

Measurement-Based Approach for Inertia-Trend **Analysis of the US Interconnections**

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BACKGROUND AND MOTIVATION

- Renewable energy integration degrades Rate of Change of Frequency(RoCoF) levels due to reduced rotating lacksquareinertia.
- In the US Eastern Interconnections, the renewable generation constitute over 10 % of total generation while in \bullet the Western Interconnection, it constitute over 22 %.
- Generation mix changes including gas-coal swap and fast frequency response from inverter-based resources ullet(IBRs) are complex, leaving the actual trend of the inertia of the system an open question.

METHODOLOGY

Utilizes synchronized the field lacksquaremeasurement data during the past

Frequency Data Collection

(Source: FNET/Grid Eye)

Frequency

	Frequency	response	of event o	on 3/28/2017 2	1:06 (UTC)
0				1	

Inertial Response

60

- decade in the US interconnections (Eastern and Western Interconnections).
- RoCoF time window of 3 seconds based \bullet on correlation coefficients is chosen for the inertia calculation.
 - Estimation 59.94 59.93 RoCoF 20 30 50 Time (seconds) $2H\frac{df_{median}}{dt} = (\Delta P - D\Delta f_{median})$ Calculation $2\widehat{H} = (RoCoF^T RoCoF)^{-1} \cdot RoCoF^T \cdot MW$ $\frac{df_{median}}{dt} = \frac{\Delta P}{2H}$ $RoCoF = \left[\frac{\Delta f_1}{\Delta t}, \frac{\Delta f_2}{\Delta t}, \dots, \frac{\Delta f_n}{\Delta t}\right]^T$ Inertia estimation Power Disturbance Data (Based on Swing (Source: NERC) Equation) $MW = [MW_1, MW_2, ..., MW_n]^T$

INERTIA TREND RESULTS FOR THE PAST DECADE

Eastern Interconnection



Year/Quarter



59.99

59.98

59.97

59.96

59.95

requency (Hz)

Data Preprocessing

(Sorting and smoothening) Trip

eD

Western Interconnection



CONCLUSION AND FUTURE WORK

- Inertia trend analysis over the last decade is carried out utilizing historical field data measured throughout the US Interconnections.
- Future works include study on the inertia trend of Texas Interconnection.







