Objectives of Quasi-Steady State Analysis

- Provide Validation and Context for Operational and Statistical Analysis
  - Cases Selected from Statistical Analysis
  - Boundary Conditions Set by Operational Analysis
- Evaluate Impact of Significant Wind Generation
  - Load Following & Ramp Rate Requirements
  - Regulation/AGC Requirements
- Illustrate Performance Issues
- Illustrate Mitigation Measures

Quasi Steady State (QSS) Analysis

- QSS Algorithm is Matlab-based Tool
- Represents Multiple Areas with Aggregate Load, Wind, Solar Data
- Boundary Conditions
  - Hourly Balance of Portfolio (BOP) Generation Dispatch
  - Hourly Import Schedule
  - Aggregate Ramp (MW/min) and Range (MW) Limits
- At 1-Minute Intervals
  - All Aggregate Load, Wind and Solar Profiles Vary
  - Regulating Power Provided by Designated Unit Type
- At 5-Minute Intervals
  - Simplified Economic Dispatch
  - Participating Unit Types Identified in MAPS Analysis
- At Hourly Intervals
  - Generation Dispatch Changes Implemented
  - Import Schedule Changes Implemented

Study Case

April 15, 2006

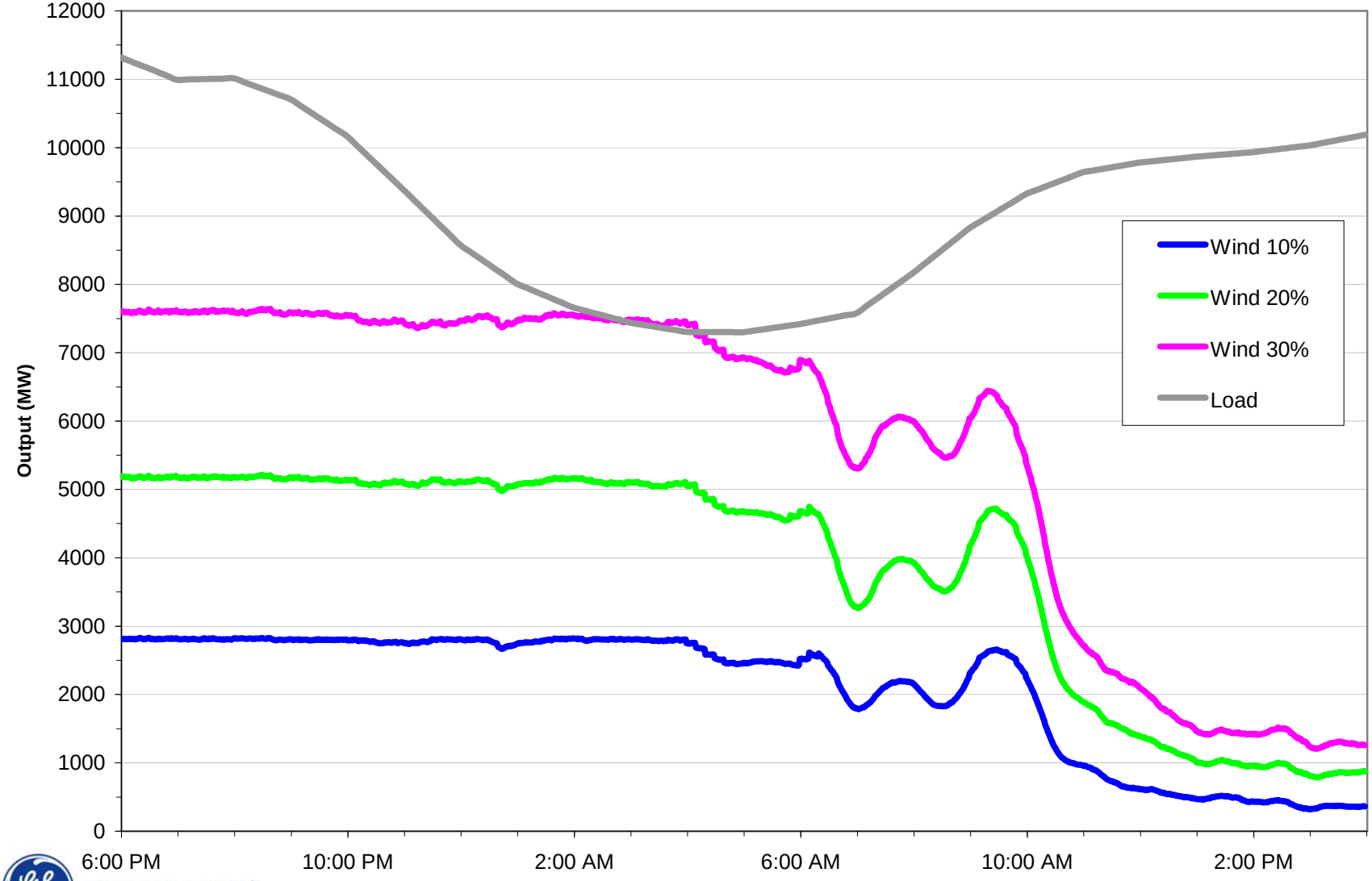
Local Priority 10%, 20%, 20-20%, 30%

1-Min Wind Data from NREL

1-Min Solar Data Interpolated from 10-Min Data

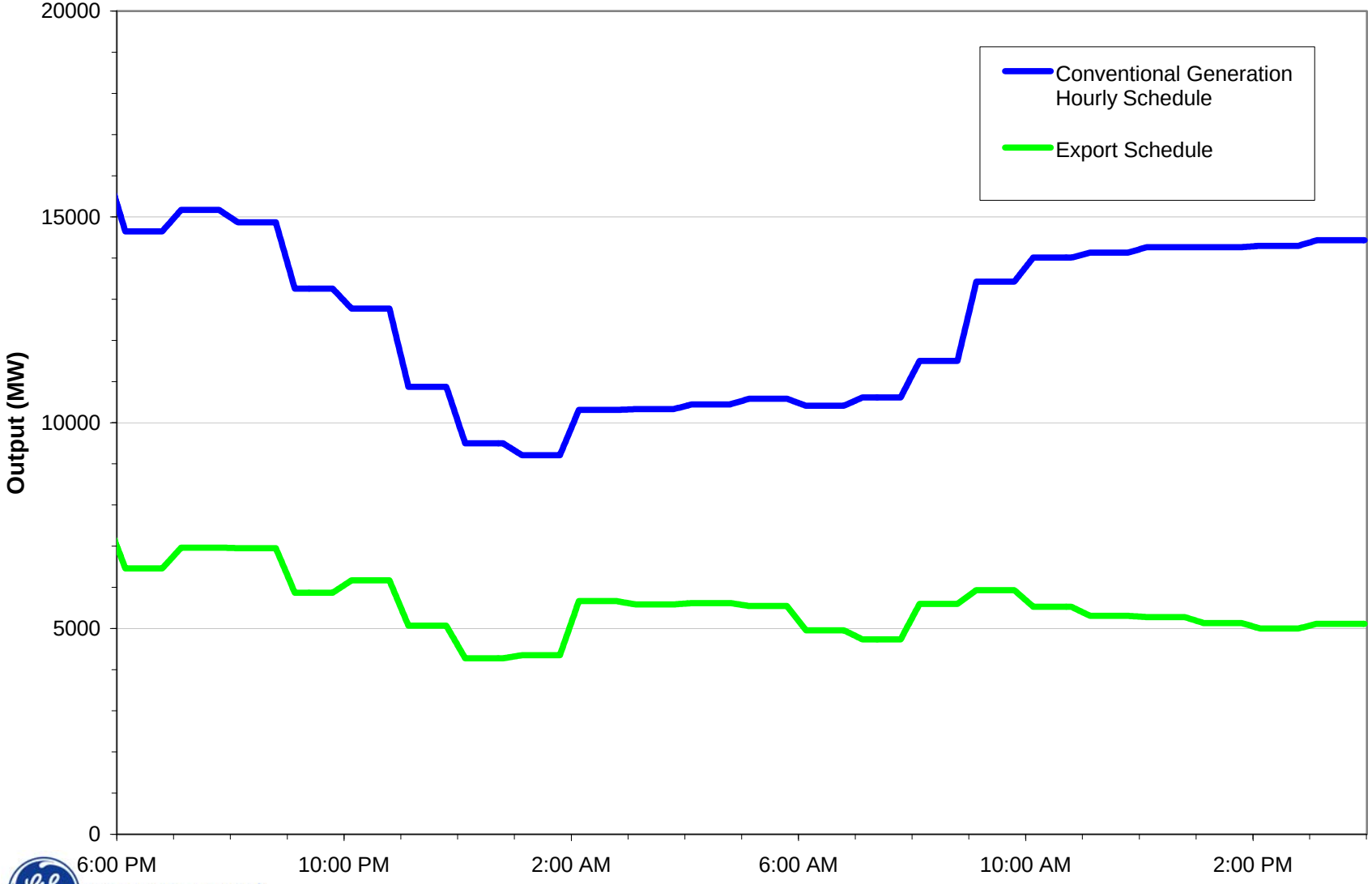
1-Min Load Data Interpolated from 1-Hour Data

Input Profiles: April 14-15, 2006 Arizona – Local Priority 10%, 20%, 30%



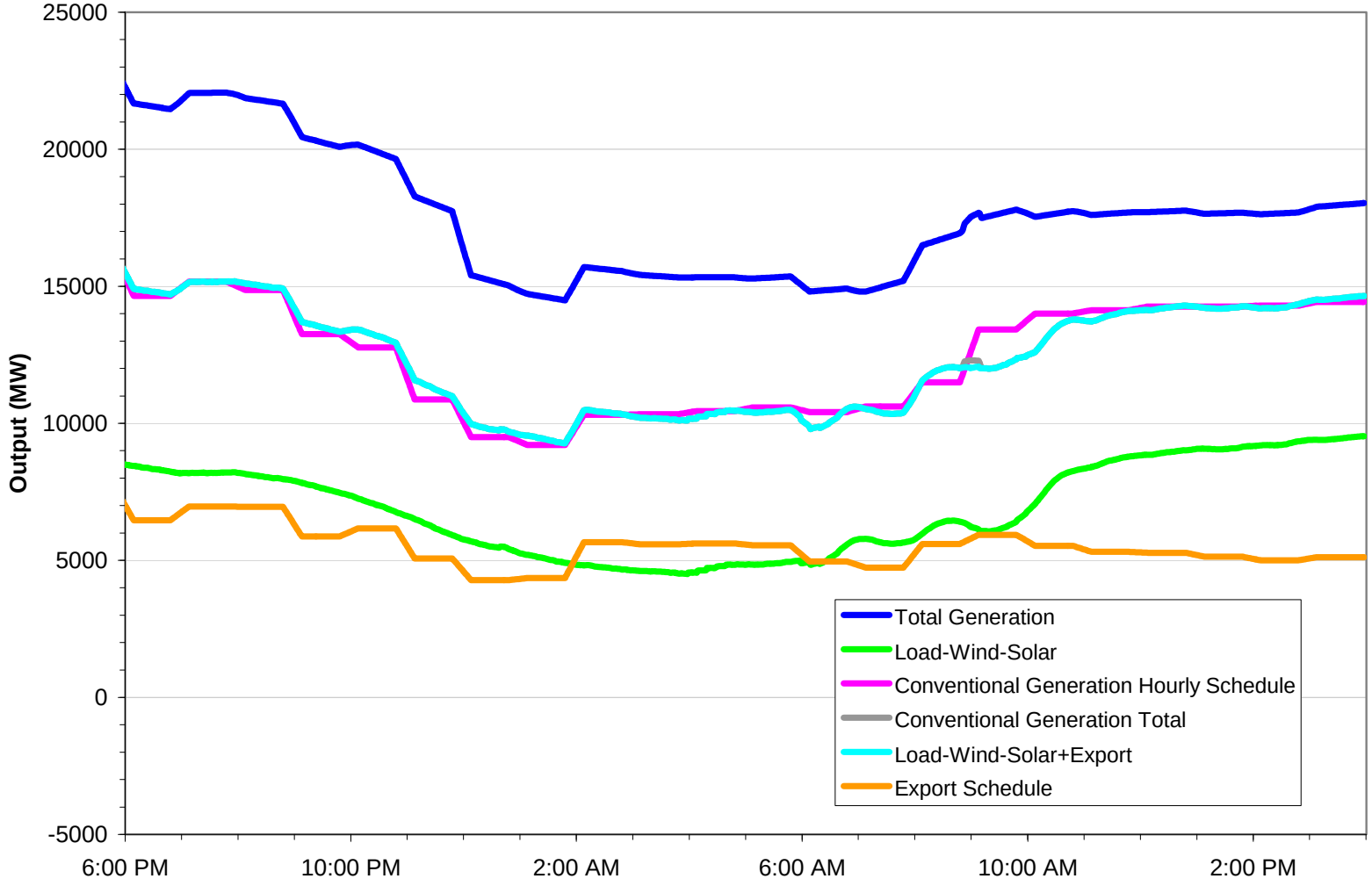
imagination at work

Boundary Conditions: April 14-15, 2006 Arizona – Local Priority 10%

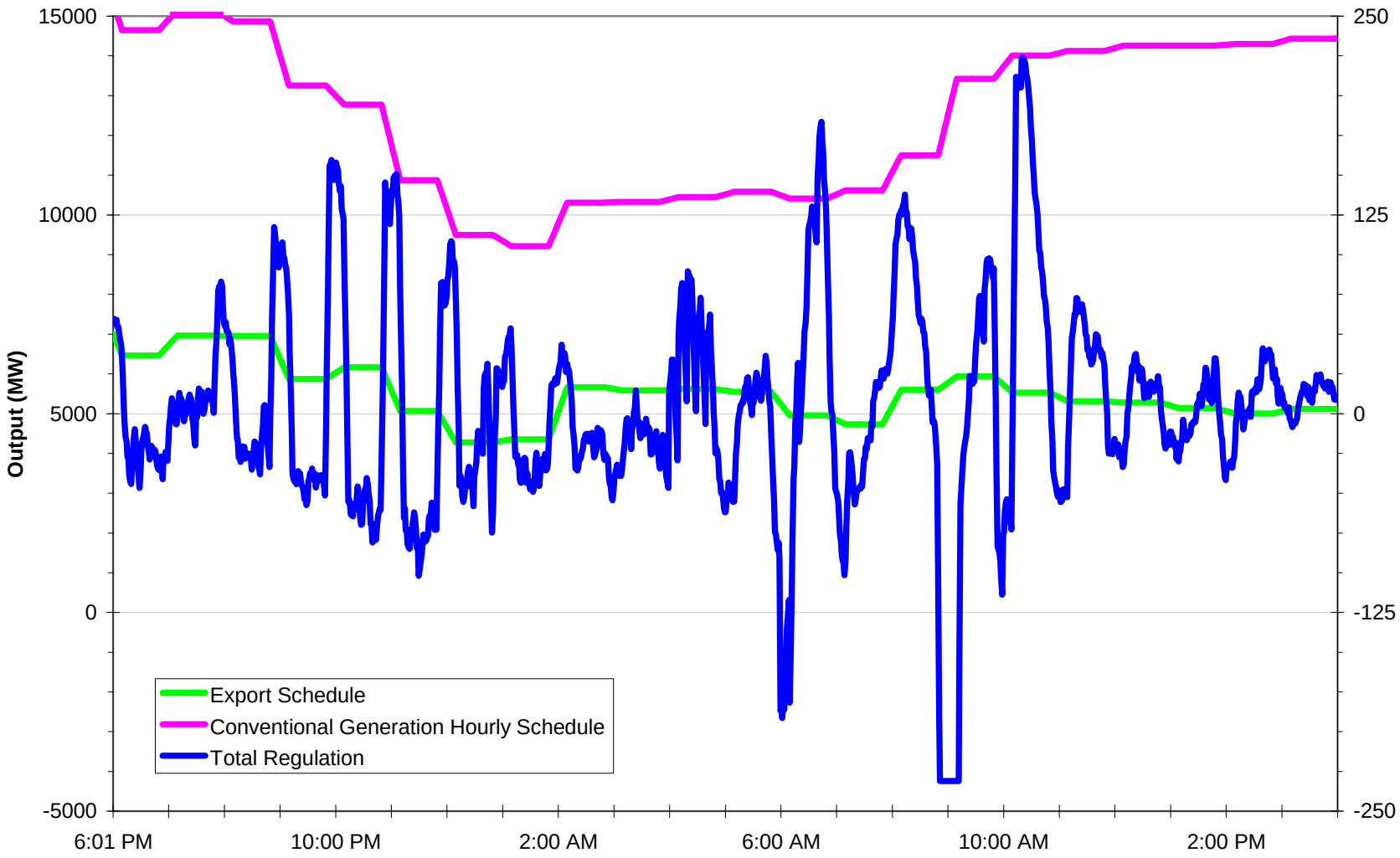


imagination at work

Total Output: April 14-15, 2006 Arizona – Local Priority 10%

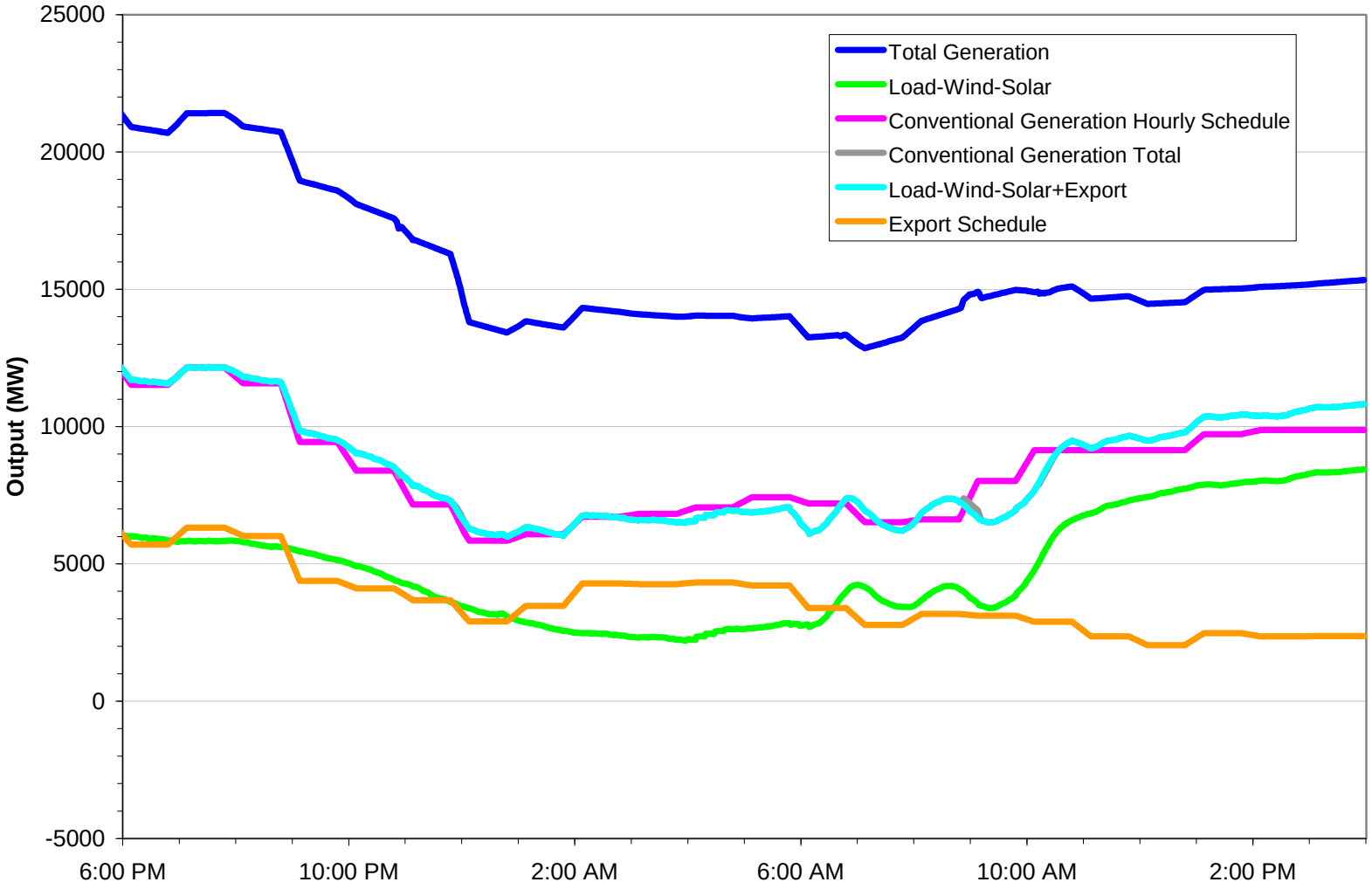


Regulation vs. Schedule Changes Arizona – Local Priority 10%

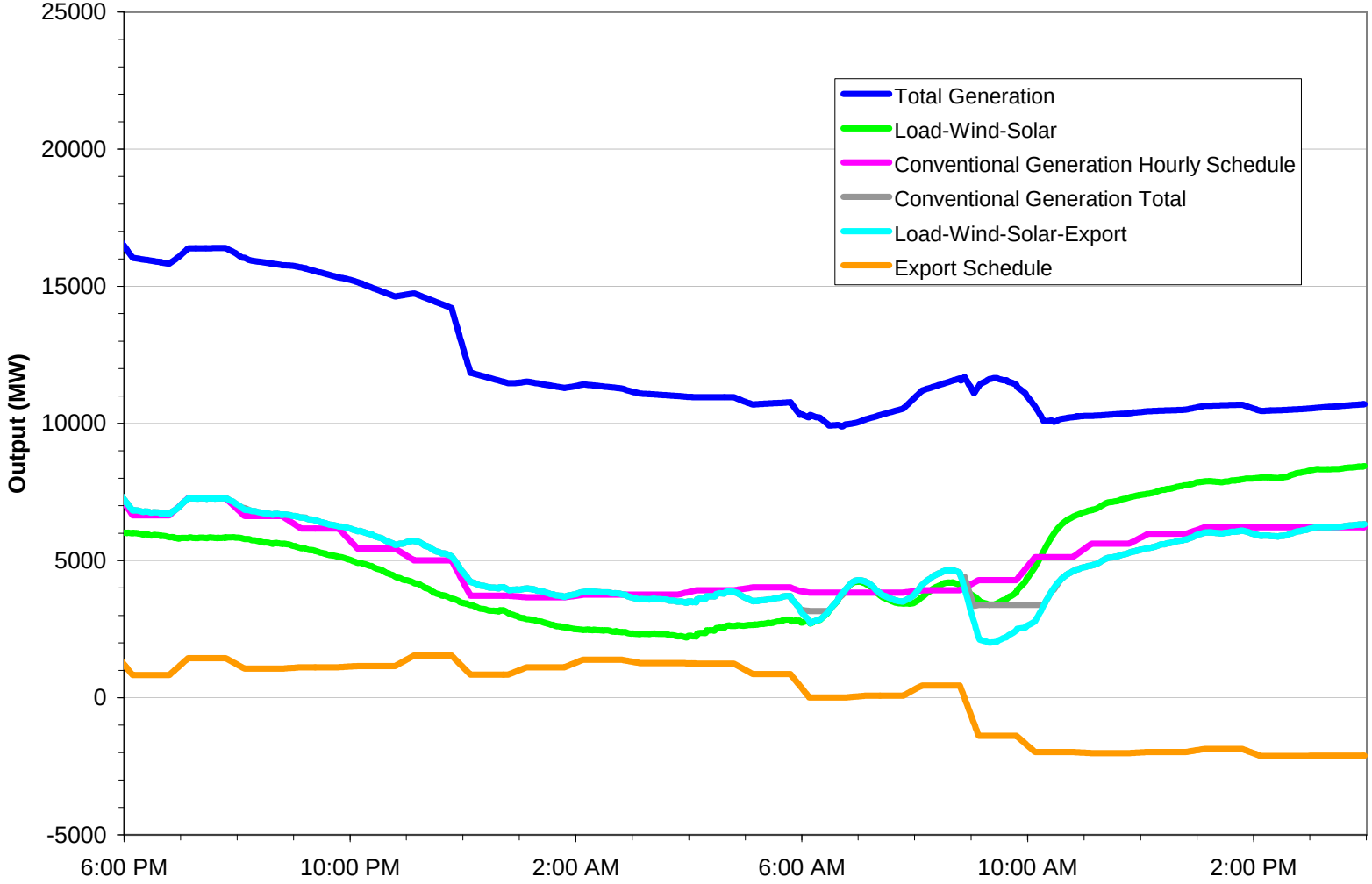


imagination at work

Total Output
Arizona – Local Priority 20%

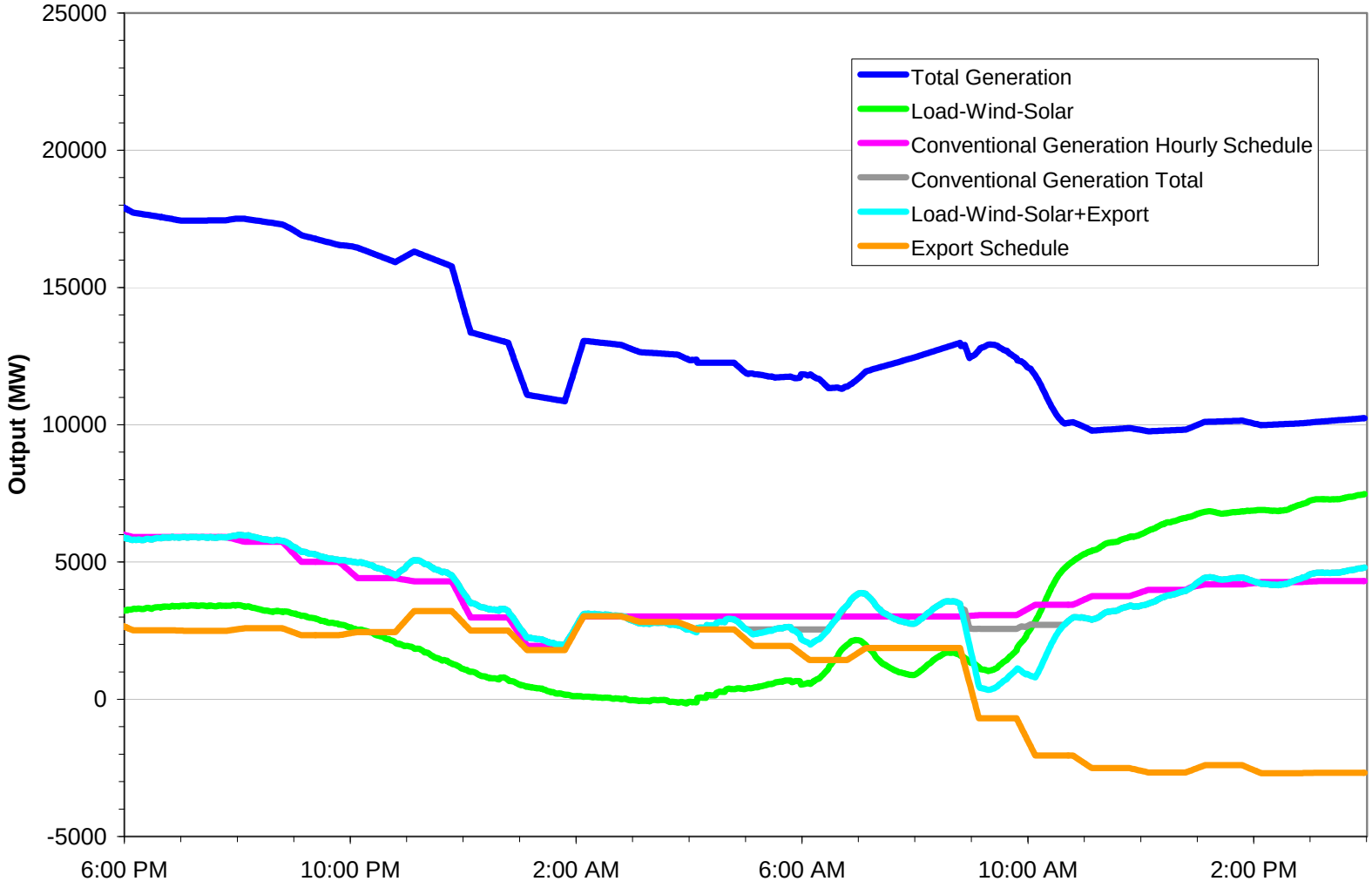


Total Output
Arizona – Local Priority 20/20%



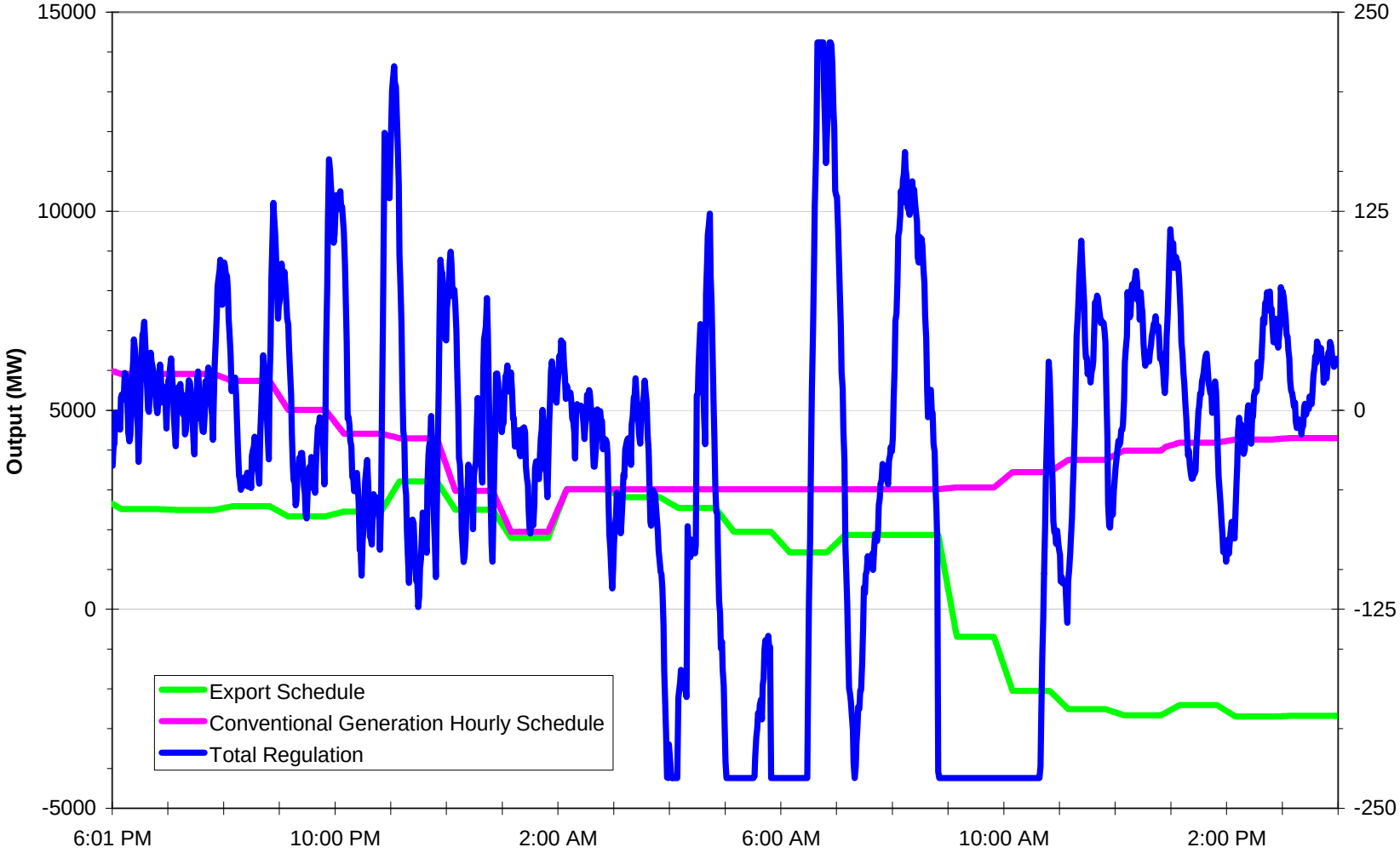
imagination at work

Total Output
Arizona – Local Priority 30%

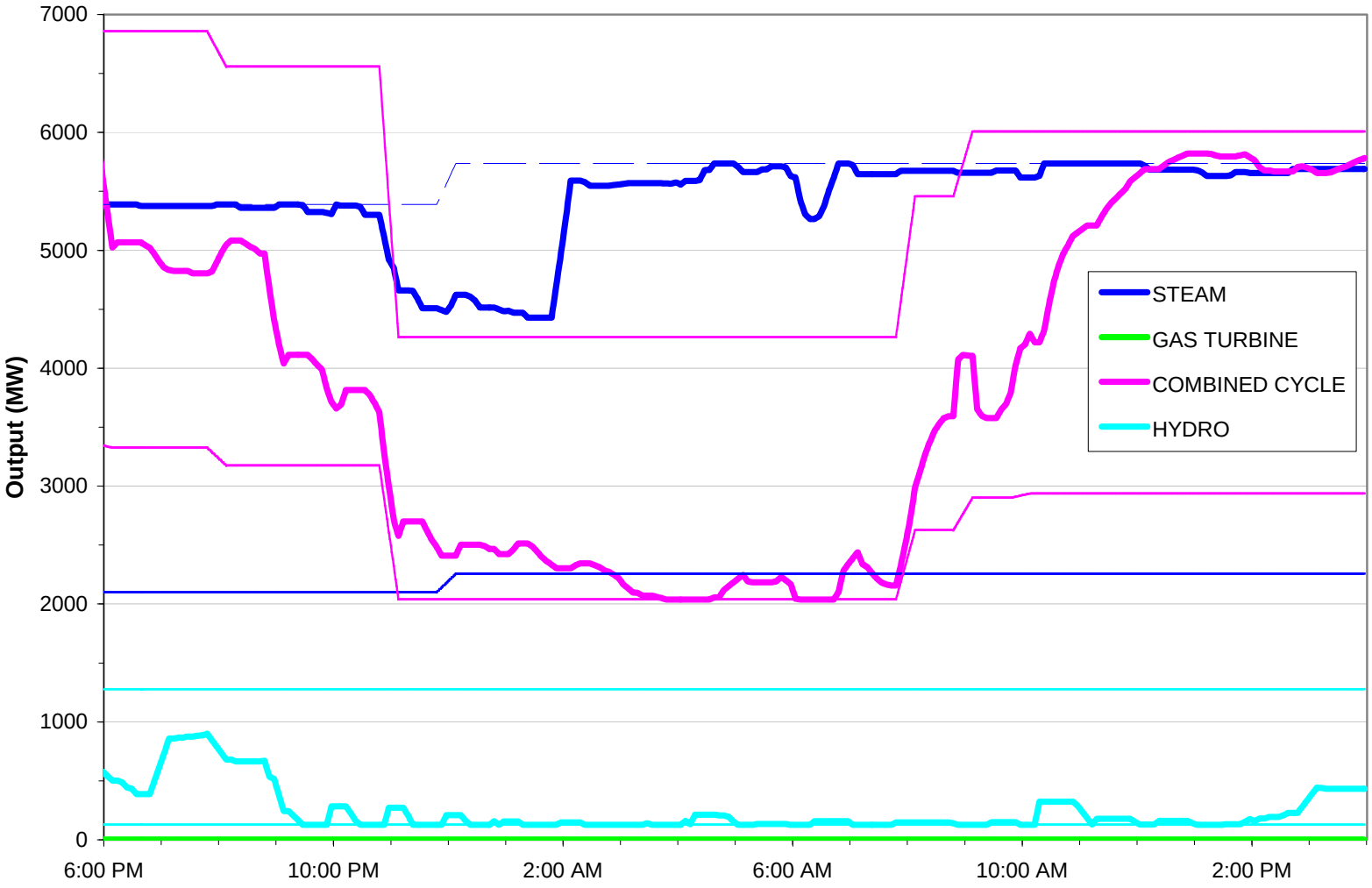


imagination at work

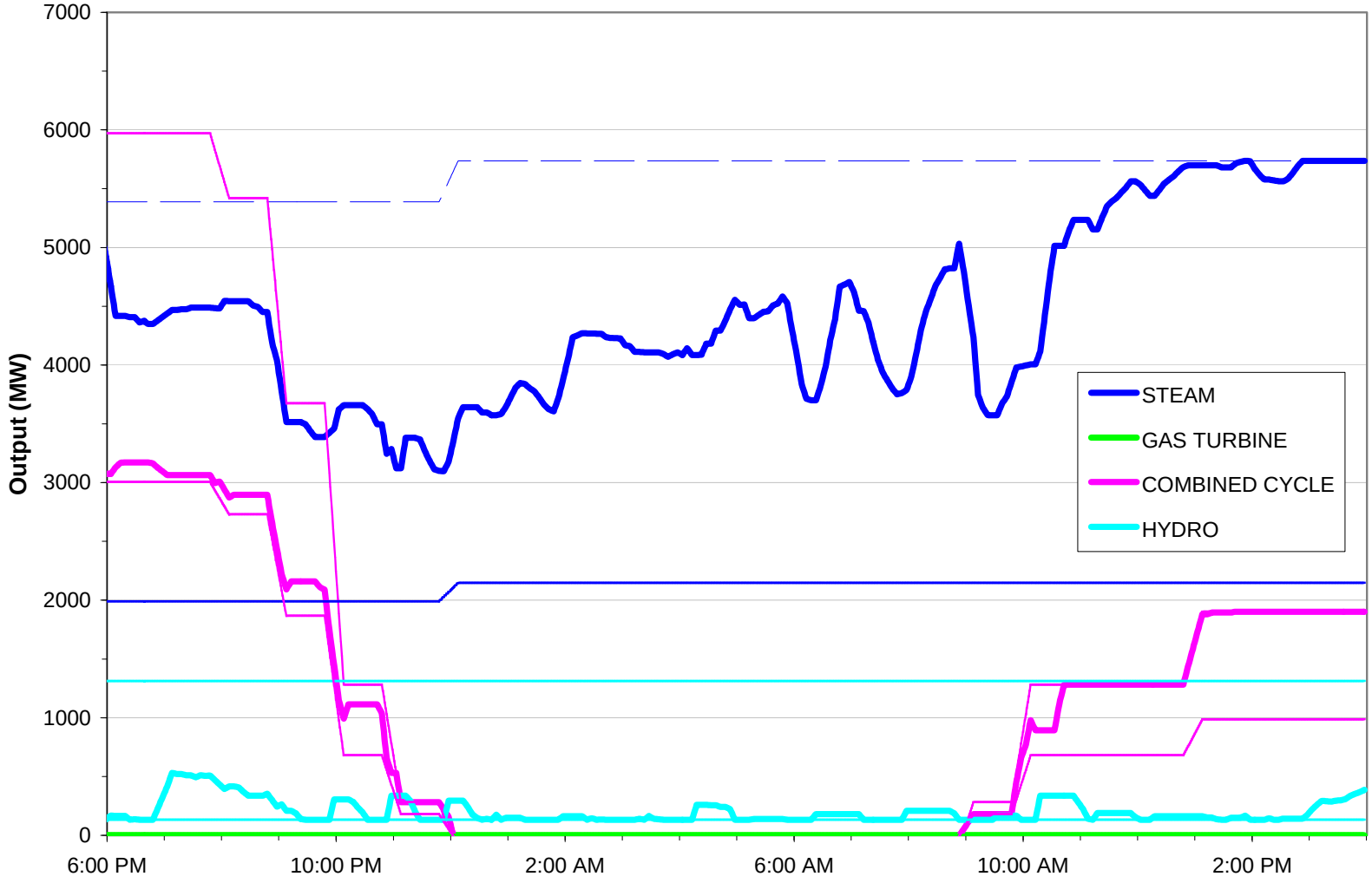
Regulation vs. Schedule Changes Arizona – Local Priority 30%



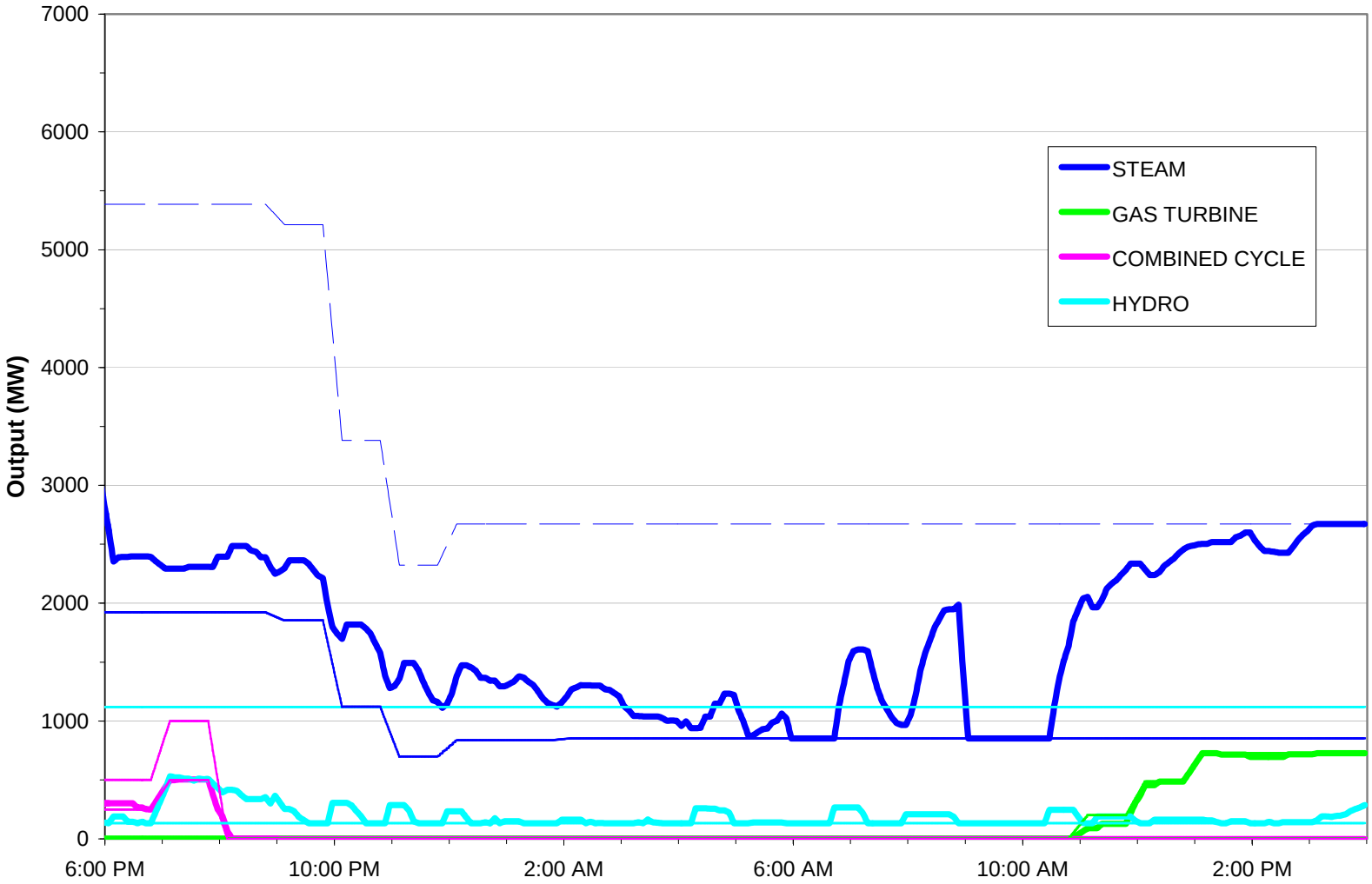
Total Dispatch
Arizona – Local Priority 10%



Total Dispatch
Arizona – Local Priority 20%

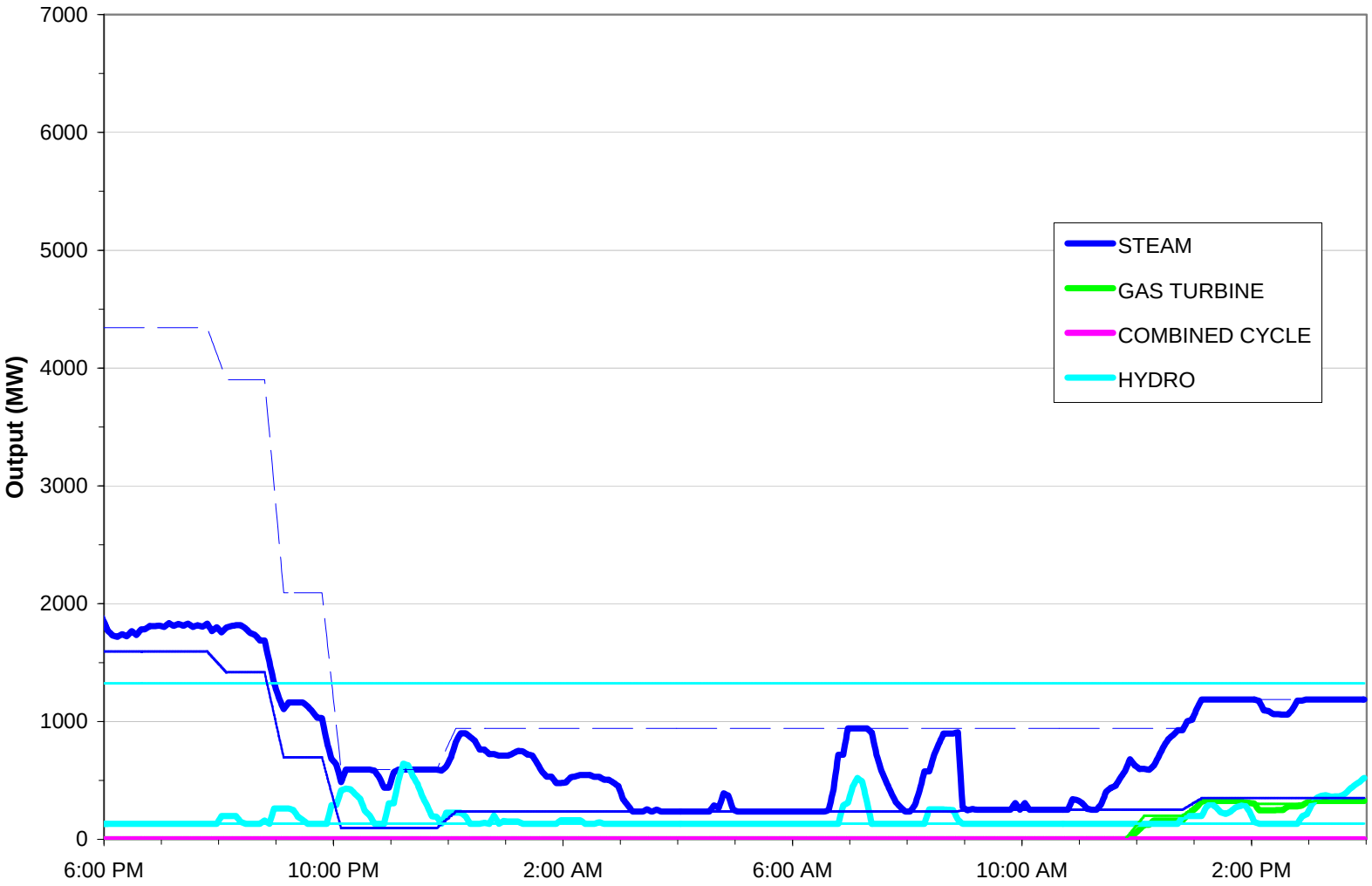


Total Dispatch
Arizona – Local Priority 20/20%



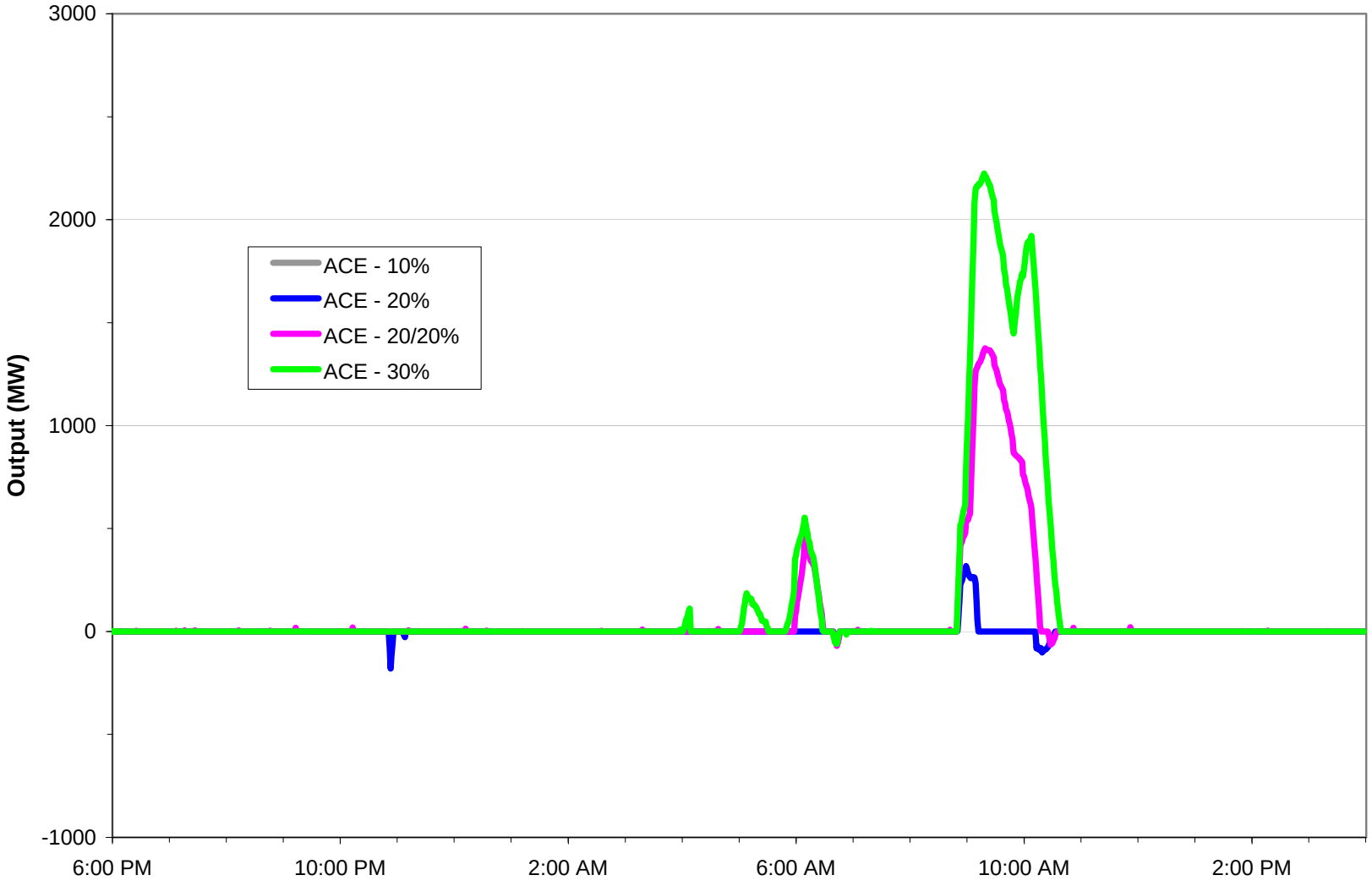
imagination at work

Total Dispatch
Arizona – Local Priority 30%

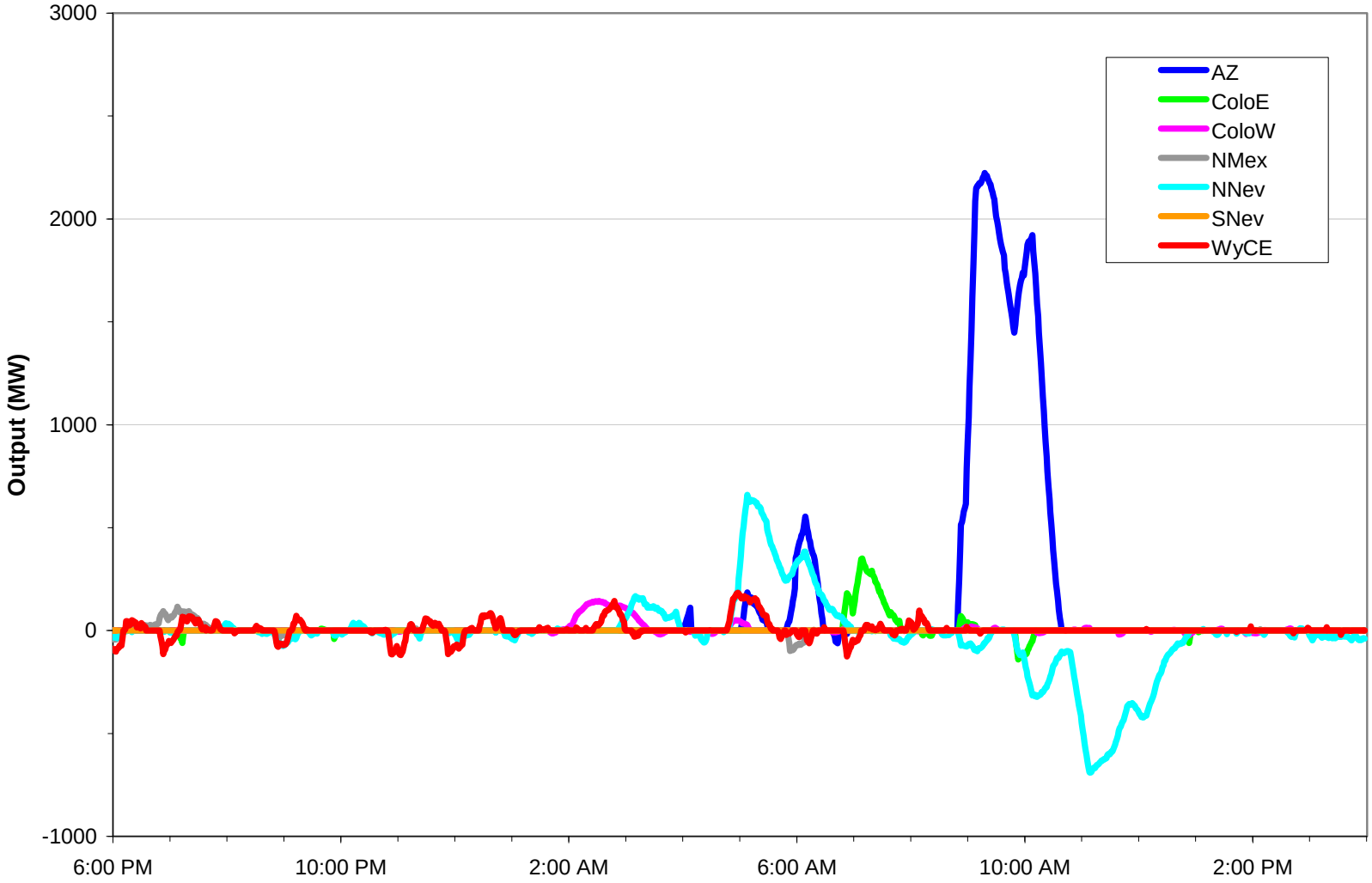
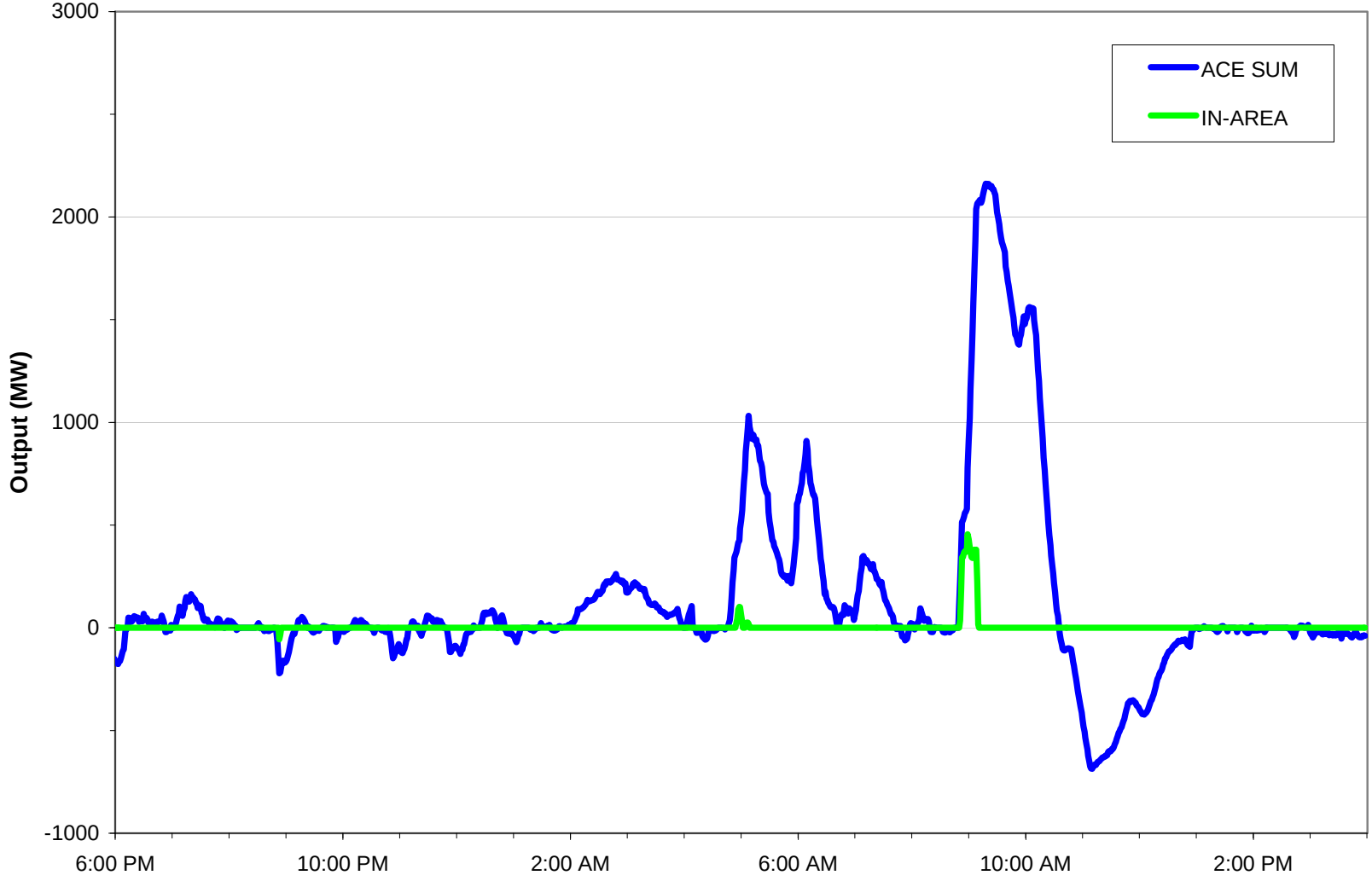


imagination at work

ACE
Arizona – Local Priority 10%, 20%, 20/20%, 30%



All Transmission Area ACEs
Local Priority 30%



In Footprint vs. Σ All TA ACEs Local Priority 30%