What is Reliability?

We say we are reliable, but what does that really mean?

- Electricity delivered in the right amounts precisely when and where it is needed
  - Three Components:
    - Power Supply
    - Transmission
    - Regional Coordination
- Maintain area reliability, meet regulatory requirements, and support regional growth
- TVA measures Reliability by:
  - Load Not Served (LNS)
  - Connection Point Interruptions (CPI)

System reliability is maintained through continual work to repair/ replace/ upgrade system elements

TVA Transmission at a Glance

- **16,000+** circuit miles of line operated at 115-kV to 500-kV
- **500+** substations and switchyards (100-kV and above)
- **103,000+** transmission structures on **237,000** right-of-way acres
- **1,200+** customer connection points
- **2** fully-operational Control Centers

TVA Generation Assets

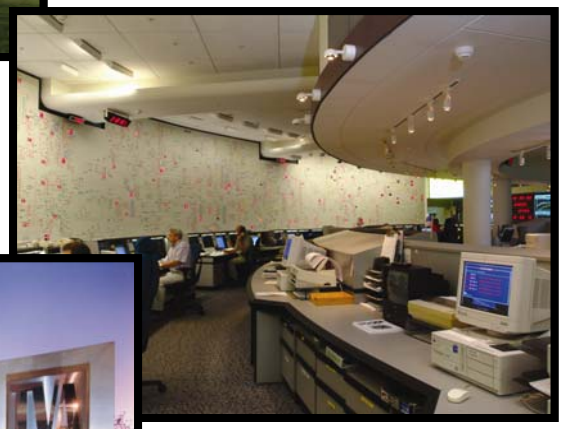
	Plants/Units	First/Last in Service	Capacity* (MW)	Capacity/Energy** (percent)
Hydro	30/113	1912/1978	5,433	15/12
Coal	10/46	1951/1973	12,901	35/40
Nuclear	3/6	1974/1996	6,724	19/33
Gas CT/CC	13/98	1971/2012	9,242	25/10
Other	• Contractual/ PPAs • Diesels • Renewable		2,294	6/4

* Summer Net Capability as of 09/30/2013

** Based on FY13 Energy Totals

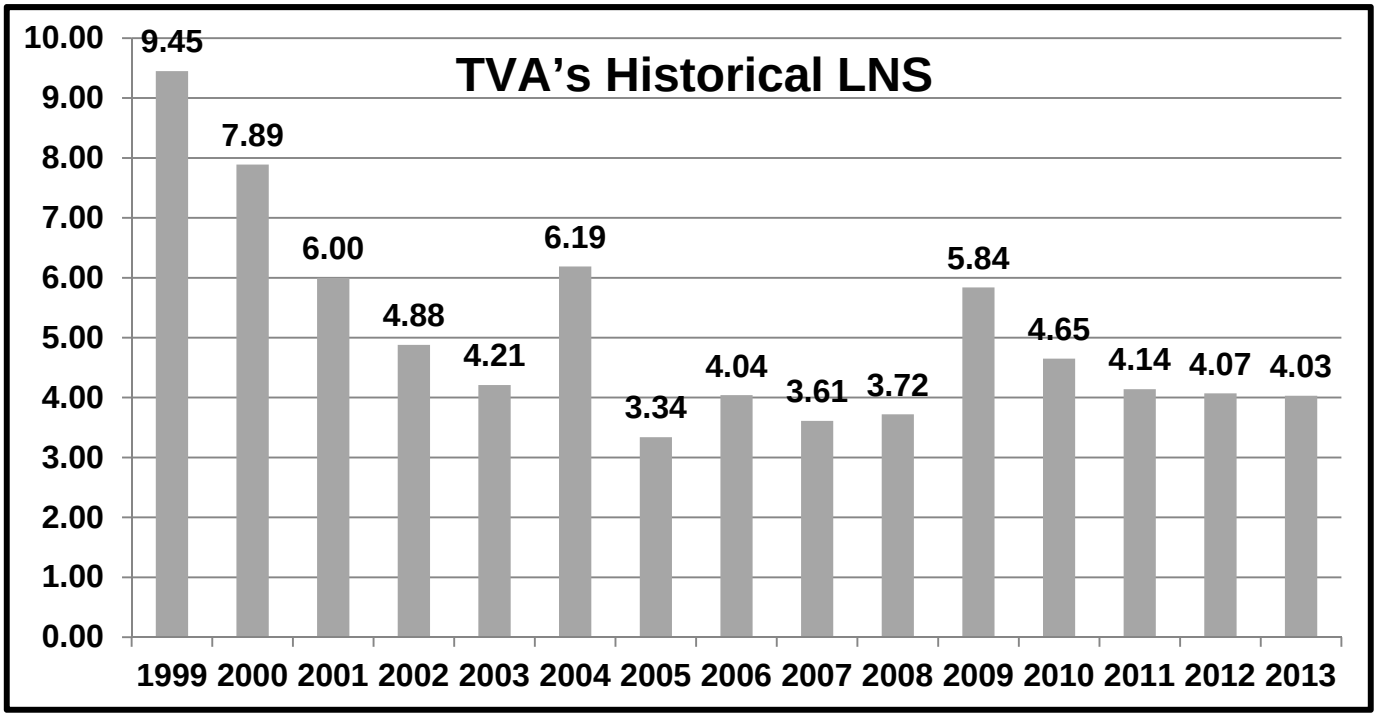
System Operations: Keeping the Lights On

- System Operations Center: Nerve center of TVA
- 24 x 7 operations
- Real-Time monitoring of the TVA Transmission System
- System Operations Center fully backed up by the Regional Operations Center
- Critical systems can be executed independently
- Continuous balancing of load and generation



TVA Reliability: Duration of Outages

- TVA's current performance is within first quartile industry performance
- 99.999% reliability = 7.8 system minutes of Load Not Served (LNS)
- Issues putting 99.999% at risk:
  - Aging Assets
  - Tightening Regulations
  - Changing System Conditions



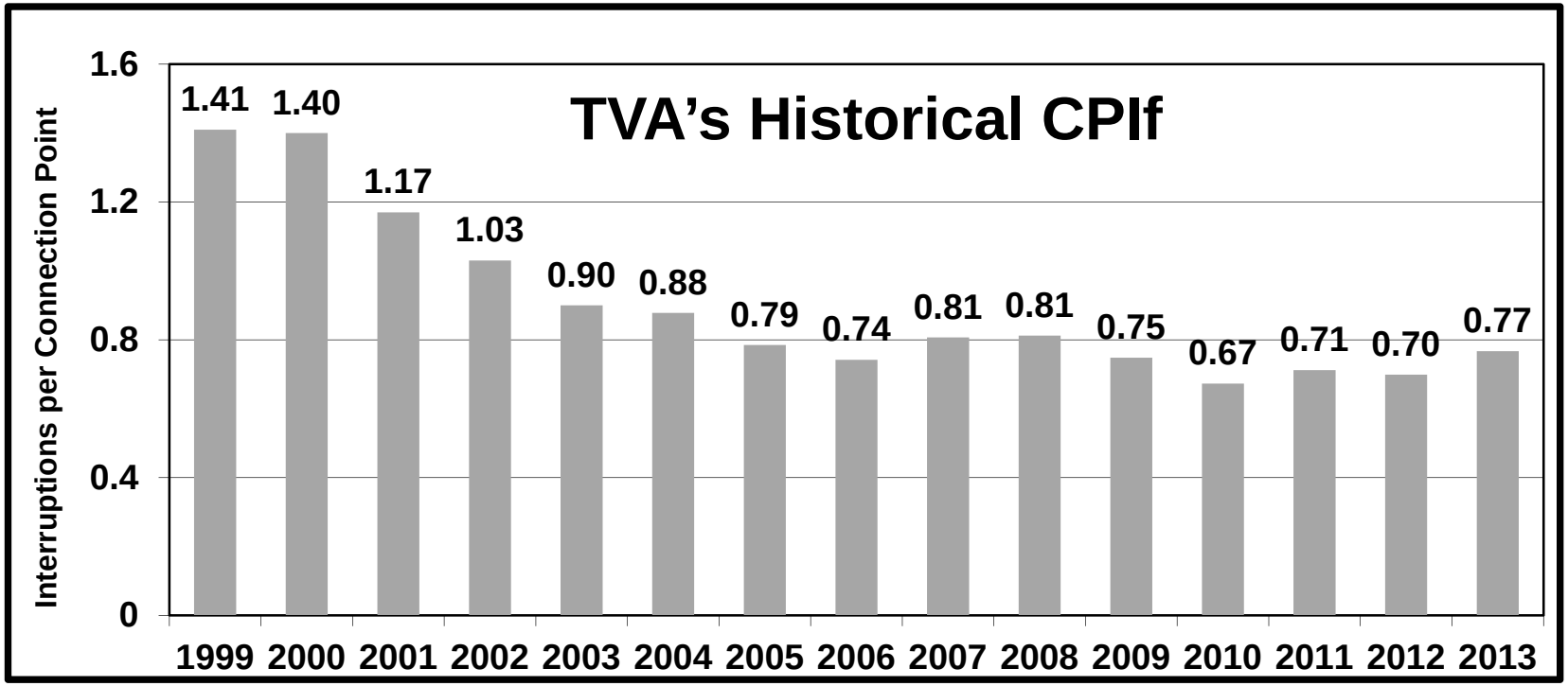
For 14 years, the TVA system has been 99.999% reliable

TVA Reliability: Frequency of Outages

- TVA's current performance is within first quartile industry performance for Connection Point Interruption Frequency (CPIf)
- Includes sustained and momentary interruptions
- Top impacts to frequency of customer interruptions:
  - Weather (Lightning and Wind)
  - Aging Assets
  - Foreign Objects (Birds, Animals, and Debris)

Since 2004*, TVA has been a Top Quartile performer or better

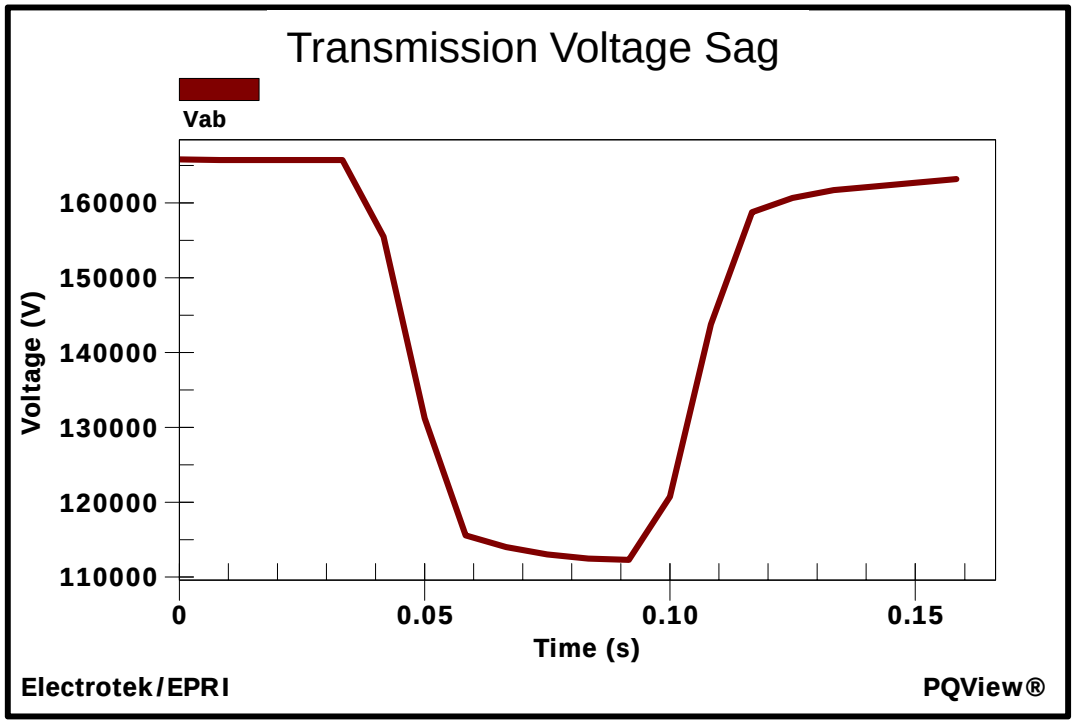
*2004 was the first year of an Industry Benchmarking being available with all voltage classes



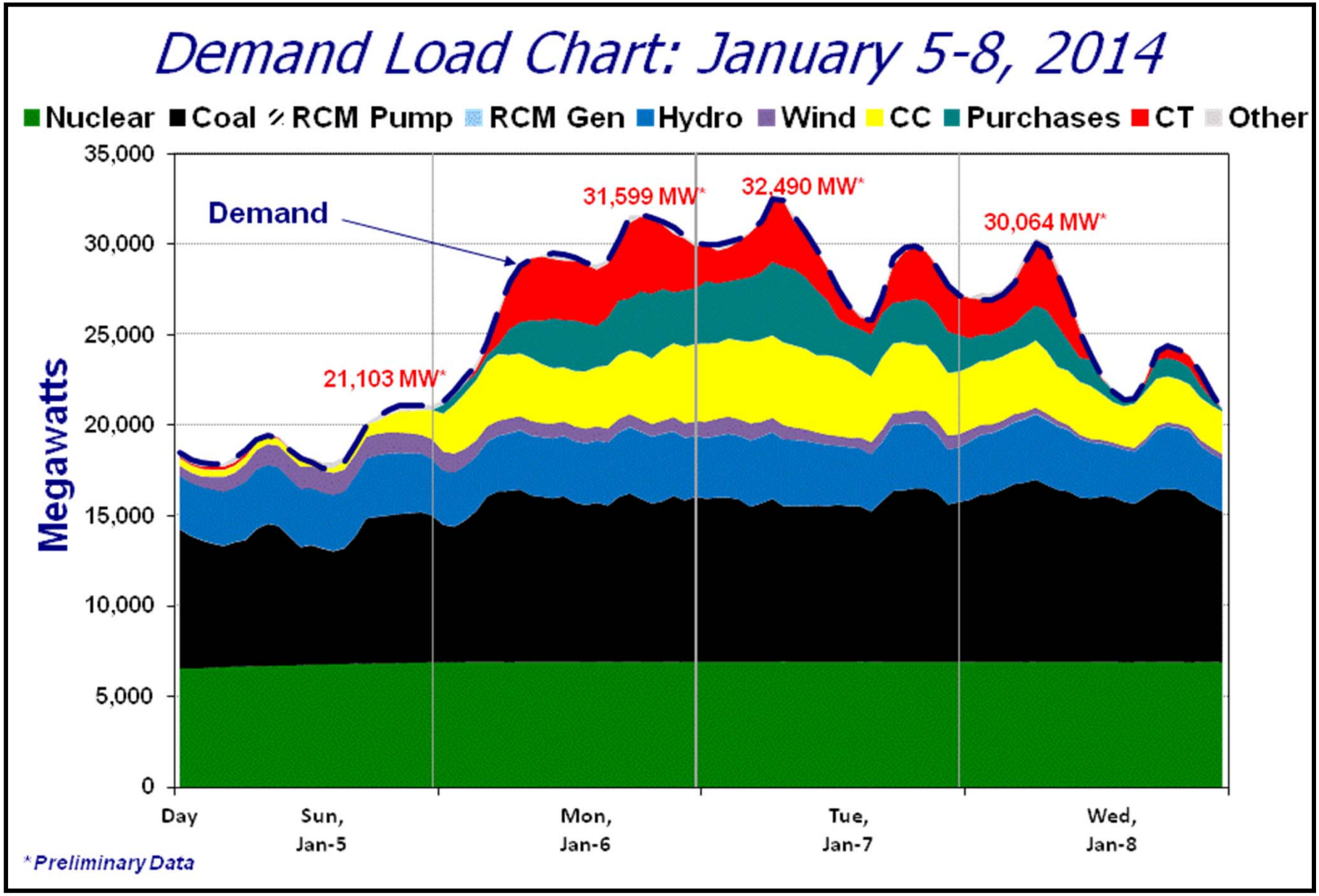
TVA Reliability: Consistency of Voltage

- Voltage sags can shut down sensitive production systems
  - Downtime costs for 50MW sensitive industry >$100k in production losses
- TVA's PQ Program goal is reducing voltage sags associated with transmission system faults
- Program targeted at top 100 largest industries in the Valley:
  - Food Production
  - Textiles
  - Paper
  - Printing
  - Chemicals
  - Rubber
  - Plastics
  - Glass
  - Primary Metals
  - Electronics
  - Transportation

Power Quality program is focused on keeping the industry in the TN Valley running smoothly

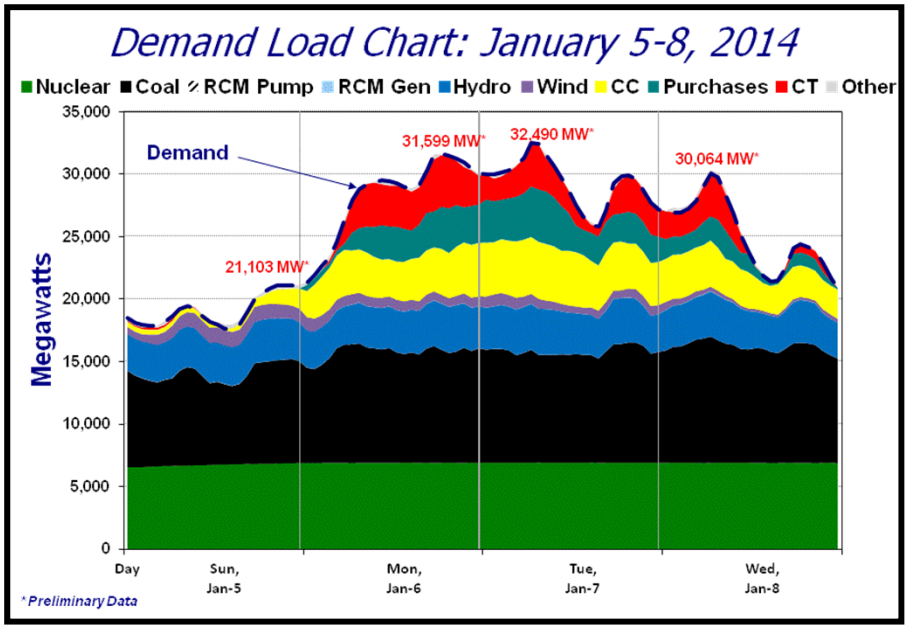


TVA Reliability: Matching Generation to Load

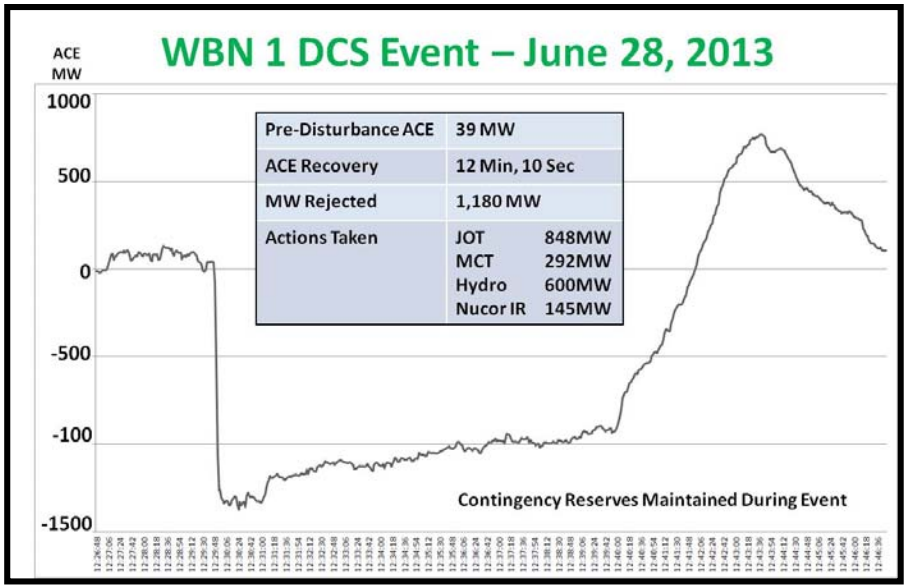


Transmission: Connecting Generation to Load

- Real-Time balancing of generation (supply) and load (demand)
  - Generation includes native sources and purchases
  - Diverse plant types ramp at different rates
  - Changing generation mix can significantly impact ability to meet load requirements

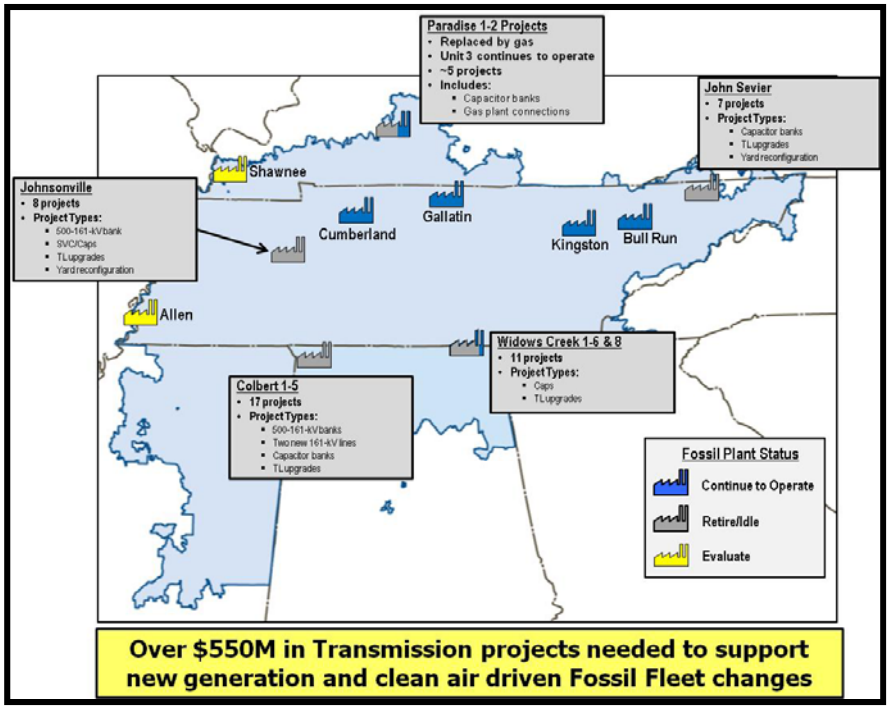


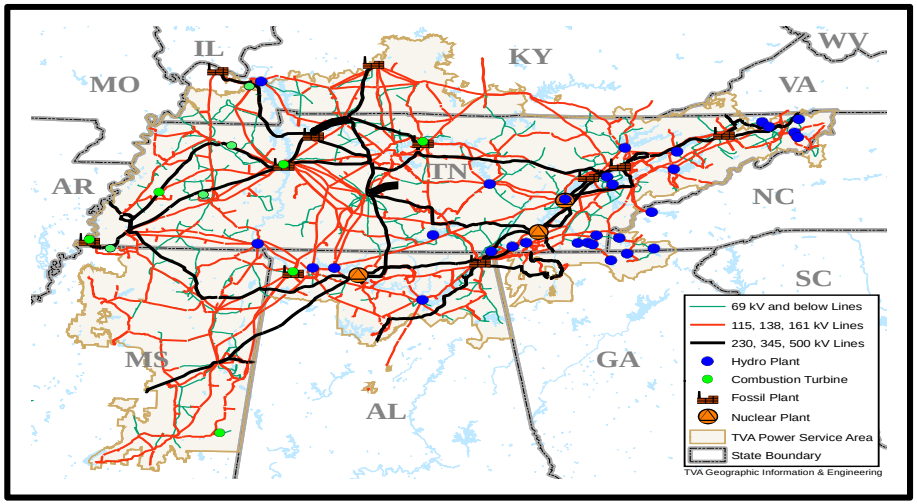
- Sufficient Reserves must be maintained at all times to recover from unexpected large generation losses



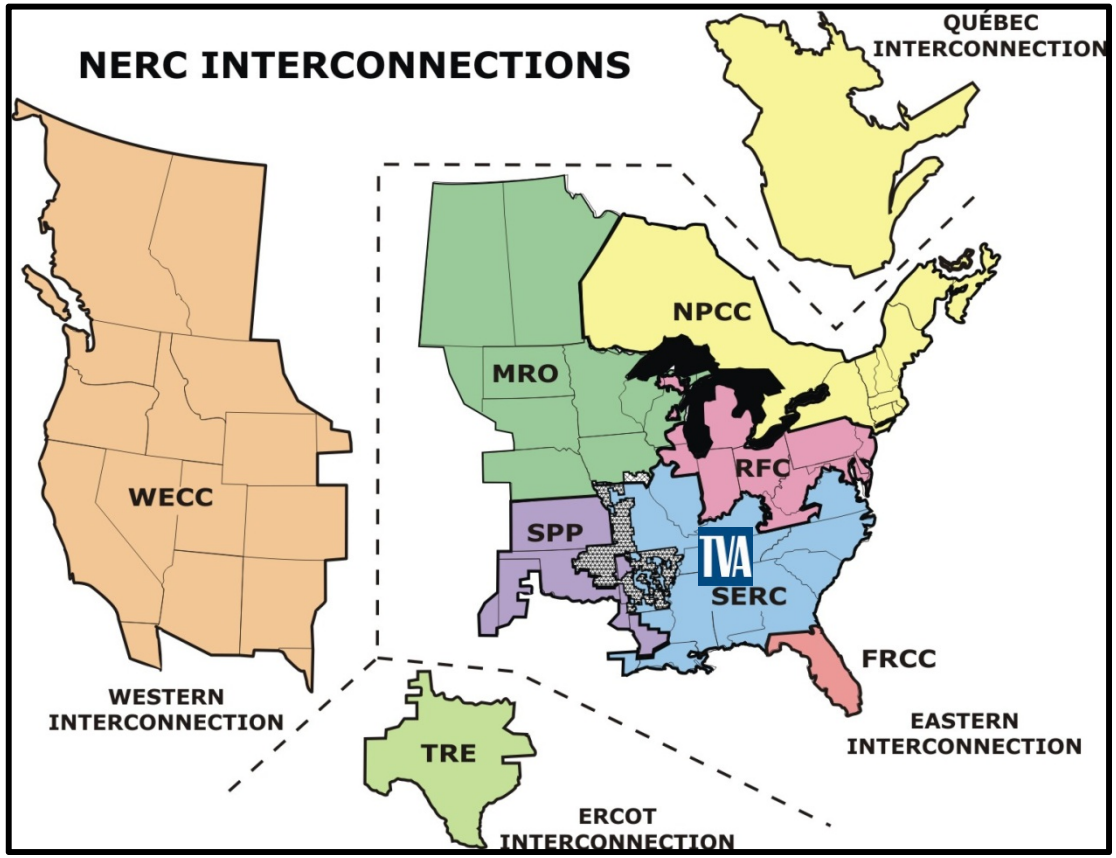
Planning for System Resiliency

- Generation decisions cannot be made without Transmission support
  - Projects must be in place to ensure power can still be delivered where needed
- Robust Transmission system is needed to provide flexibility and respond to system events
  - Localized storm damage does not impact the entire system
  - Single generator loss can be balanced with power from another source





Big Picture Reliability: Eastern Interconnection



- TVA is one of 23 Planning Authorities in the Eastern Interconnection
- TVA has 68 interconnections with 12 neighboring systems
- Partner with other industry participants to,
  - Prevent cascade of instabilities across neighboring systems (NE Blackout)
  - Plan robust and flexible systems
  - Guarantee resource adequacy

TVA partners with others to ensure the reliability of the Eastern Interconnection and the U.S.