Balancing Diversification and Reliability

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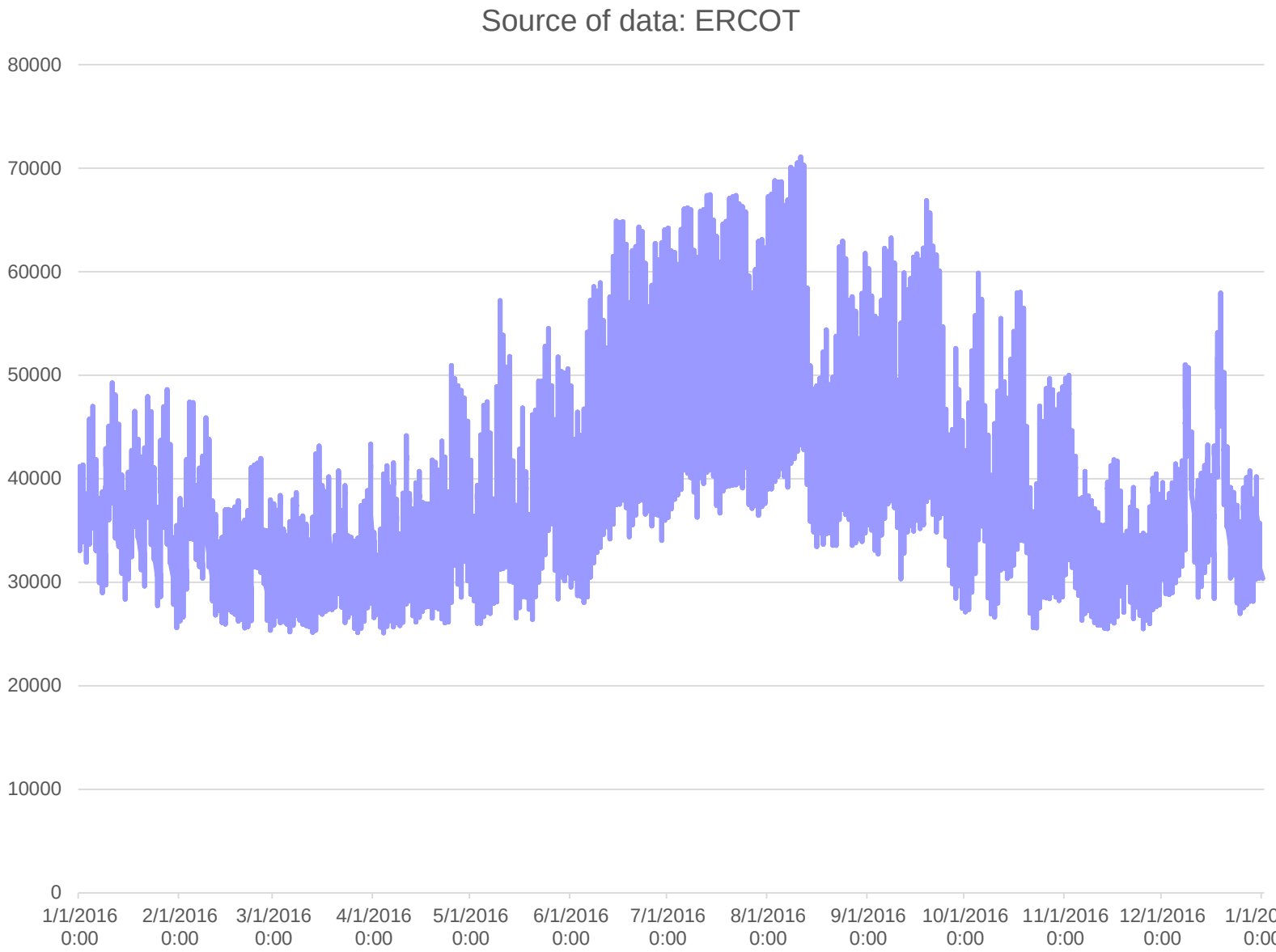
Outline

- The panelists:
  - Alison Silverstein, Consultant,
  - Kenneth Ragsdale, ERCOT,
  - Wesley Cole, NREL,
  - Elaina Ball, Austin Energy.

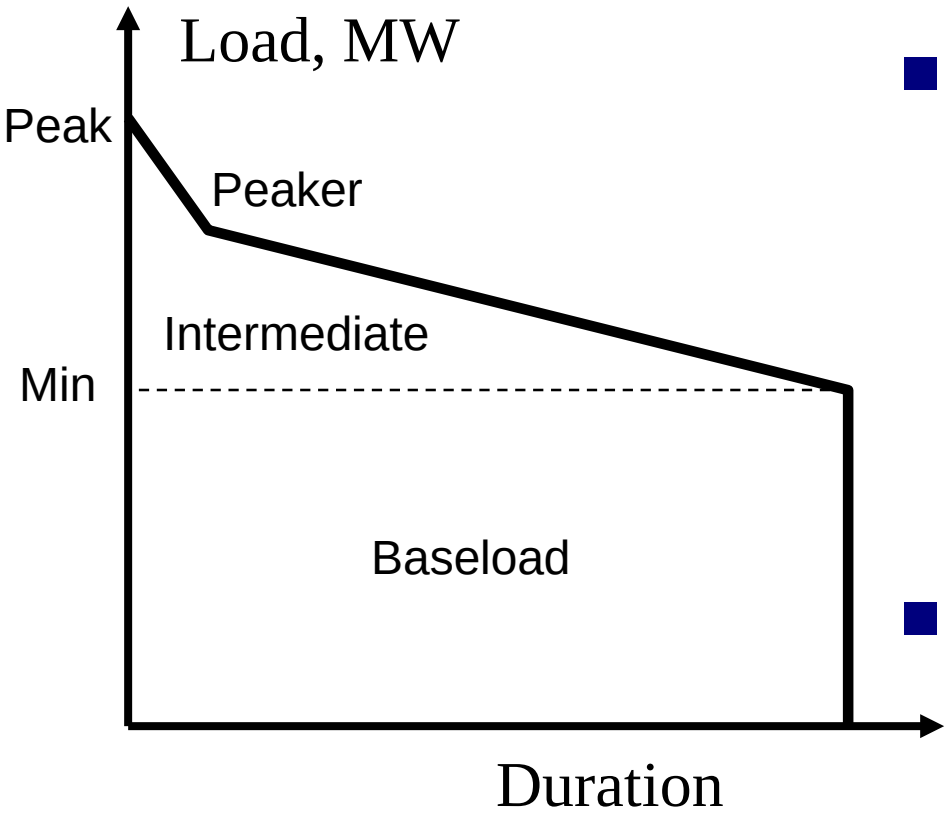
Outline

- Supply-demand balance:
  - Load-duration and net load-duration,
  - Renewables large and growing,
  - Supplying net load and implications for resource diversity,
- Transmission, distribution, and distributed energy.

Load in ERCOT in 2016.



Load-duration curve.

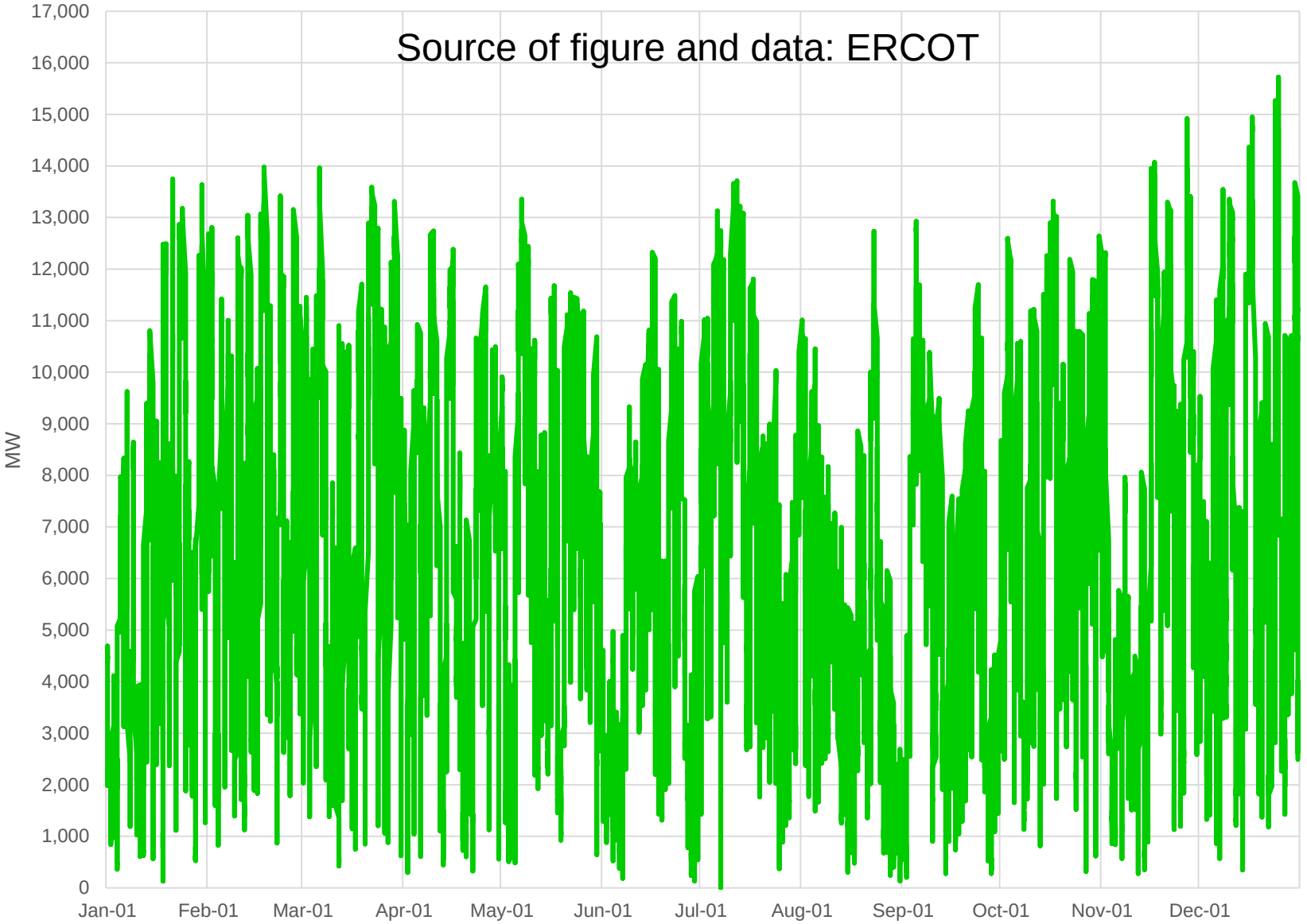


- Re-order chronological data from highest to lowest.
- Think of minimum load as “baseload,” most efficiently served by low operational cost resources:
  - Traditionally coal and nuclear.
- Higher levels served by higher operating cost resources.

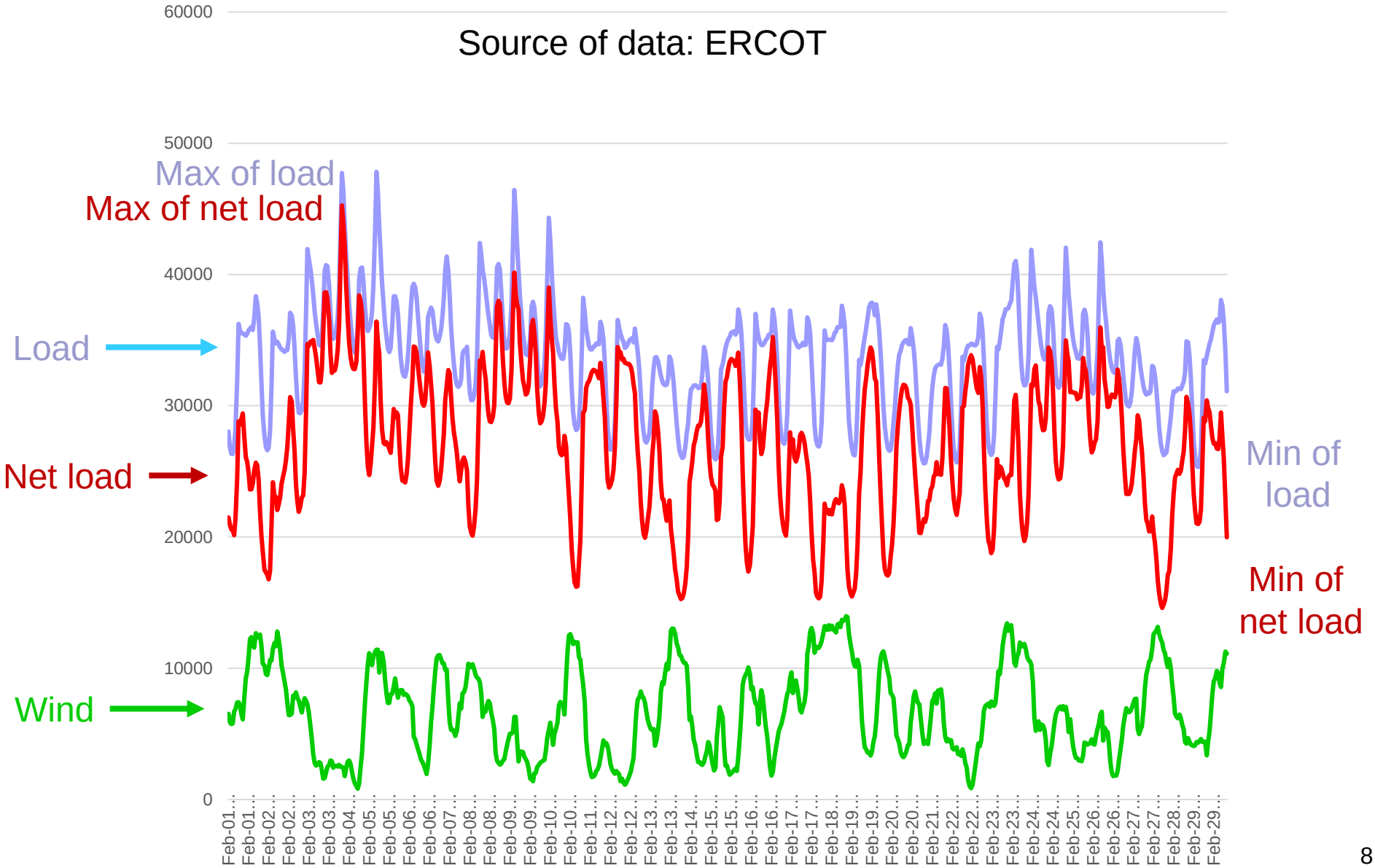
Renewables large and growing!

- Overall level of renewables in interconnection more important than individual contractual positions.
- ERCOT is at forefront of integrating wind, with over 15% by energy.
- Solar is also growing.
- Also significant growth in renewables in various states nationwide and in various countries worldwide.

Wind in ERCOT in 2016.

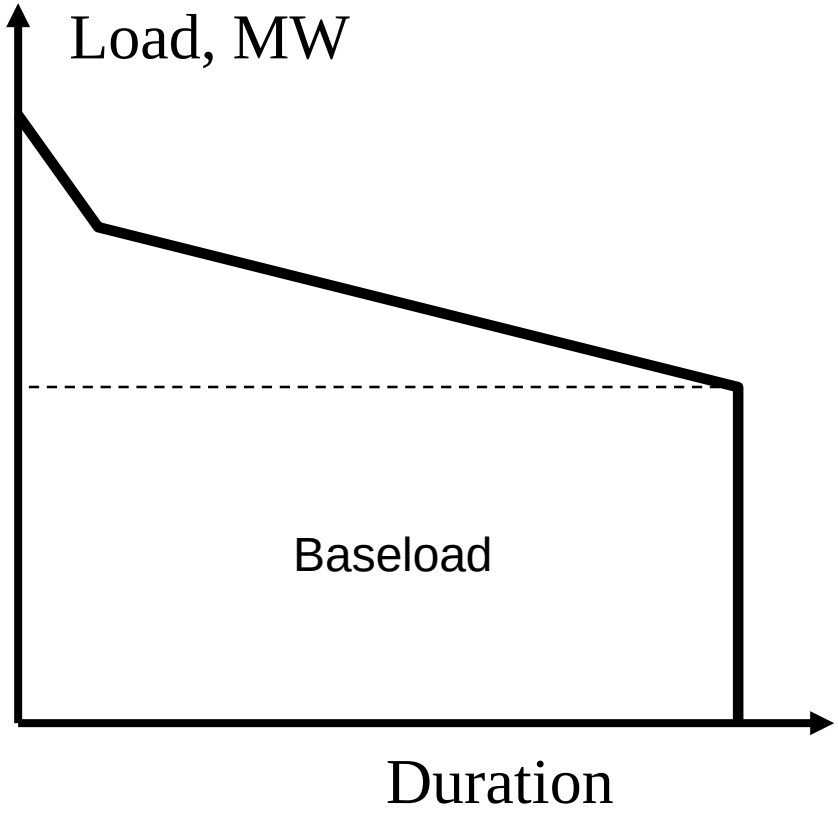


Load, wind, net load Feb 2016.

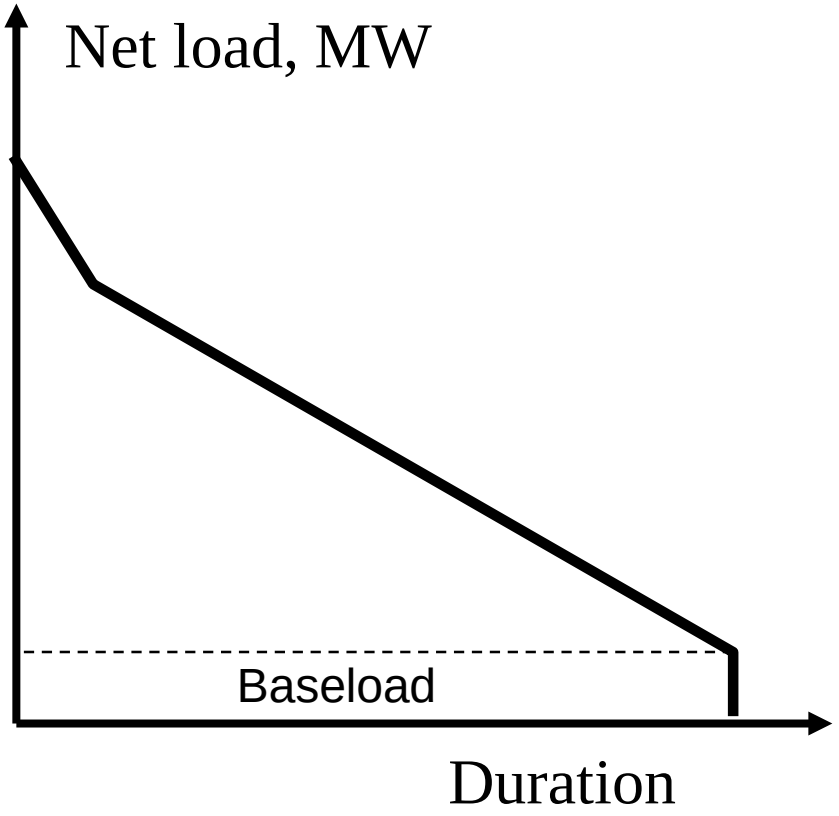


Load-duration curve.

Load-duration without wind.



Net Load-duration with wind.
Net load = load minus wind.



Supplying net load.

- Peak of net load nearly as large as load peak:
  - So meeting peak net load requires nearly as much non-renewable production as without wind,
  - Typical for onshore wind; however, correlation of coastal wind and solar with peak is stronger.
- Minimum of net load is lower than minimum of load:
  - Decreasing baseload with higher wind penetration,
  - Min of net load less affected by solar.

Supplying net load.

- Coal and nuclear fleets static or decreasing:
  - Low gas prices,
  - Decreasing baseload.
- Combined cycle gas turbine and storage increasingly important:
  - Typically also flexible resources to match increased shorter-term variability of net load.
- Non-renewable distributed resources may further reduce net load.
- Portfolios shifting from coal/nuclear towards renewables/gas/eventually storage.

Transmission, distribution, and distributed energy.

- Bulk power generation needs transmission and distribution to provide “end-use reliability:”
  - Challenges in building new large-scale transmission (at least outside of ERCOT),
- Distributed energy resources can also contribute to end-use reliability:
  - Storage implications for distributed renewables,
  - Challenges of two-way flow in distribution.

Panelists

- Alison Silverstein:
  - Consultant, lecturer, and writer on the electricity industry.
  - Organized research and drafted technical portions of the Department of Energy “Staff Report on Electricity Markets and Reliability.”
- Kenneth Ragsdale:
  - Principal, Market Design and Development, ERCOT,
  - ERCOT market design and implementation, leadership roles including the Future Ancillary Services Team.

Panelists

- Wesley Cole:
  - Energy System Modeler and Analyst at the National Renewable Energy Laboratory.
  - Specializes in renewable energy integration, battery storage market potential, and impacts of high solar penetration futures.
- Elaina Ball:
  - Chief Operating Officer, Austin Energy.
  - Leads a team of over 800 employees responsible for electric generation, transmission, distribution, market operations, and IT.