



Pump Storage: A System Operations Perspective

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- Sam Holeman
 - Power System Engineer
 - 25 years at Duke Energy
 - 7 yrs - Energy Management System Development
 - Generation Resource Commitment logic
 - Generation Economic Dispatch logic
 - Power Flow logic
 - 18 yrs – Bulk Electric System Operations
 - NERC Certified System Operator-Reliability
 - 0 yrs – Pump Storage Plant Operations
 - 0 yrs – Pump Storage Asset Maintenance

Slide 2

HS1 Holeman, Sam, 7/27/2010

HS2 Holeman, Sam, 7/27/2010

HS3 Holeman, Sam, 7/27/2010



Duke Energy Carolinas Generation Mix

- These are approximations
- Total Generation Capability – 21,000 MWs
 - Nuclear – 7000 MWs
 - Fossil (Coal) – 7600 MWs
 - Combustion Turbines – 3100 MWs
 - Conventional Hydro – 1100 MWs
 - Pump Storage Hydro – 2000 MWs
- Pump Storage Hydro (MWs) – approx. 9.5% of capacity
- Pump Storage Generation (MWhrs) – approx. 2.5% of energy generated



From the view of System Operations.....

[Bad Creek Pumped-Storage Generating Station](#)

Capacity: 1,065 megawatts

Location: Oconee County, South Carolina

Commercial Date: 1991

[Jocassee Pumped-Storage Generating Station](#)

Capacity: 610 megawatts

Location: Pickens County, South Carolina

Commercial Date: 1973

Numbers don't tell the story of the value of
Pump Storage!



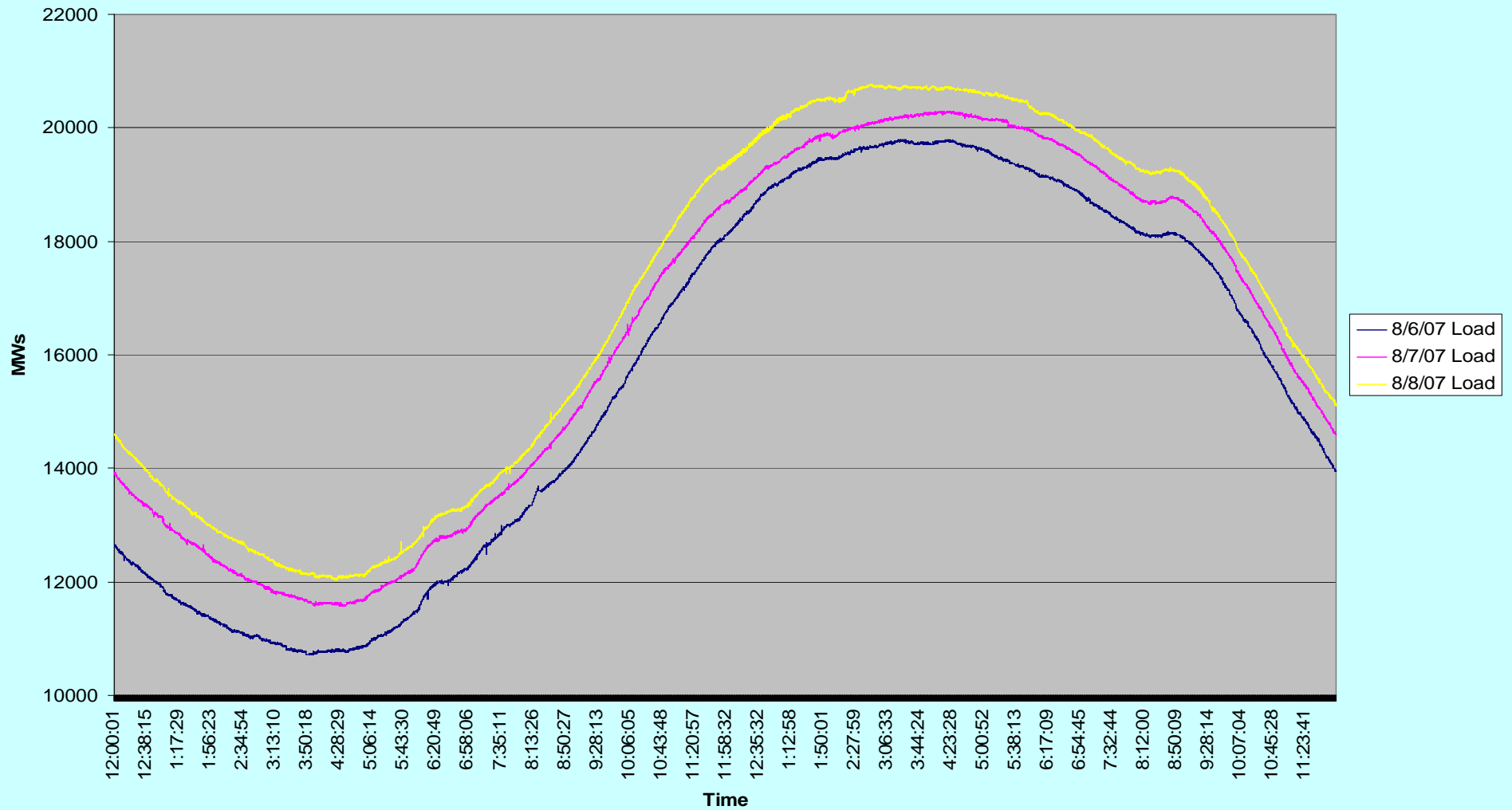
The Pump Storage System Operations Story

- NERC Interconnected Operations Services
 - Operating Reserves
 - Regulating Reserves/Load Following
 - Contingency Reserves
 - Reactive Power Supply
 - Frequency Response
- From the eyes of System Operations
 - Dependable
 - Flexible
 - Fast
 - Nimble
 - Our Duct Tape



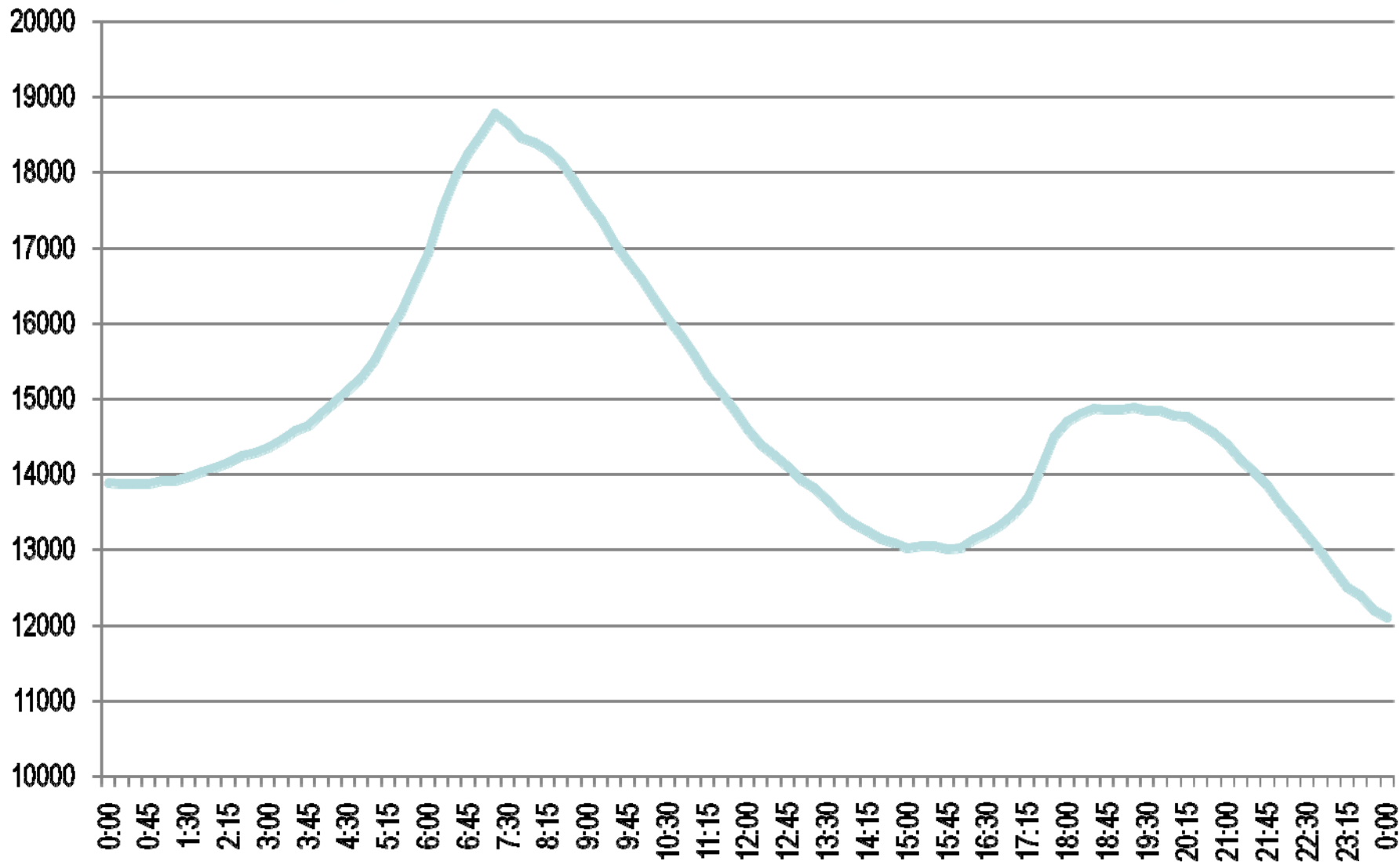
Summer Demand

Load



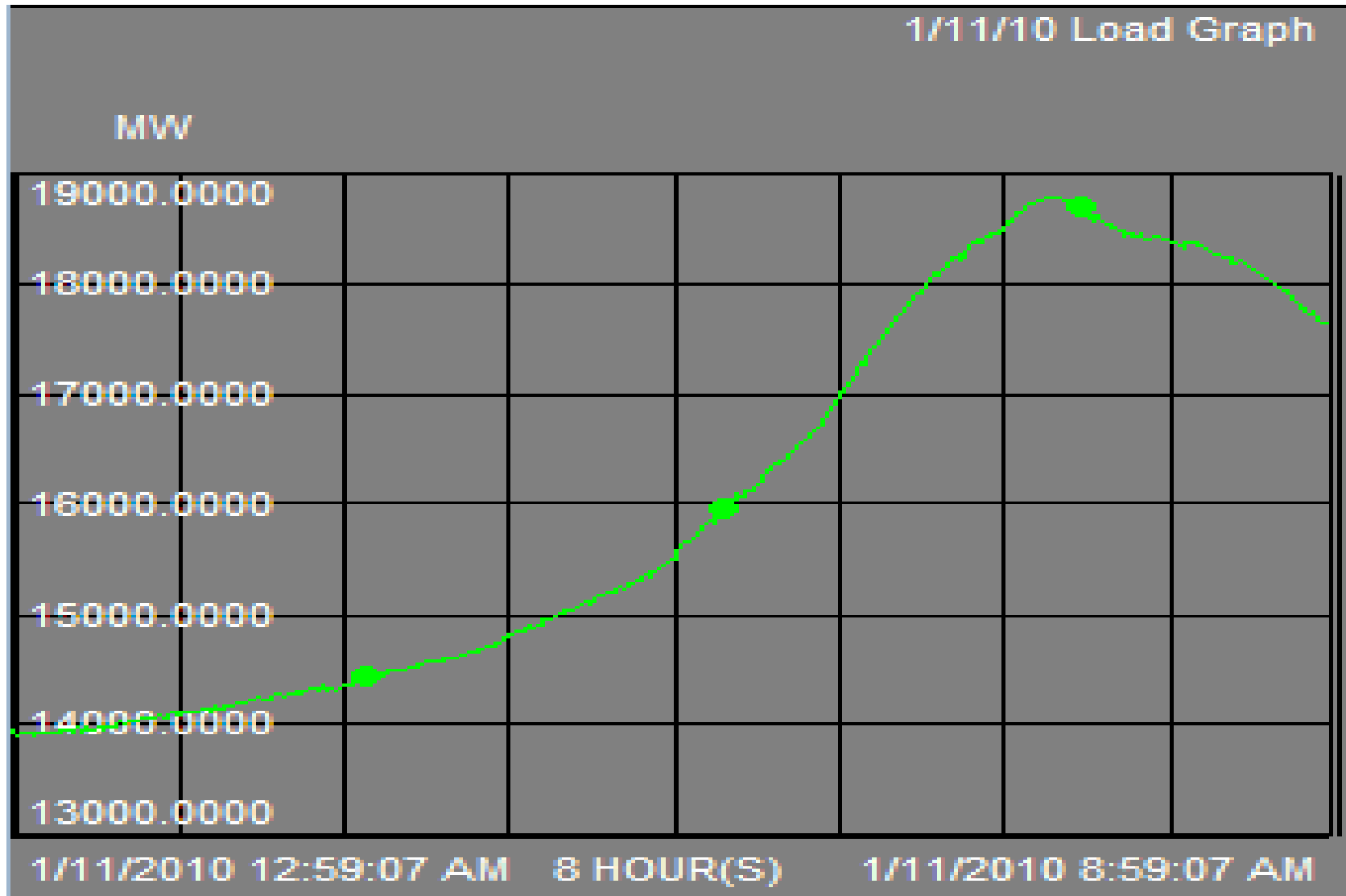


Winter Demand



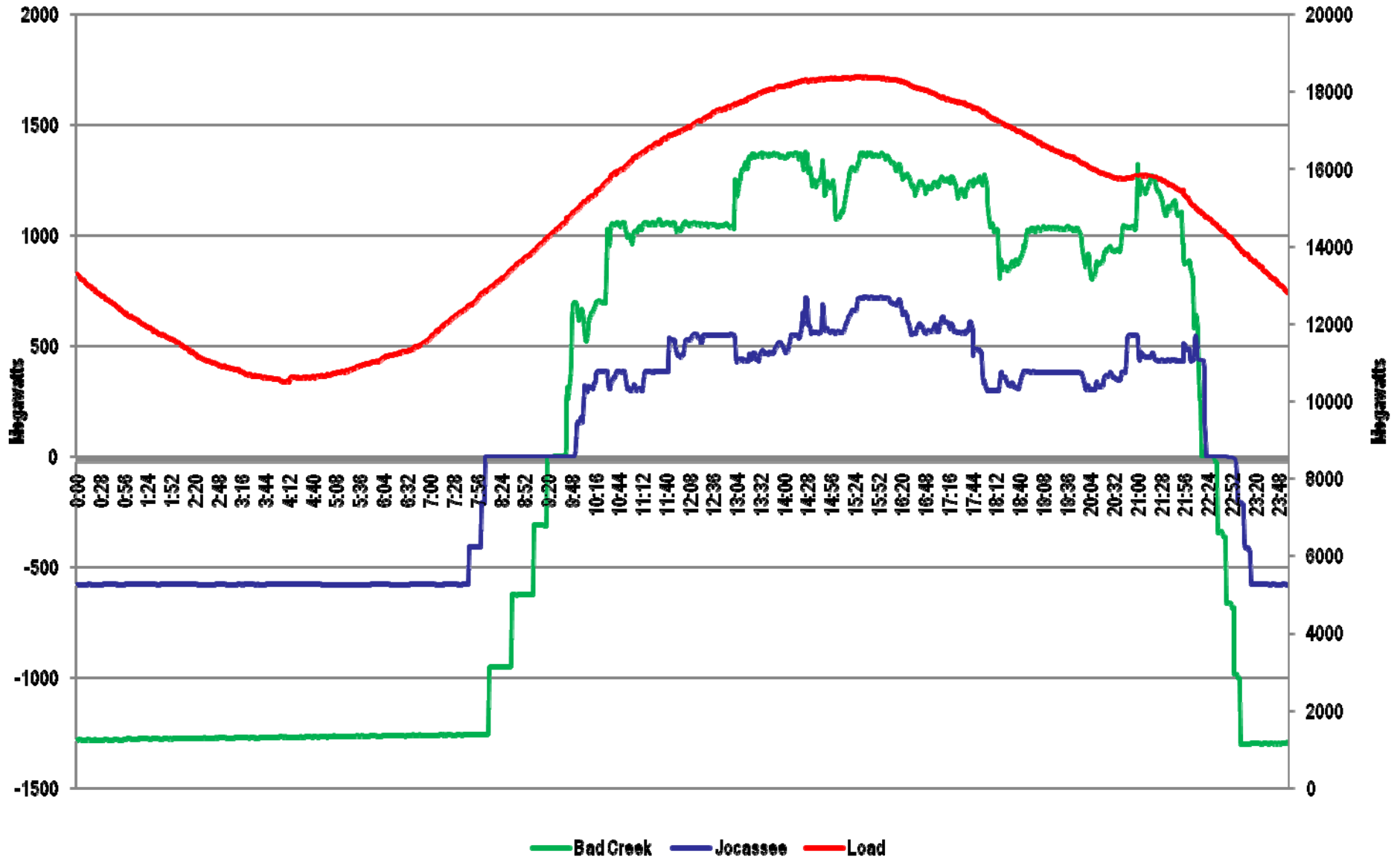


Winter Ramp



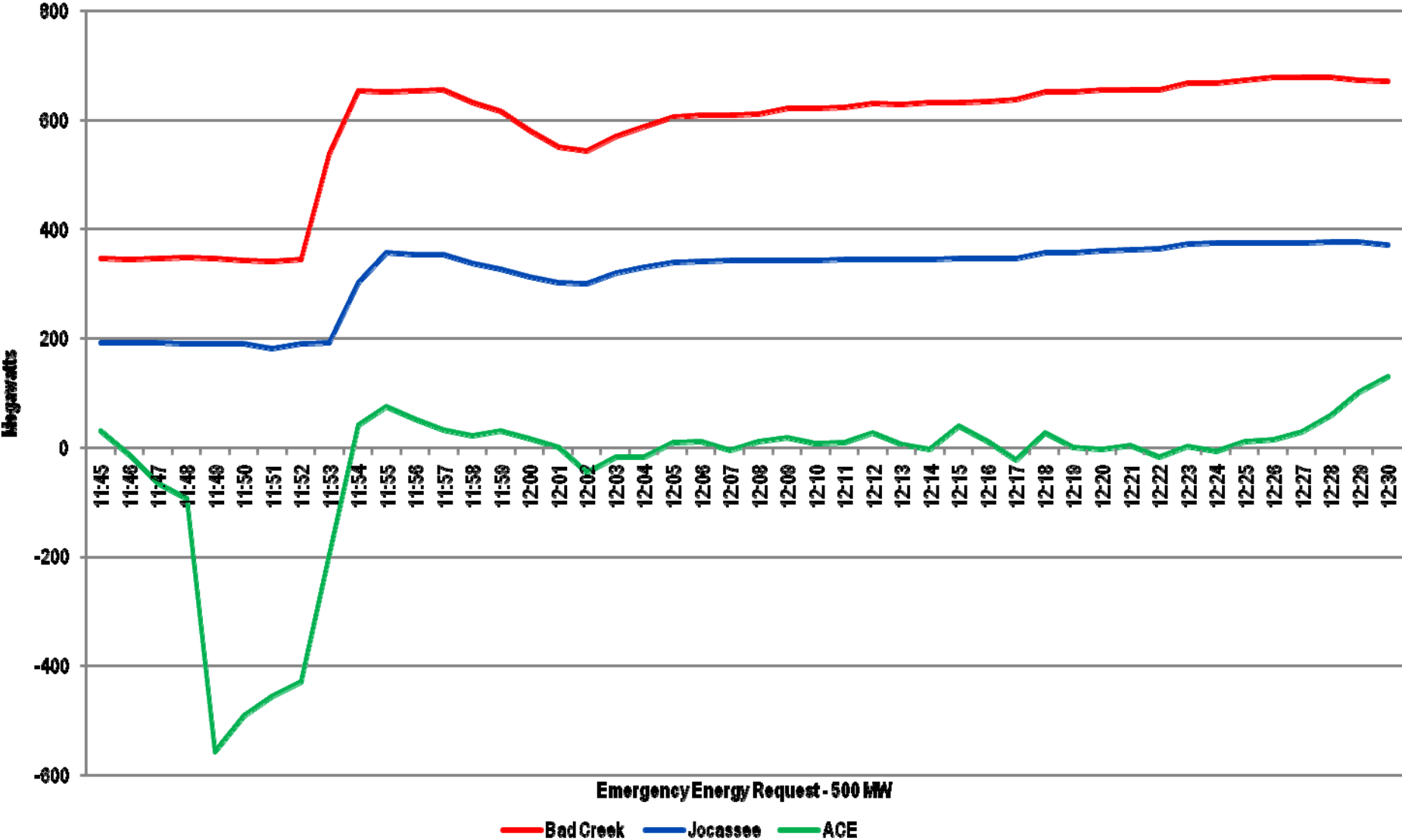


Operating Reserves/Load Following/Regulating Reserves





Contingency Reserves/Emergency Response





The Real Time Whole Ball of Wax – Pump Storage At Its Best

