Senior design project: Texas Grid and Market Analytics
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Introduction and Motivation

The electricity infrastructure and market in Texas are managed by the Electric Reliability Council of Texas (ERCOT). It schedules the power production of over 710 generation units having a total capacity of over 86 GW and moves electric power over 46,500 miles of 69 kV and higher transmission lines. As the nation's largest wind power producer, ERCOT operates a total installed capacity of 25 GW wind generation capacity. Additionally, ERCOT runs the electricity wholesale bulk-power and retail markets. Over 1800 active market participants generate, move, buy, sell, or use wholesale electricity. To operate the Texas grid reliably, ERCOT monitors and collects grid and market conditions. Collected data are diverse and voluminous.

Introduction and Motivation

The objective of this senior design project is to design, develop, and demonstrate a web-based dashboard for displaying grid and market conditions and performing analytic functions. The initial design of the dashboard shall include essential grid and market data over time, such as system frequency, current and forecasted demand, generation by fuel type, energy prices, system inertia. Additionally, it must have facilities to display generation resources, particularly forecast and actual generation of wind and photovoltaic generation, by geographical region and the total area. The dashboard must be informative, logical, user-friendly, secure, and reliable. It allows users to view, navigate, zoom, download, and perform fundamental statistical analysis. Data shown must include real-time and historical data. Examples of dashboards from around the world can be found below.

In addition to developing the dashboard, the senior design project shall extend it to include grid analytics and visualization for wind and solar generation applications. The analytics shall perform the following basic functions for each wind power/PV region. Additional functions will be identified once data arrive.

- Determine key statistics and time-series properties: seasonality, stationarity, discontinuities, up/down ramp rates, energy production, generation and its associated temporal information,
- Estimate real-time inertia contribution
- Comparison to historical generation over multiple periods and space-time
- Generation modeling, forecast errors, and distributions

Deliverables:

The deliverables are derived from the objective described above.

Examples of dashboards

https://www.rte-france.com/en/eco2mix
https://www.energydashboard.co.uk/live
https://www.eia.gov/electricity/gridmonitor/dashboard/electric_overview/US48/US48
https://winderful.diascreative.net/
https://www.solar.sheffield.ac.uk/pvlive/
https://www.iso-ne.com/isoexpress/web/charts
https://www.pjm.com/markets-and-operations/energy