

Wind and PV affect system reliability

System Stability

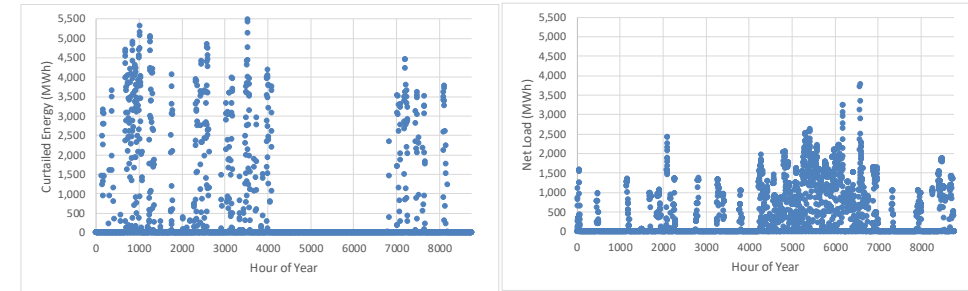
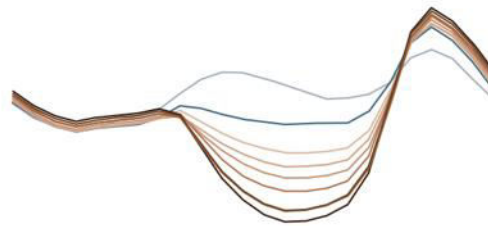
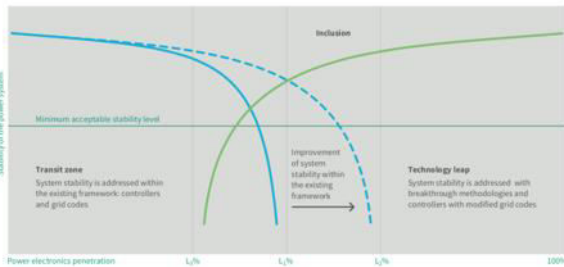
- High penetrations of inverter-based resources
 - Frequency stability
 - Transient stability
 - Small-signal stability

System Balancing

- Wind and solar variability and uncertainty
- Reducing curtailment
- Ramping needs

Resource Adequacy

- Seasonal mismatch of supply and demand
- Periods of low wind/solar/hydro
- 1 day in 10 years Loss of Load Expectation



Short-term

Medium-term

Long-term

Graphics: EU-MIGRATE 2016
CAISO, Fast Facts 2016
A. Bloom, ESIG Planning WG Oct 2018

