



Voltage Profile During Event Reclosing Shots

TABLE I
OBSERVED LOAD REACTIONS AT MONITORED DATA CENTERS DURING THE 230 KV BUS DISTURBANCE.

Monitored Data Center	Distance from Fault (mi)	Load Reaction	Transfer Occurred?	Transfer Sustained?
DC_1	0.00	Drop, recovered	Y	N
DC_2	0.00	Drop, recovered	Y	N
DC_3	0.00	Drop, recovered	Y	N
DC_4	3.28	Rode through	N	-
DC_5	3.54	Rode through	N	-
DC_6	3.54	Rode through	N	-
DC_7	3.54	Rode through	N	-
DC_8	3.54	Drop, recovered	Y	N
DC_9	3.54	Drop, sustained transfer	Y	Y
DC_10	3.54	Drop, sustained transfer	Y	Y
DC_11	3.75	Rode through	N	-
DC_12	3.75	Drop, sustained transfer	Y	Y
DC_13	4.06	Drop, recovered	Y	N
DC_14	4.12	Rode through	N	-
DC_15	4.12	Drop, recovered	Y	N
DC_16	4.12	Drop, sustained transfer	Y	Y
DC_17	4.12	Drop, sustained transfer	Y	Y
DC_18	4.12	Drop, sustained transfer	Y	Y
DC_19	4.68	Rode through	N	-
DC_20	5.16	Rode through	N	-
DC_21	5.16	Rode through	N	-
DC_22	5.16	Drop, recovered	Y	N
DC_23	5.45	Rode through	N	-
DC_24	5.45	Rode through	N	-
DC_25	7.41	Drop, sustained transfer	Y	Y
DC_26	13.93	Drop, sustained transfer	Y	Y
DC_27	13.93	Drop, sustained transfer	Y	Y
DC_28	13.93	Drop, sustained transfer	Y	Y
DC_29	32.00	Rode through	N	-

Drop = initial load drop following the 230 kV bus event.
Sustained = Load stayed off-grid for at least 7 minutes.

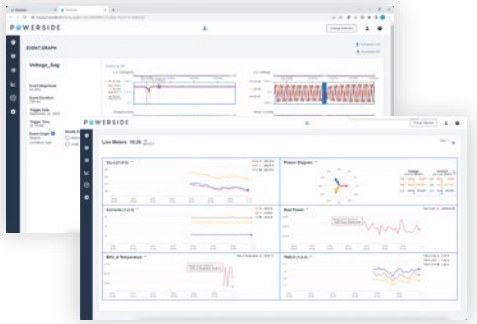
Summary of Data Center Response to Event

Summary & Lessons Learned

- Highlighted a need for standardization on settings & monitoring
  - Determined ride thru setting inconsistency & sensitivity
  - Enables improved planning/prediction of Data Center response

- Lessons Learned & recommendations to maintain BES Reliability:
  - **“Feeder measurement devices with high sampling rates should be installed on all new and existing Data Centers”**

Power Quality Analyzers



Analytics Platform

Fleetwide Diagnostics

Fleetwide PQ Solution Enabling Utility Detection & Correction of Major BES Event

Thank You!

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