Committee on Energy Resources and the Environment

Room for One More? A Conversation on Power Systems and Load Growth

This session will begin at 9:30 a.m.
What does NREL see when projecting electrification futures?
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Mid-case with high electrification from NREL’s 2021 Standard Scenarios

Least-cost buildout, subject to policy and operational constraints
What does NREL see when projecting electrification futures?
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For projections of other futures, see [https://scenarioviewer.nrel.gov/](https://scenarioviewer.nrel.gov/)
What happens if you add new load in off-peak hours?
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Room for One More? A Conversation on Power Systems and Load Growth
Electrification Impacts

- Power grid planning, scheduling, and operations
- Long & short run economics

Balancing Authority

At all times in its footprint

Long-term Integrated Resource Planning

- Multi-Year Planning

Year/month Ahead Planning/Scheduling

- Yr1
- Yr2
- Yr3
- Yr4
- Yr5
- Yr6

Week Ahead Scheduling

- M1
- M2
- M3
- M4
- M5
- M6
- M7
- M8
- M9
- M10
- M11
- M12
- M13
- M14
- M15

Day Ahead Scheduling

- W1
- W2
- W3
- W4
- W5
- W6
- W7
- W8
- W9
- W10
- W11
- W12
- W13
- W14
- W15
- W16
- W17
- W18
- W19
- W20
- W21
- W22

Hour Ahead Scheduling

- D1
- D2
- D3
- D4
- D5
- D6
- D7
- D8
- D9
- D10
- D11
- D12
- D13
- D14
- D15
- D16
- D17
- D18
- D19
- D20
- D21
- D22

Real Time Dispatch

- T1
- T2
- T3
- T4
- T5
- T6
- T7
- T8
- T9
- T10
- T11
- T12
- T13
- T14
- T15
- T16
- T17
- T18
- T19
- T20
- T21
- T22

- Resource adequacy (e.g., reserve margin)
  - Demand projections (system peak load)
  - Supply: retirements & additions (flexibility)

- Schedule supply resource availability
  - Planned maintenance outages
  - Manage limited energy supplies (hydropower)

- Plan system production costs/unit scheduling
  - Slow-long start unit commitments (old steam)
  - Hydropower/water releases
  - Battery & pump storage schedule (arbitrage)

- Reevaluate schedules (revised forecasts)
  - Long-start unit commitments (steam, comb cycle)
  - Revise unit-level schedules (production levels)

- Reevaluate schedules (revised forecast)
  - Quick-start unit commitments (gas turbines)
  - Revise unit-level schedules (production levels)

- Actual system operations (gen, regulations, etc.)
  - Response to real time events & forecast error
Capacity Expansion Requirements (Long-run Economic Costs)

Technology Attributes
- Capital cost
- Fixed & variable O&M costs
- Energy source(s) & prices
- Efficiency profile
- Dispatchable
- Response & ramping
- Maximum operations
- Minimum operations
- Reserve capabilities
- Location

How will electrification impact loads?
Locational Marginal Prices (LMPs)  
(Short-run Economic Costs - Serve Last/Next MWh of Load)

LMP = Marginal Energy Bid Price + Transmission Congestion Cost + Cost of Marginal Losses + Other (air emissions)

- Most expensive bid accepted
- Re-dispatch costs to avoid line overloads
- Electrification Economics Depends on Location and Timing

Electrification shifts the demand curve upward

- Build low cost generation and adequate supply
- Reduce load
- Maintain a highly competitive market
  - Many players (minimize market power)
- Effective market rules and monitoring

- Open congested lines
- Install phase shifters
- Build transmission capacity/capabilities
- Build low cost generation in high LMP areas
- Reduce load in high LMP areas
Spare Capacity: Current and Projected Future
Some times, in some places, but not always everywhere

National Electricity Reliability Council
2022 Summer Reliability Assessment

➢ High risk of energy emergencies (higher load, less capacity, transmission)
  ▪ Midcontinent Independent System Operator

➢ Elevated risk of energy emergencies (drought)
  ▪ Western Electricity Coordinating Council (snowpack, transfers, wind/solar output)
  ▪ Electric Reliability Council of Texas (extreme heat, reduced output, outages, 7/11/22)
  ▪ Southwest Power Pool (cooling water shortages, outages, wind/solar output)

EIA Annual Energy Outlook 2022: Reference Case
Cumulative Retirements & Additions (GW)

Economic Efficiency
Addition Cost < Production Cost Savings
Thanks for attending. The next session begins at 10:45 a.m.