ANGLE CHARACTERIZATION USING PMUS FOR CONTROL CENTERS

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$P_{ij} \approx \frac{V_i V_j}{X} \sin \theta_{ij}$
METHODOLOGY - GETTING THE DATA

1. Select two buses of the power system
2. Sum all the active power of each generator behind Bus A
3. Measure with a PMU the voltage angle of the two buses.
METHODOLOGY- DATA ANALYSIS

250 days data

Active power sum of each generator behind Bus A every second

Scenario 1: 0 - 200 MW

Scenario 9: 1401 - 1600 MW

Monday data

Sunday data

Average and standard deviation of the data.

00:01 - 00:30

23:31-24:00 h

Angle difference A-B every second.

Scenario 1: 0 - 200 MW
RESULTS

10:11 500 kV Line out

14:33 500 kV line in

Total generation behind Bus A
Angle difference between two buses can be predicted using the correlation of the generation, the week day and the time period.

Tracking the angle difference can be a tool for post mortem analysis.

Predicting the angle difference between two buses can increase the situational awareness in the control center.