

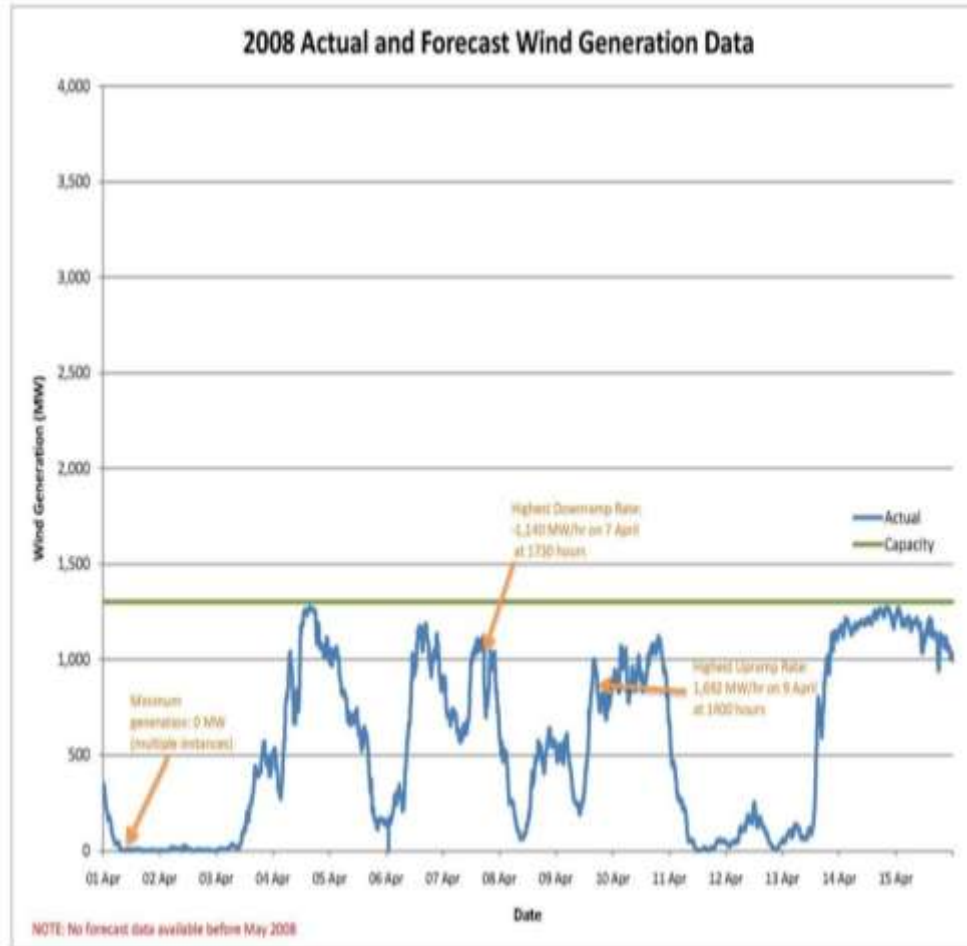
# **A Focus on Markets Hydro Has Value, but.... Will it be Valued?**

**Richard R. Miller, P.E.  
HDR Engineering, Inc.**

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**DOE Electricity Advisory Committee  
June 5-6, 2013**

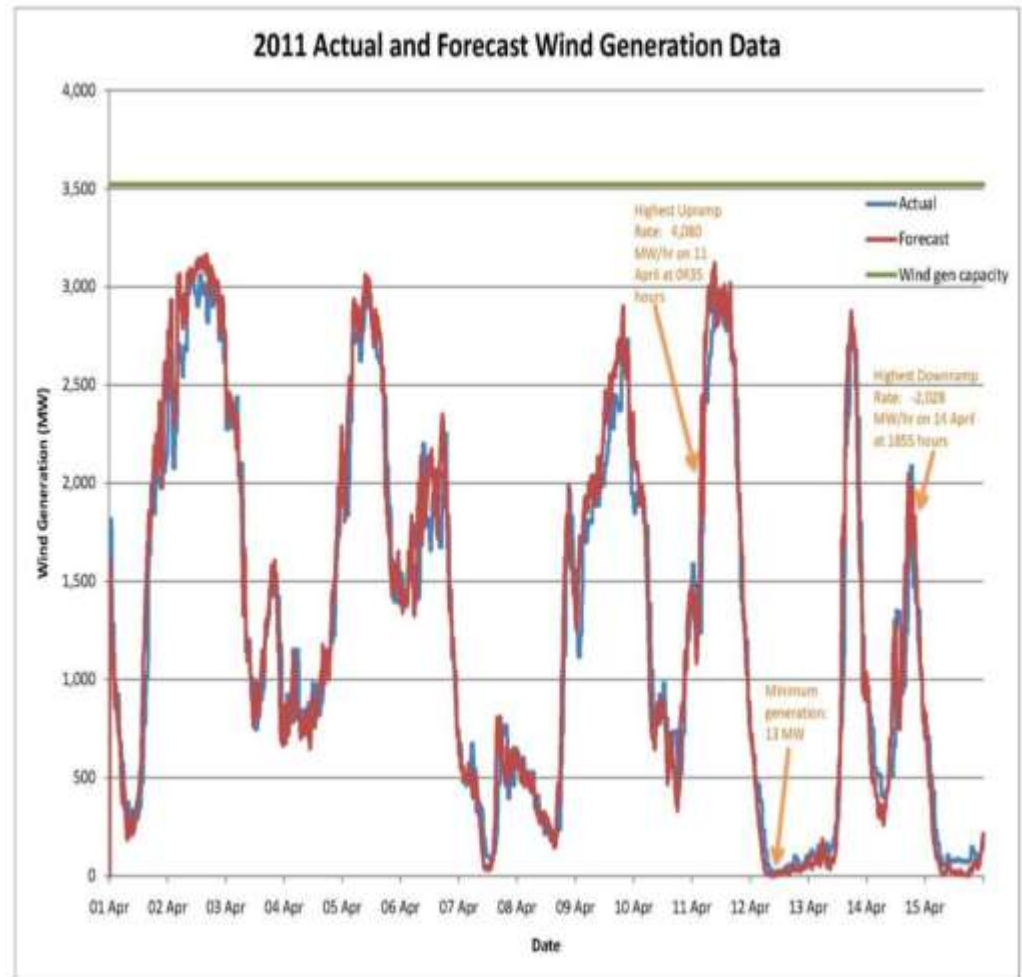
# Is BPA Today California's Energy Future?



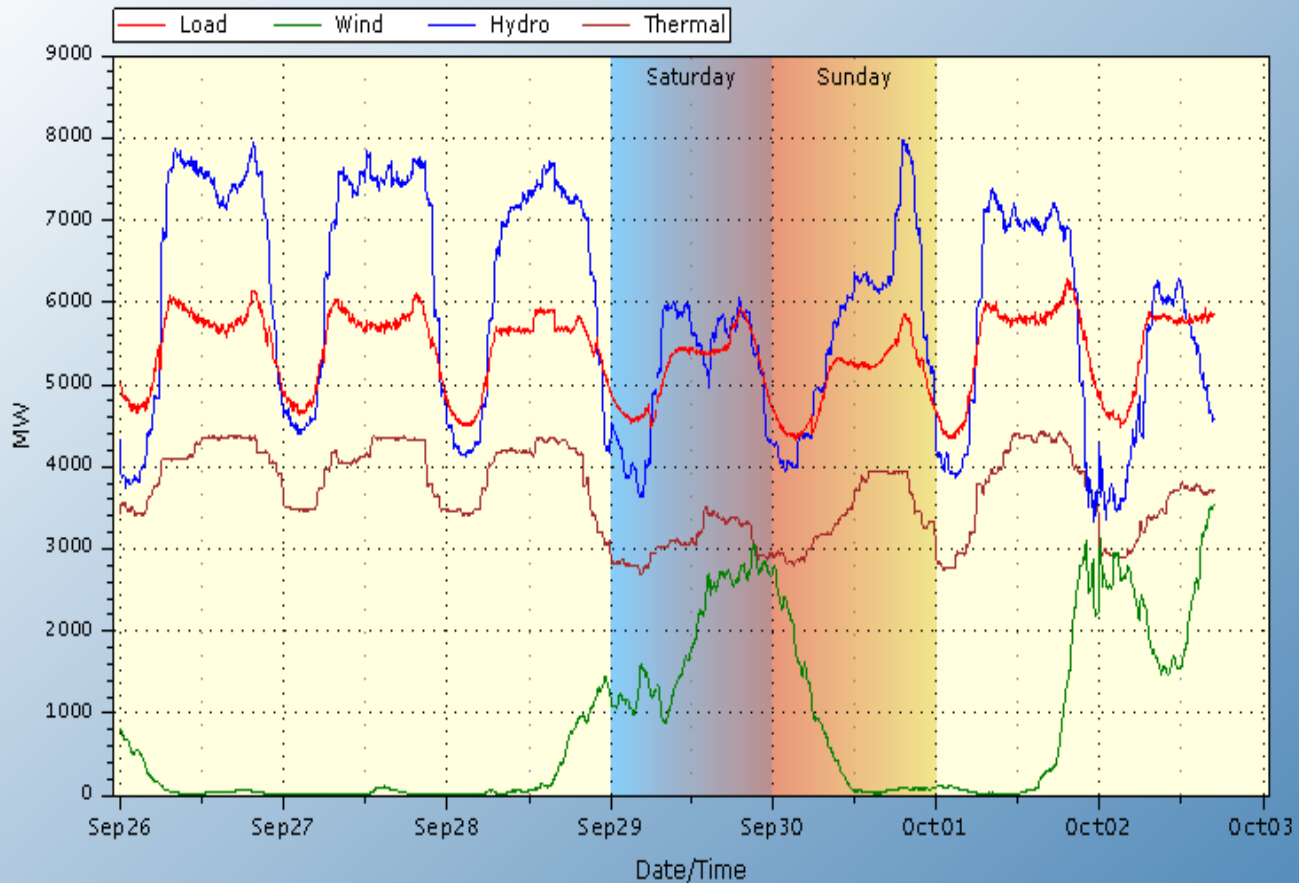
***Actual and forecasted wind: large swings in power supply need to be supplemented by other sources***

# Is BPA Today California's Energy Future?

***Adding Wind Plants Under Current Market Incentives ≠ Geographic Diversity : Large Ramp Rates Are Exacerbated!***

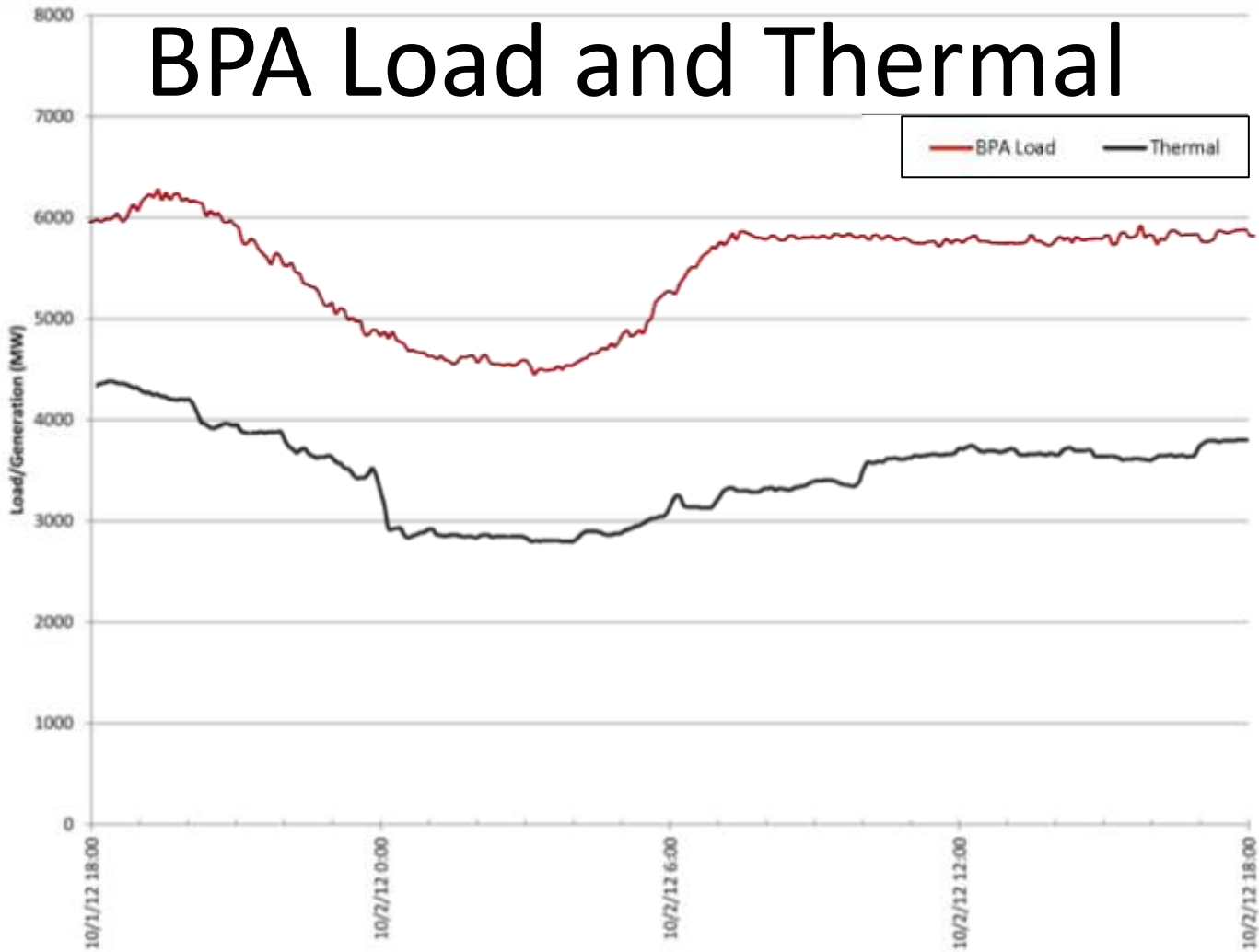


BPA Balancing Authority Load & Total Wind, Hydro, and Thermal Generation, Last 7 days  
26Sep2012 - 03Oct2012 (last updated 20Oct2012 16:51:54)

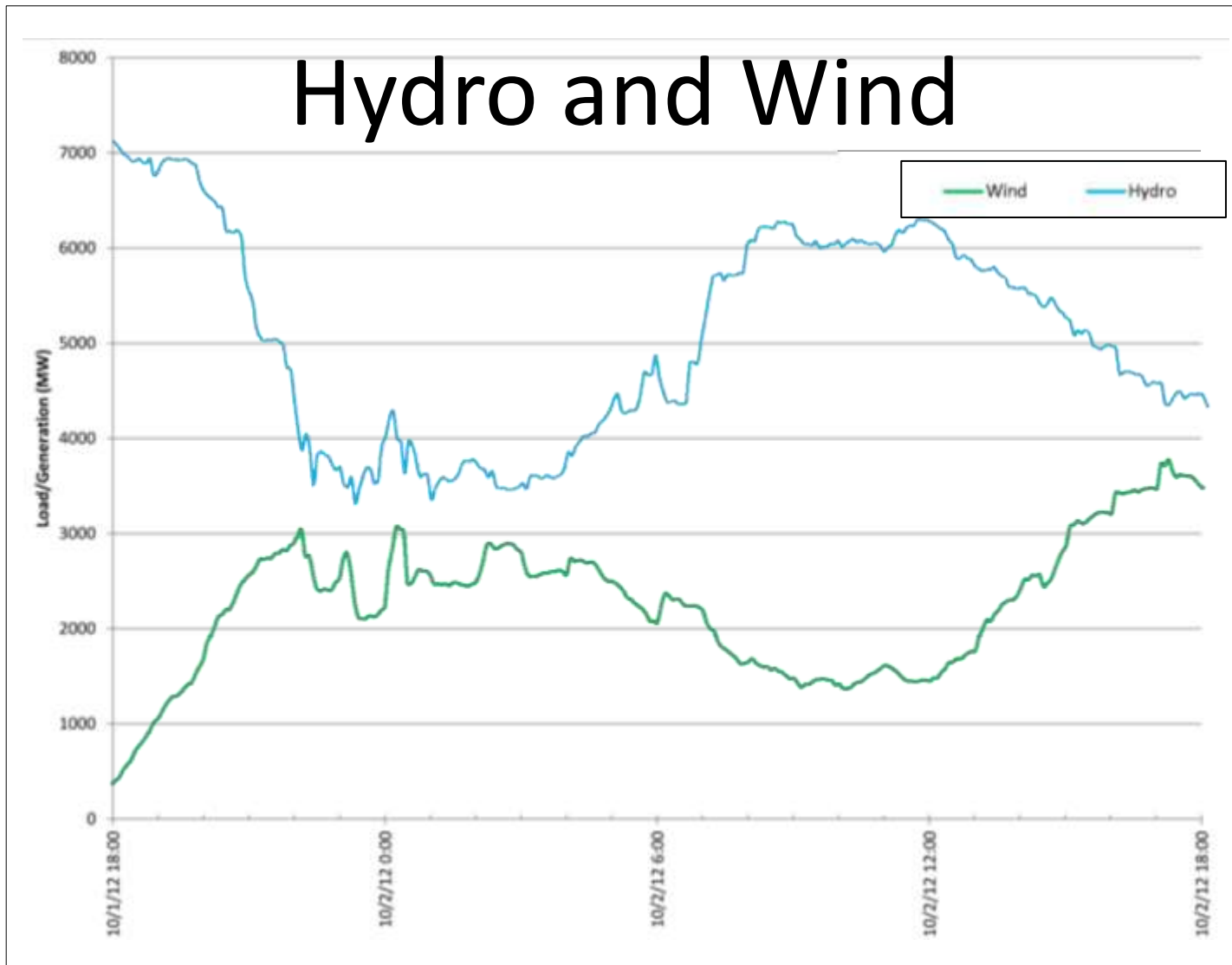


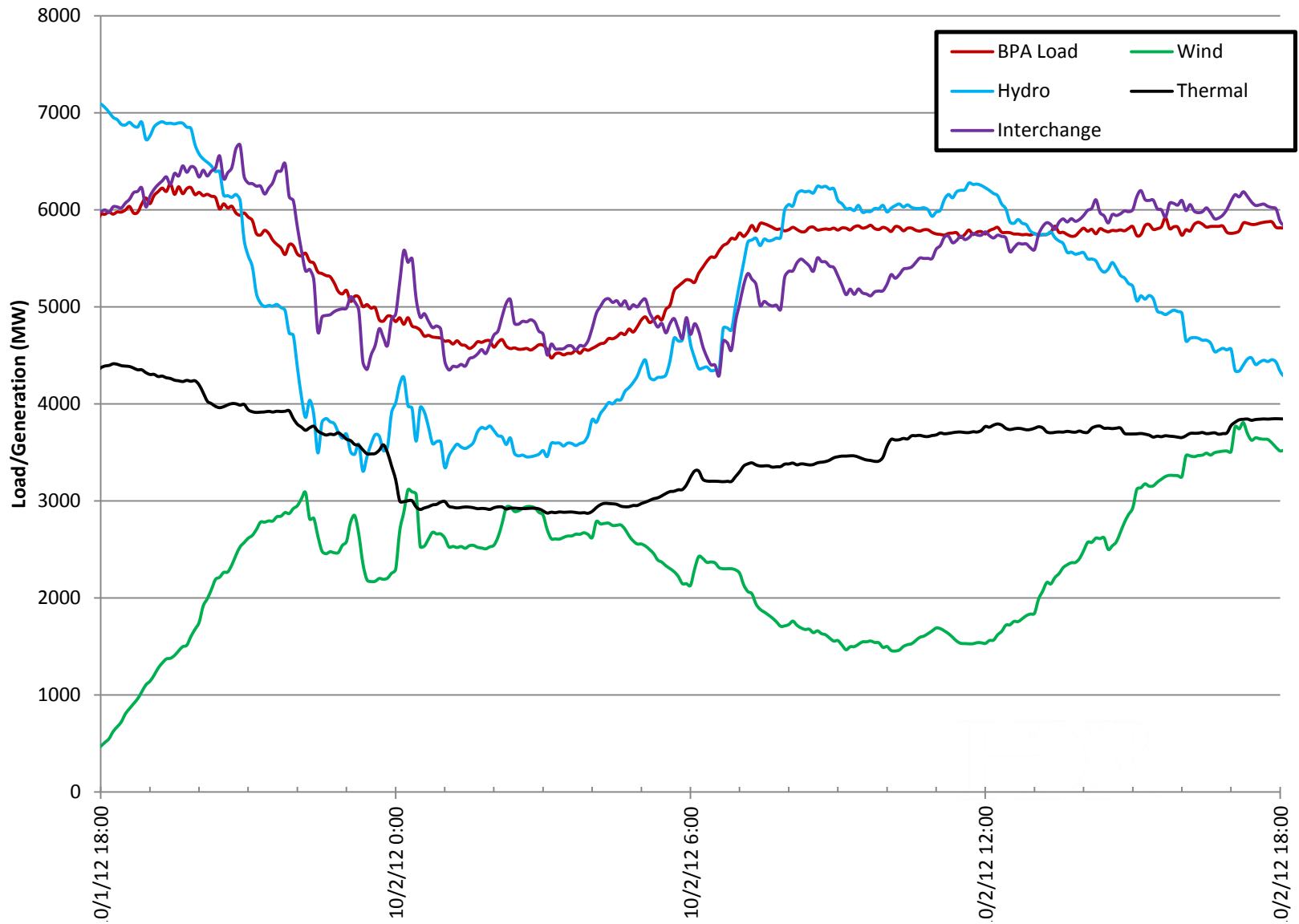
Based on 5-min readings from the BPA SCADA system for points 45583, 79687, 79682, and 79685  
Balancing Authority Load in Red, Wind Gen. in Green, Hydro Gen. in Blue, and Thermal Gen. in Brown  
Click chart for installed capacity info  
BPA Technical Operators (TOT-OpInfo@bpa.gov)

# BPA Load and Thermal



# Hydro and Wind

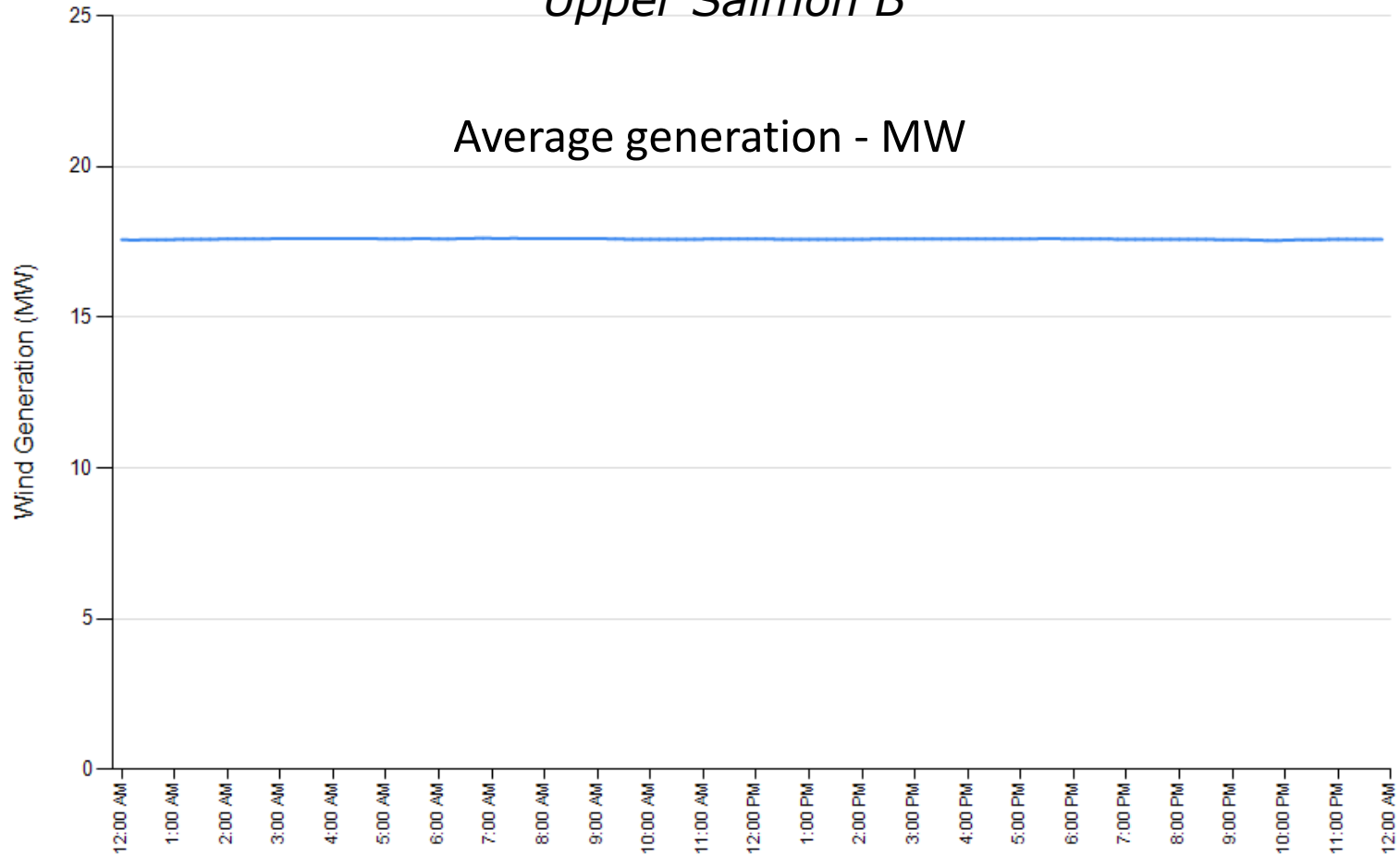




# February 2012

## IDAHO POWER

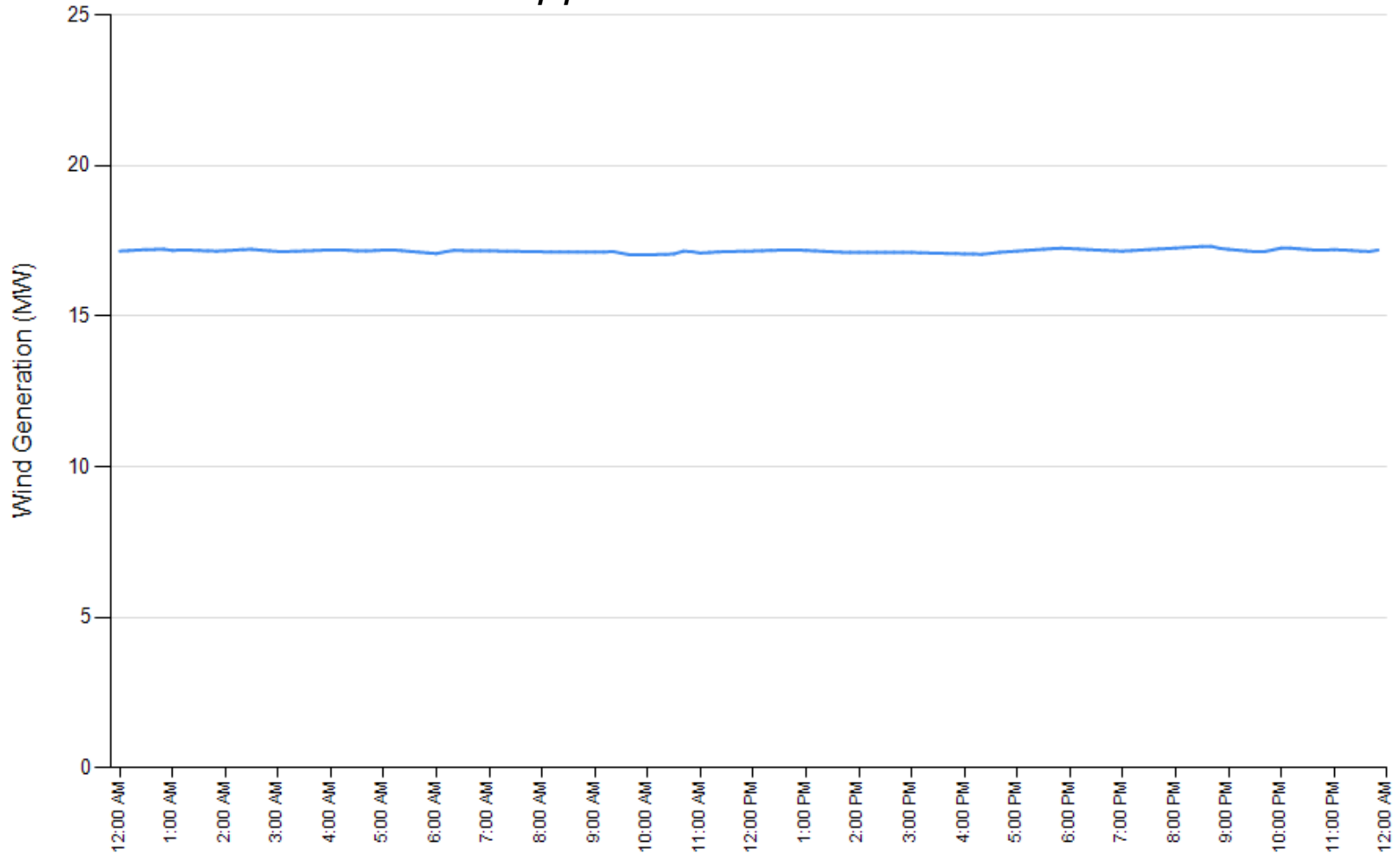
### *Upper Salmon B*





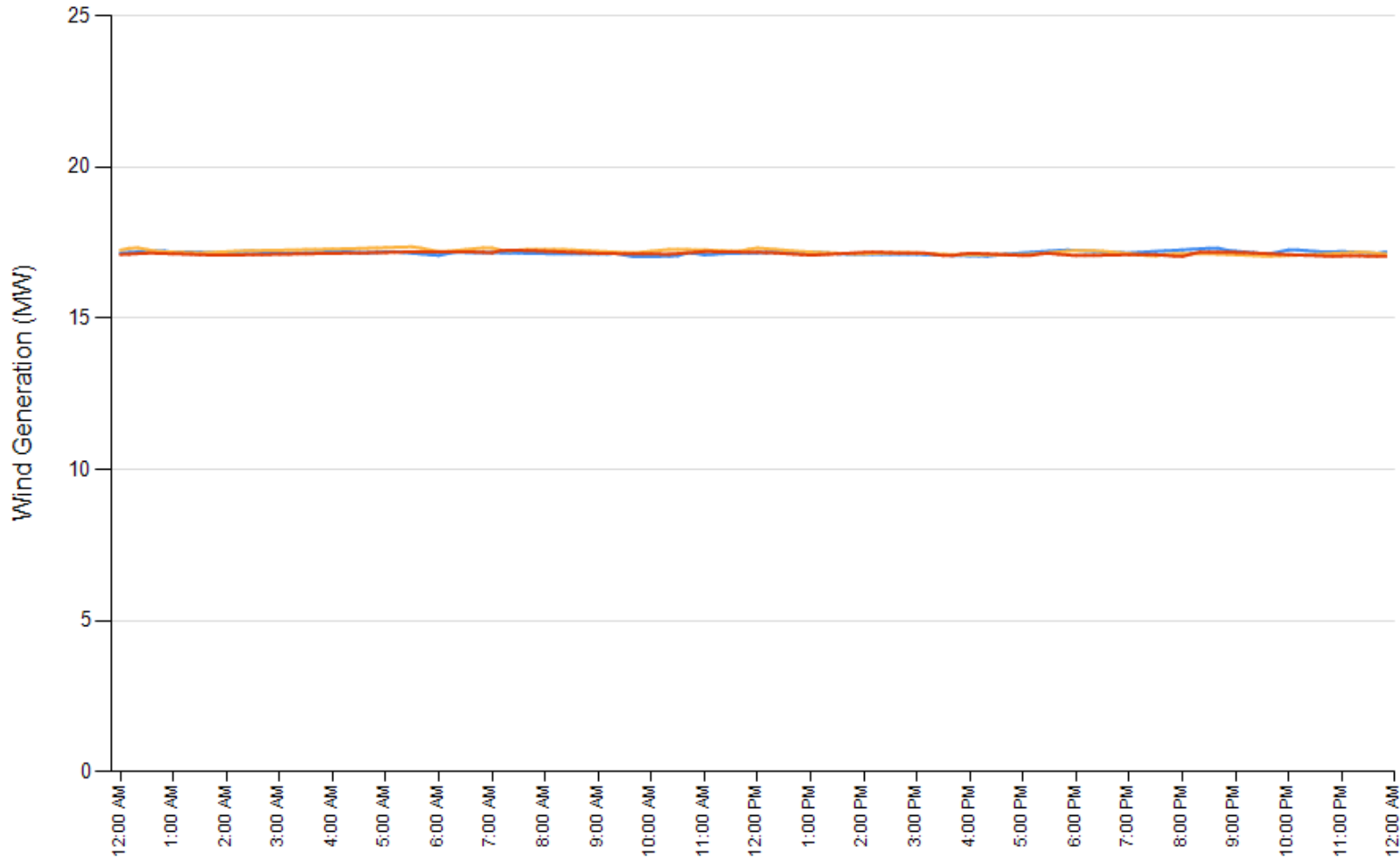
# February 2012 - 1 day

*Upper Salmon B*



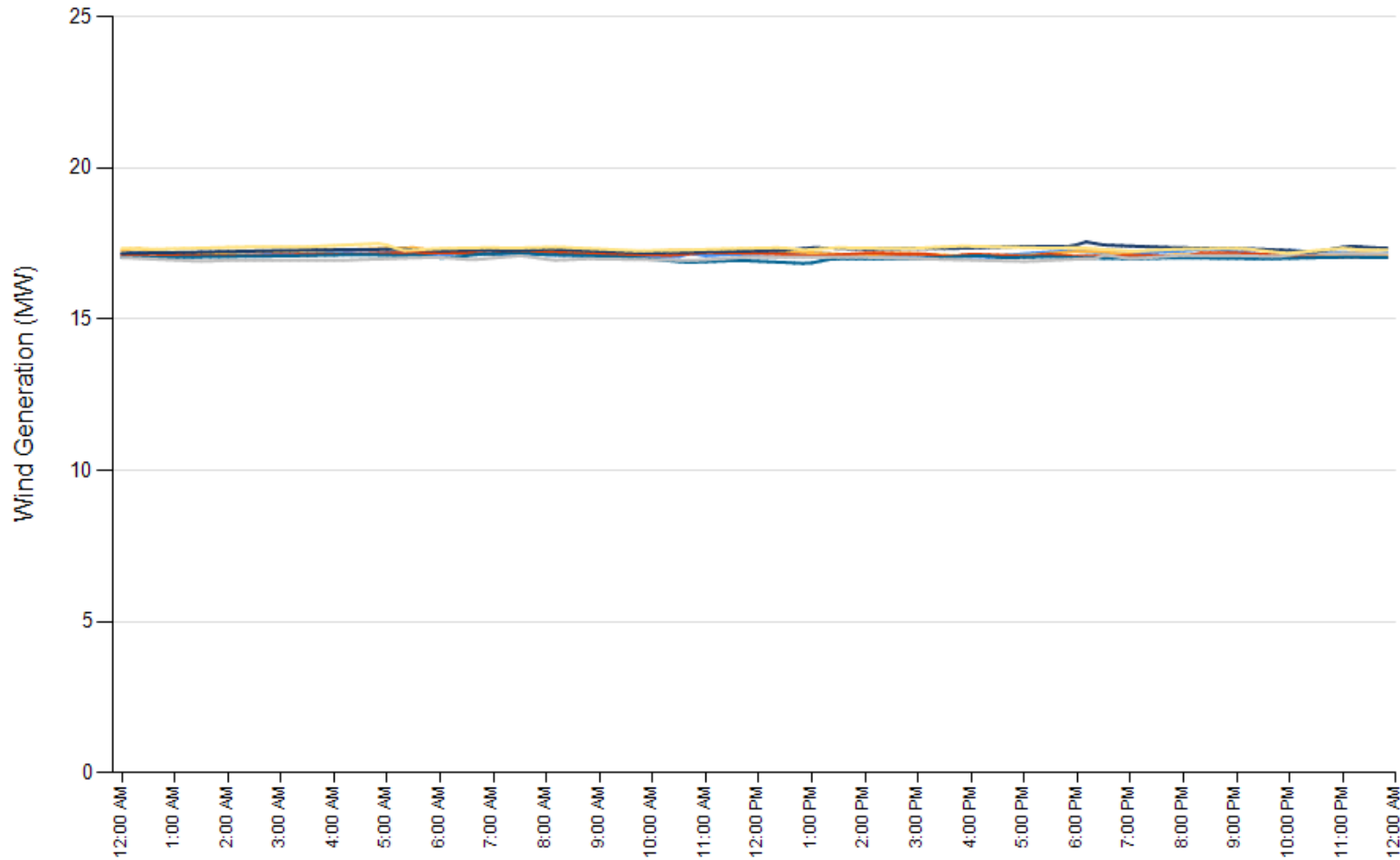
# February 2012 – 3 days

*Upper Salmon B*



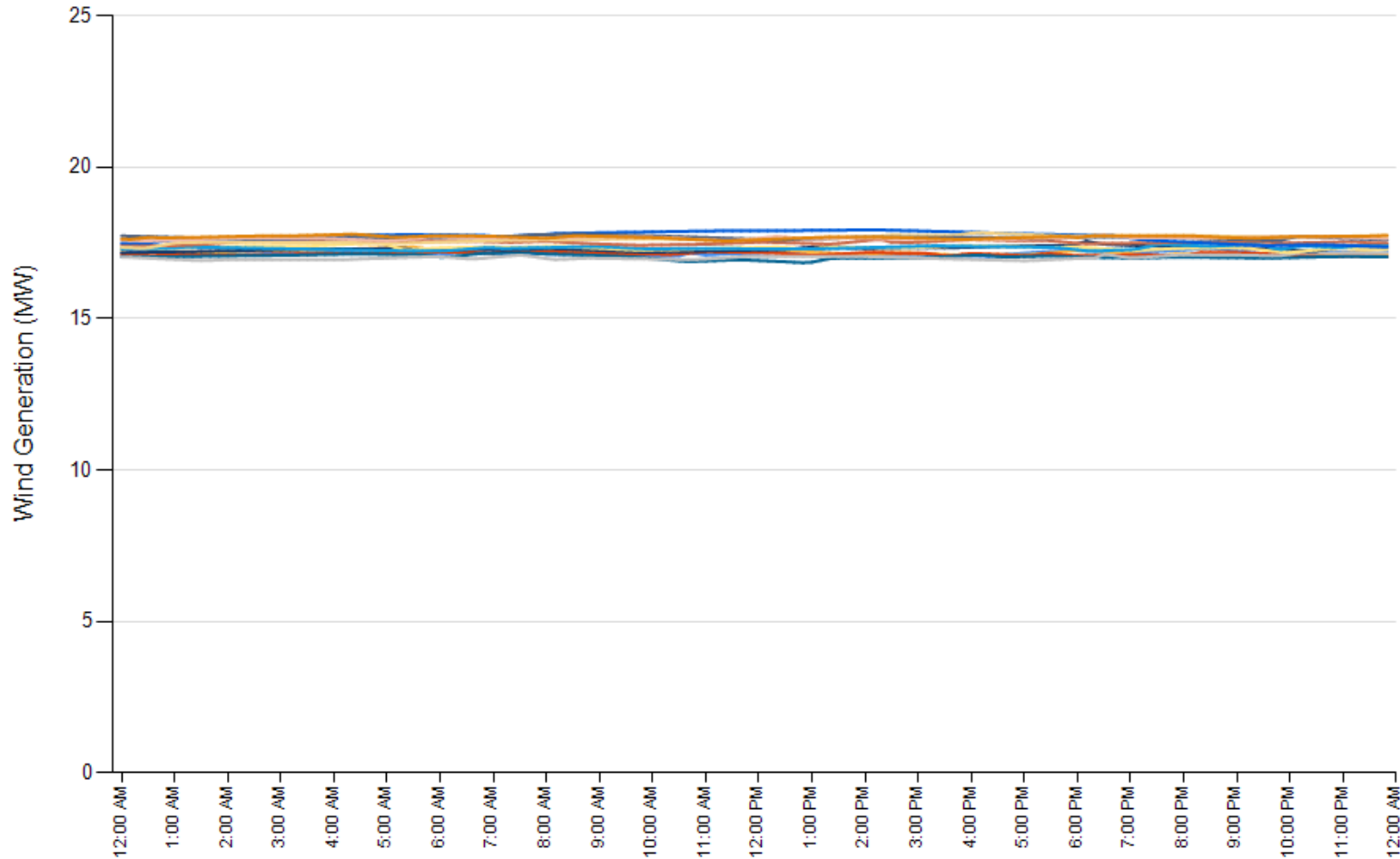
# February 2012 – 7 days

*Upper Salmon B*



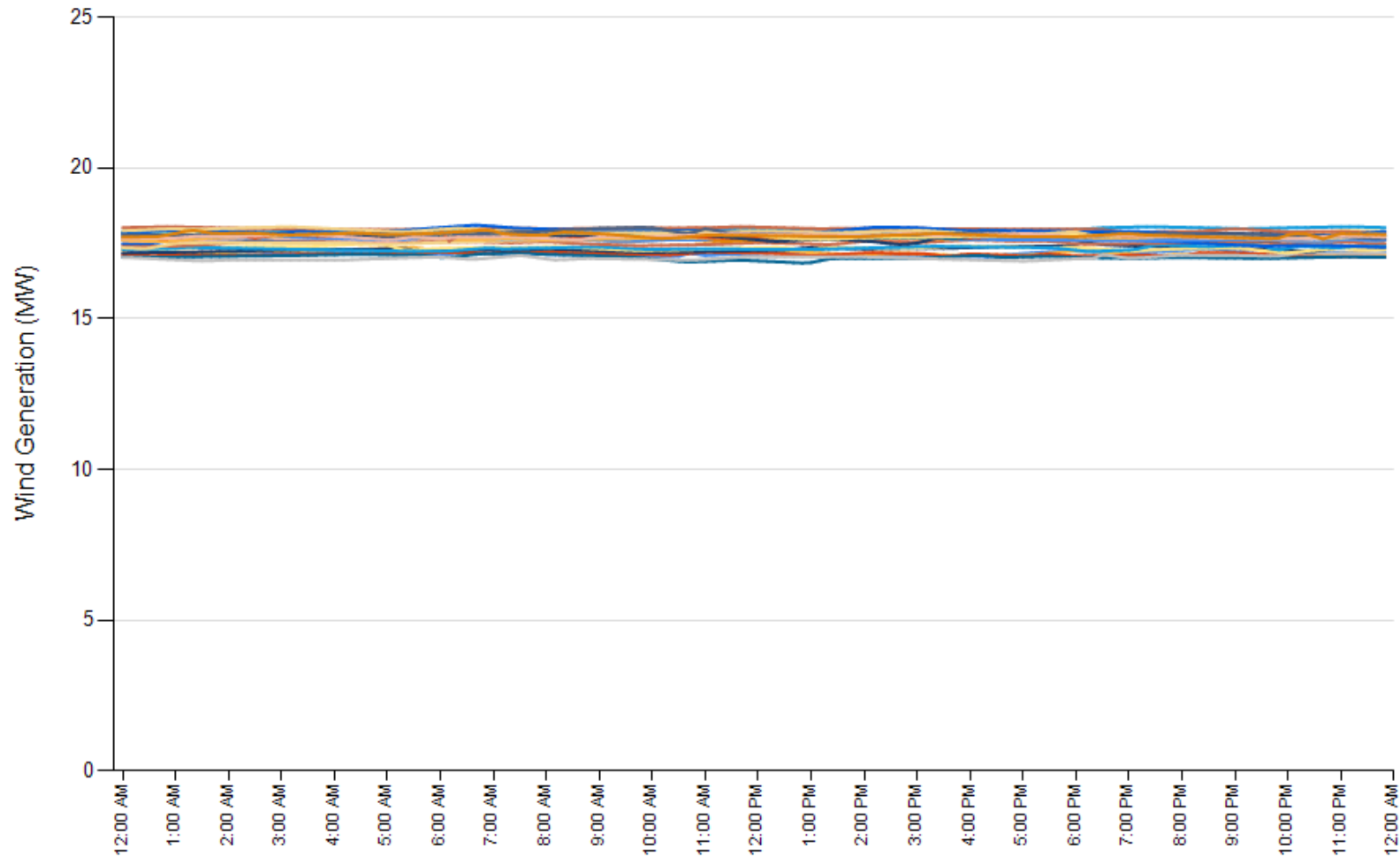
# February 2012 – 14 days

*Upper Salmon B*



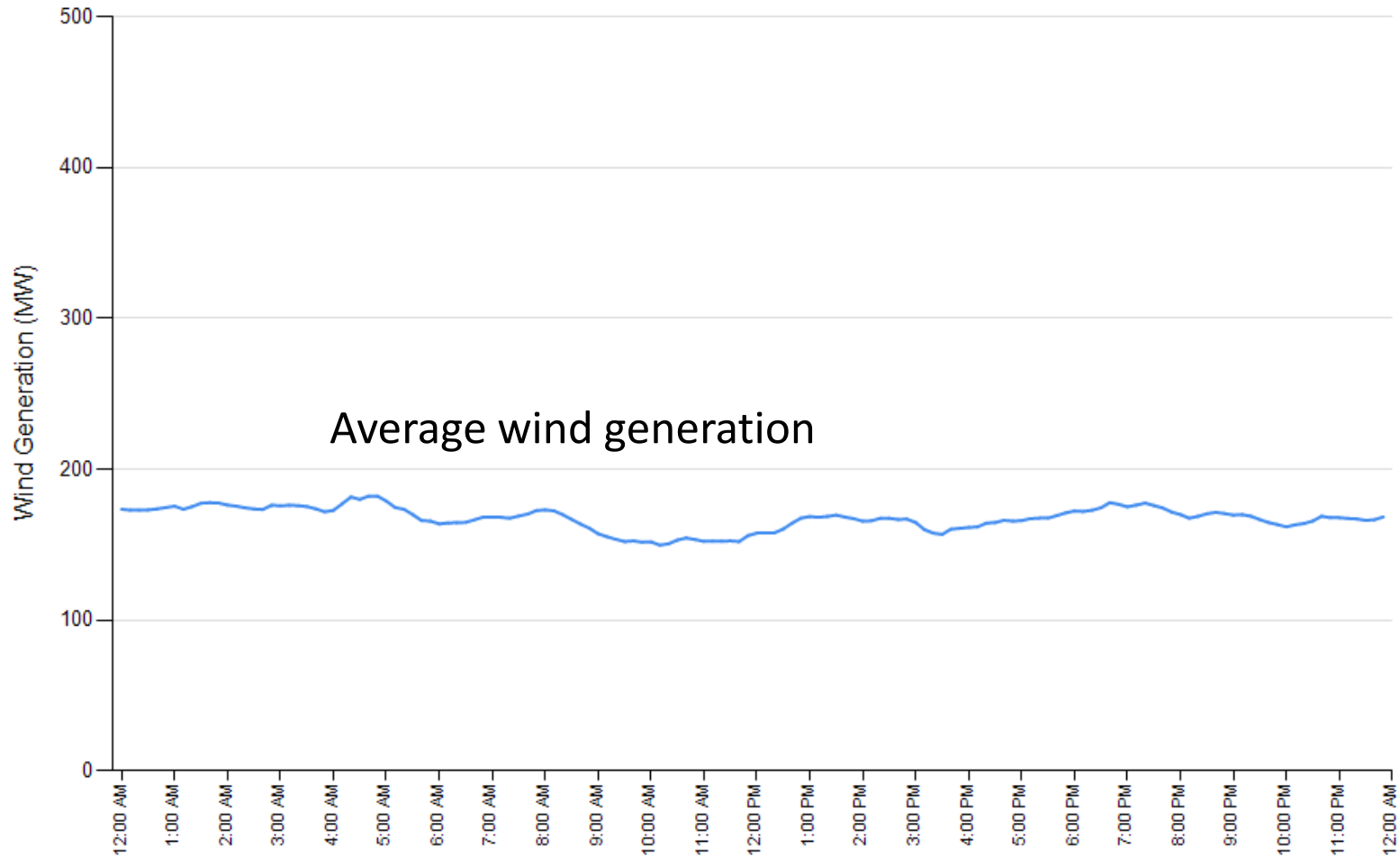
# February 2012 – 29 days

*Upper Salmon B*



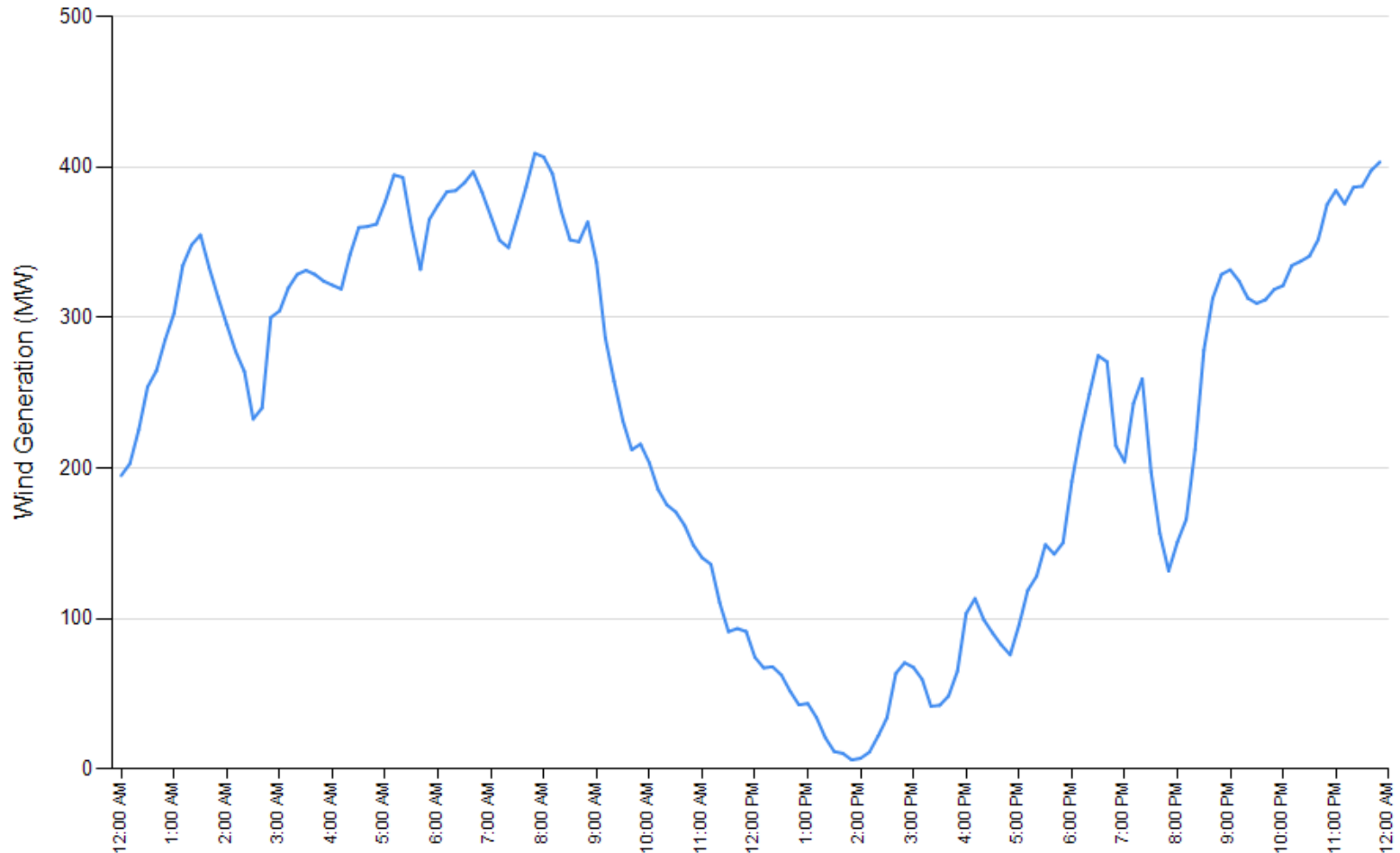
# February 2012

## *Wind Generation*



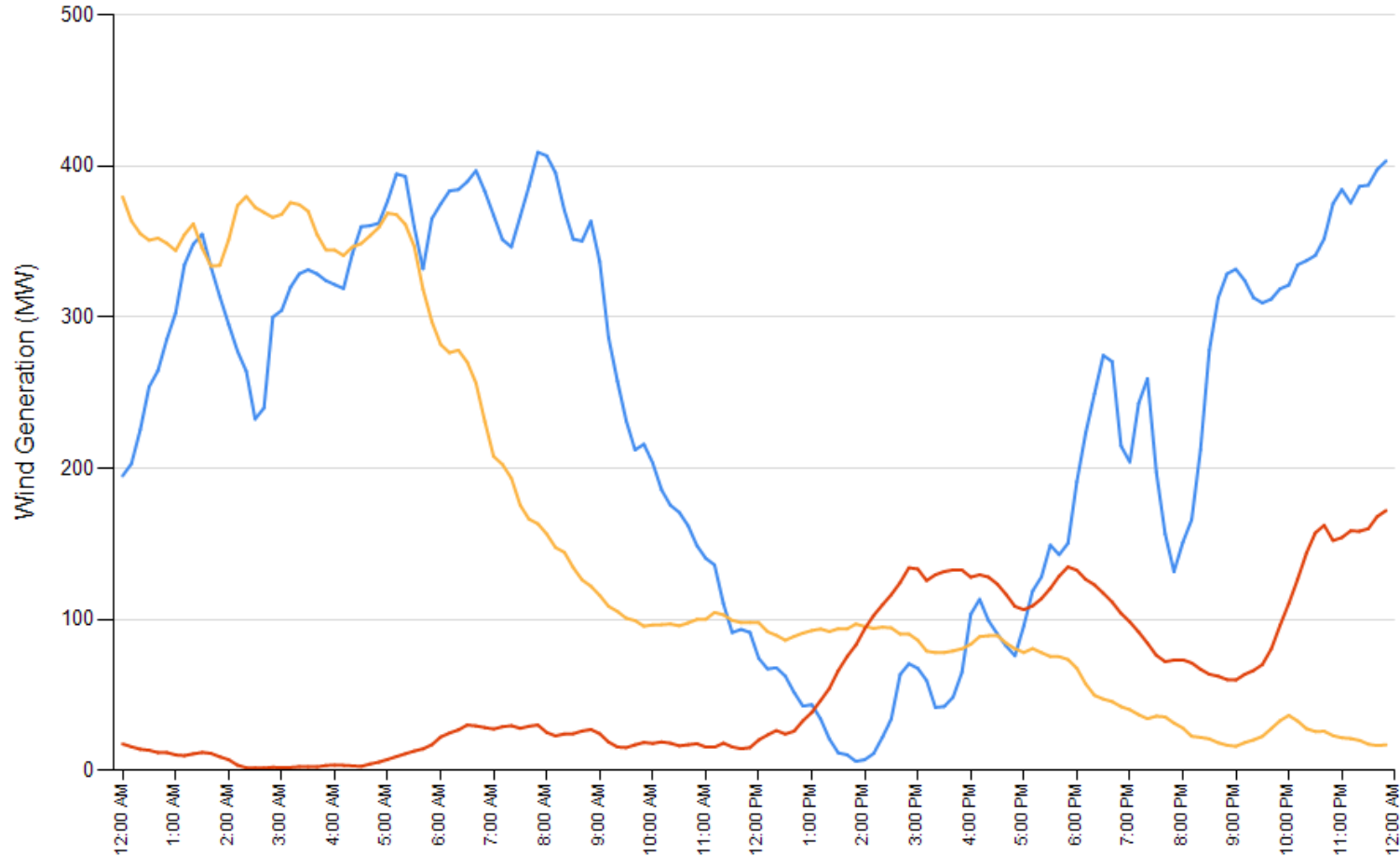
# February 2012 – 1 day

## *Wind Generation*



# February 2012 – 3 days

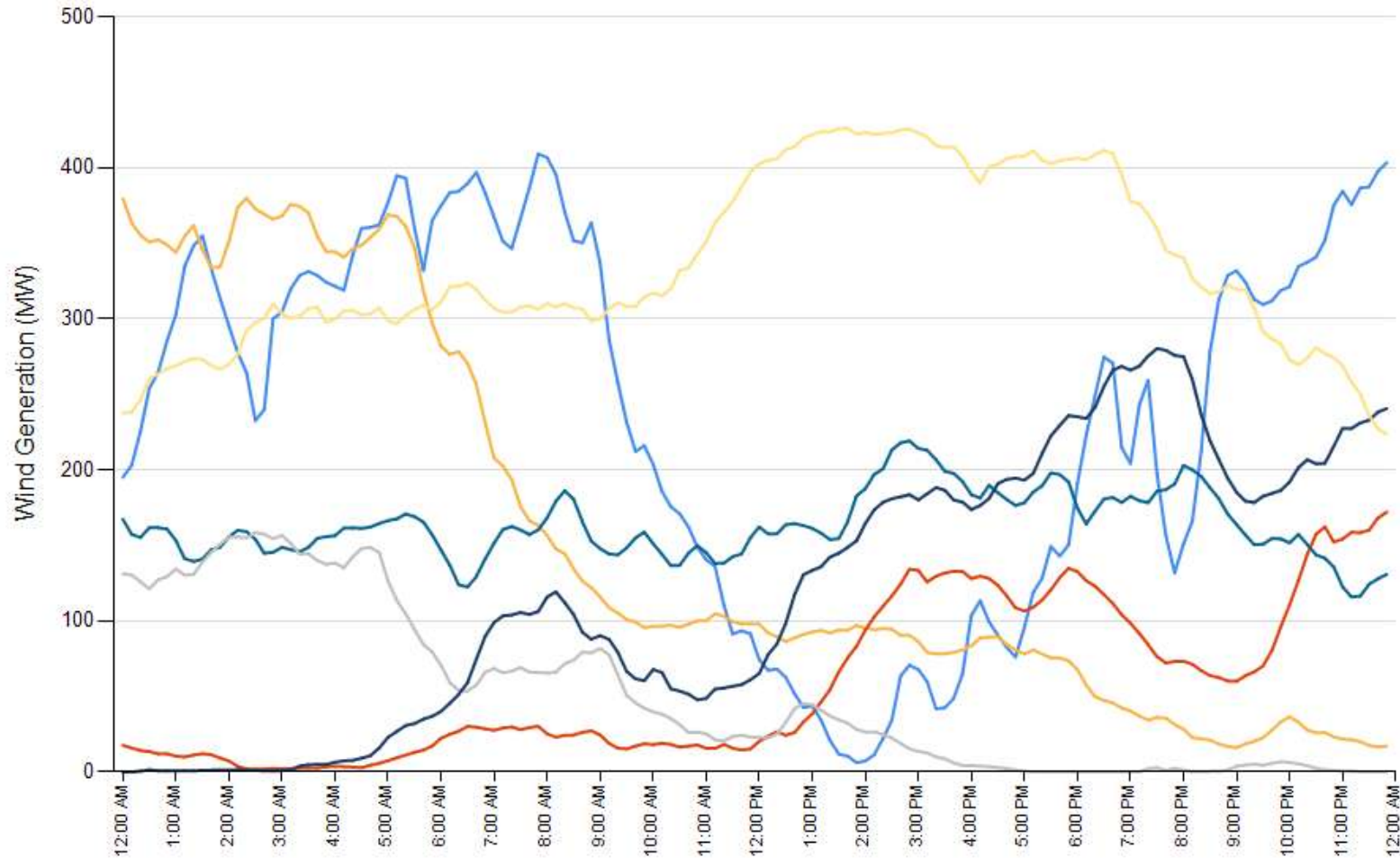
## *Wind Generation*





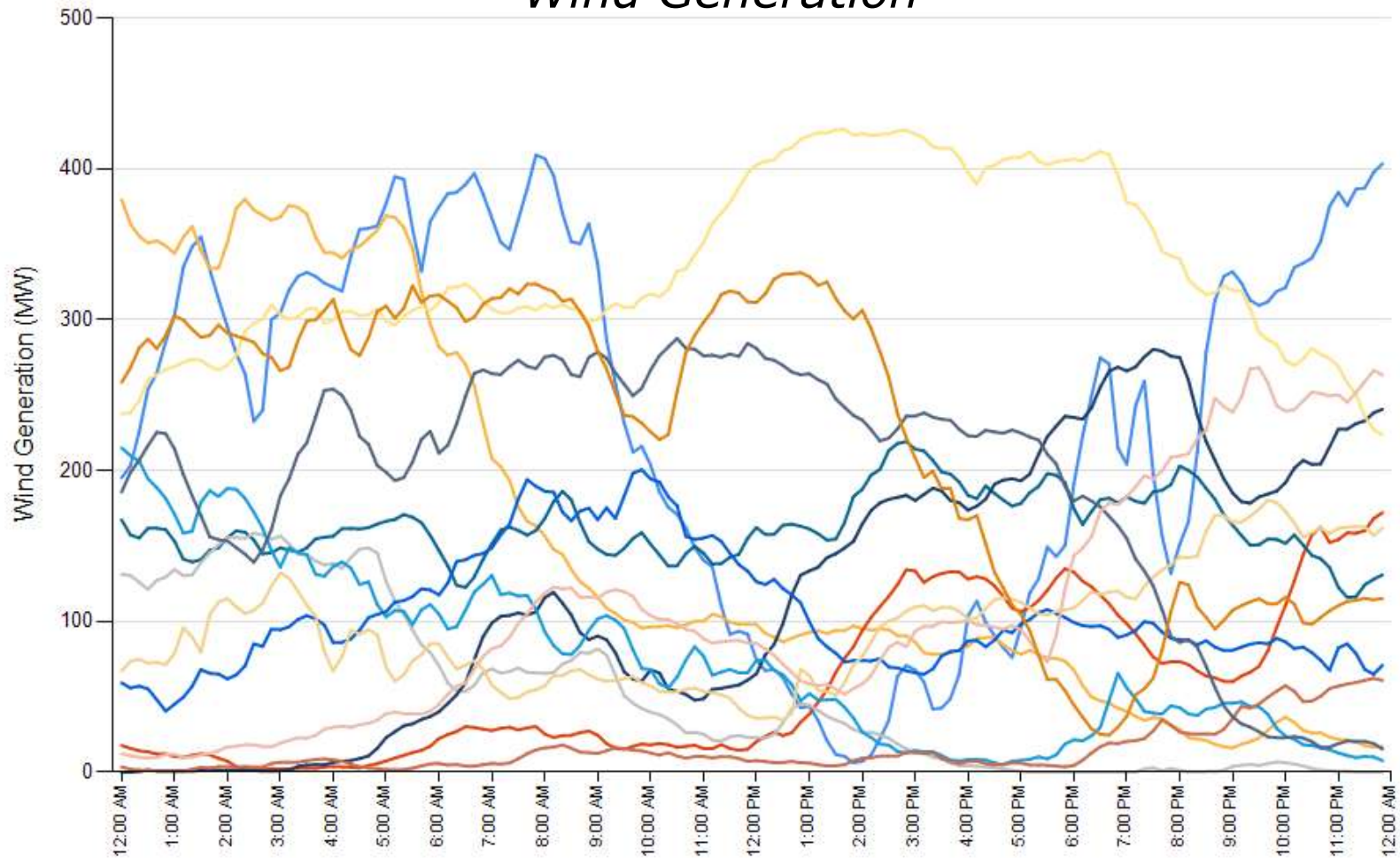
# February 2012 – 7 days

## Wind Generation



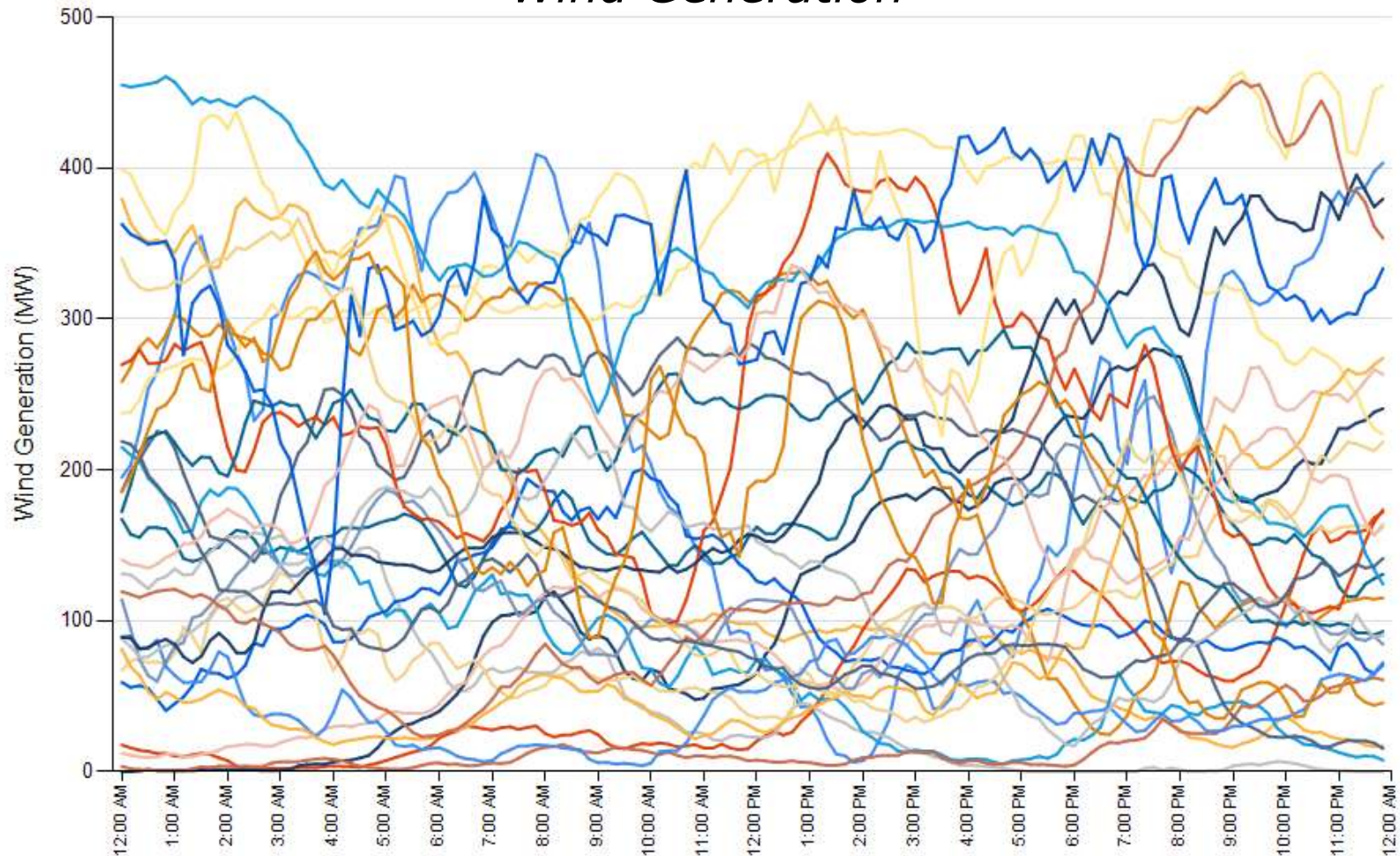
# February 2012 – 14 days

## Wind Generation

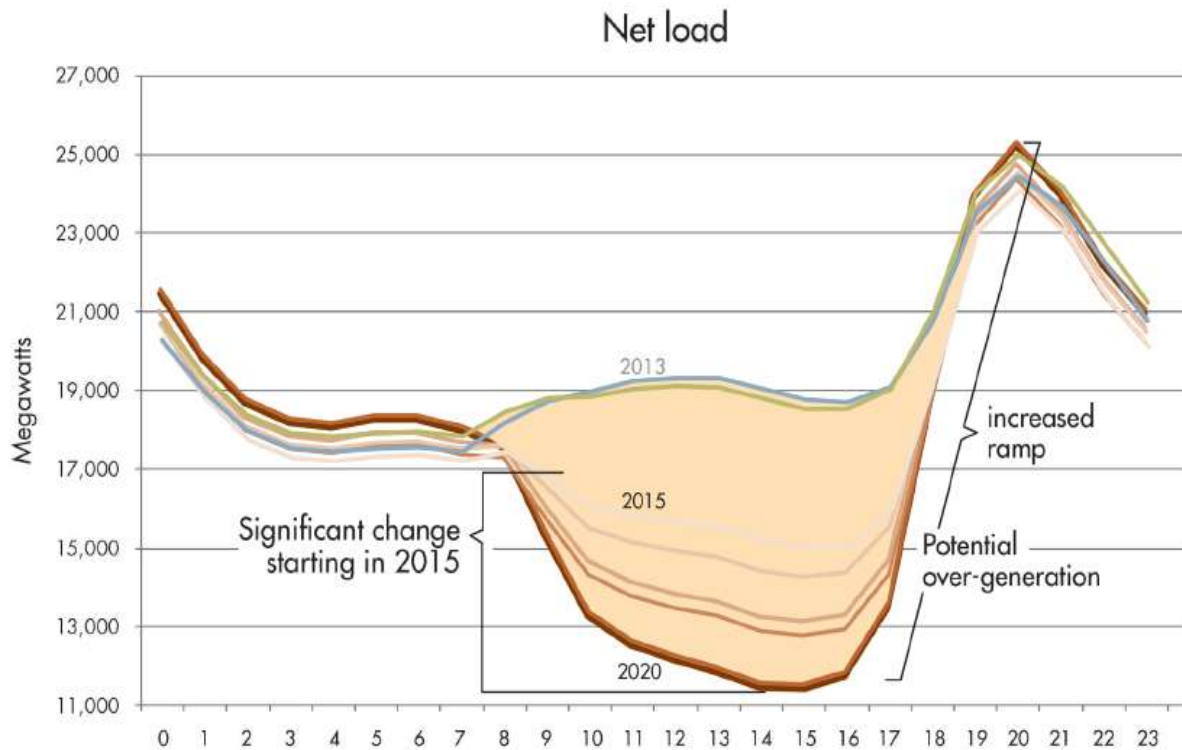


# February 2012 – 29 days

## *Wind Generation*



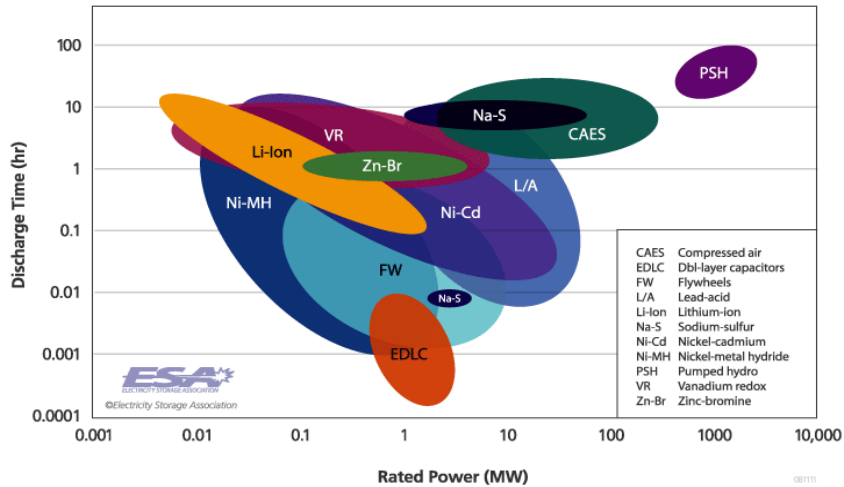
# Growing need for flexibility starting 2015



# Bulk and Distributed Energy Storage Technologies

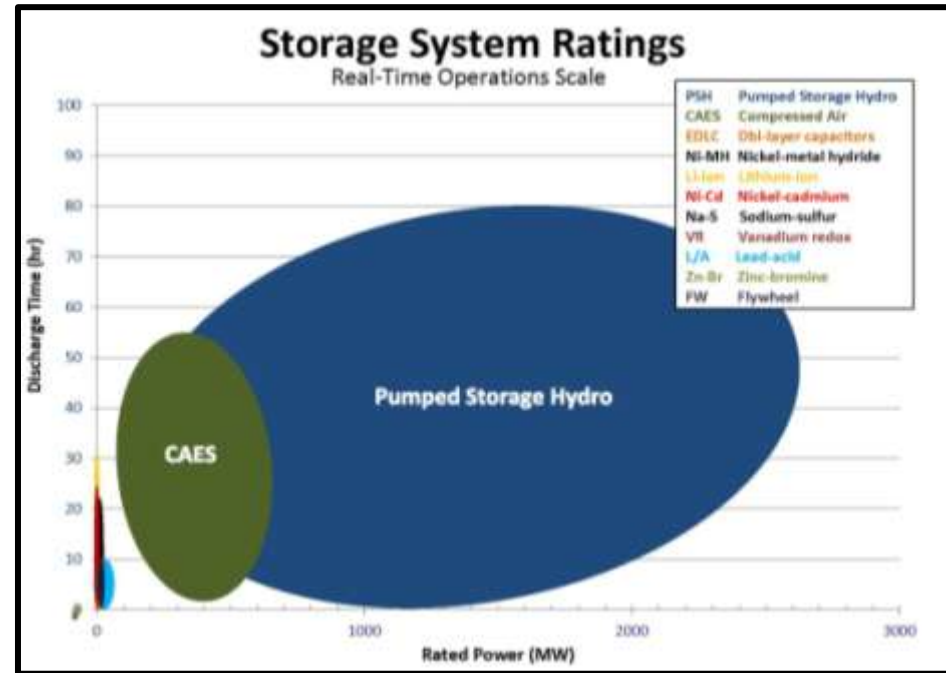
## System Ratings

Installed systems as of November 2008



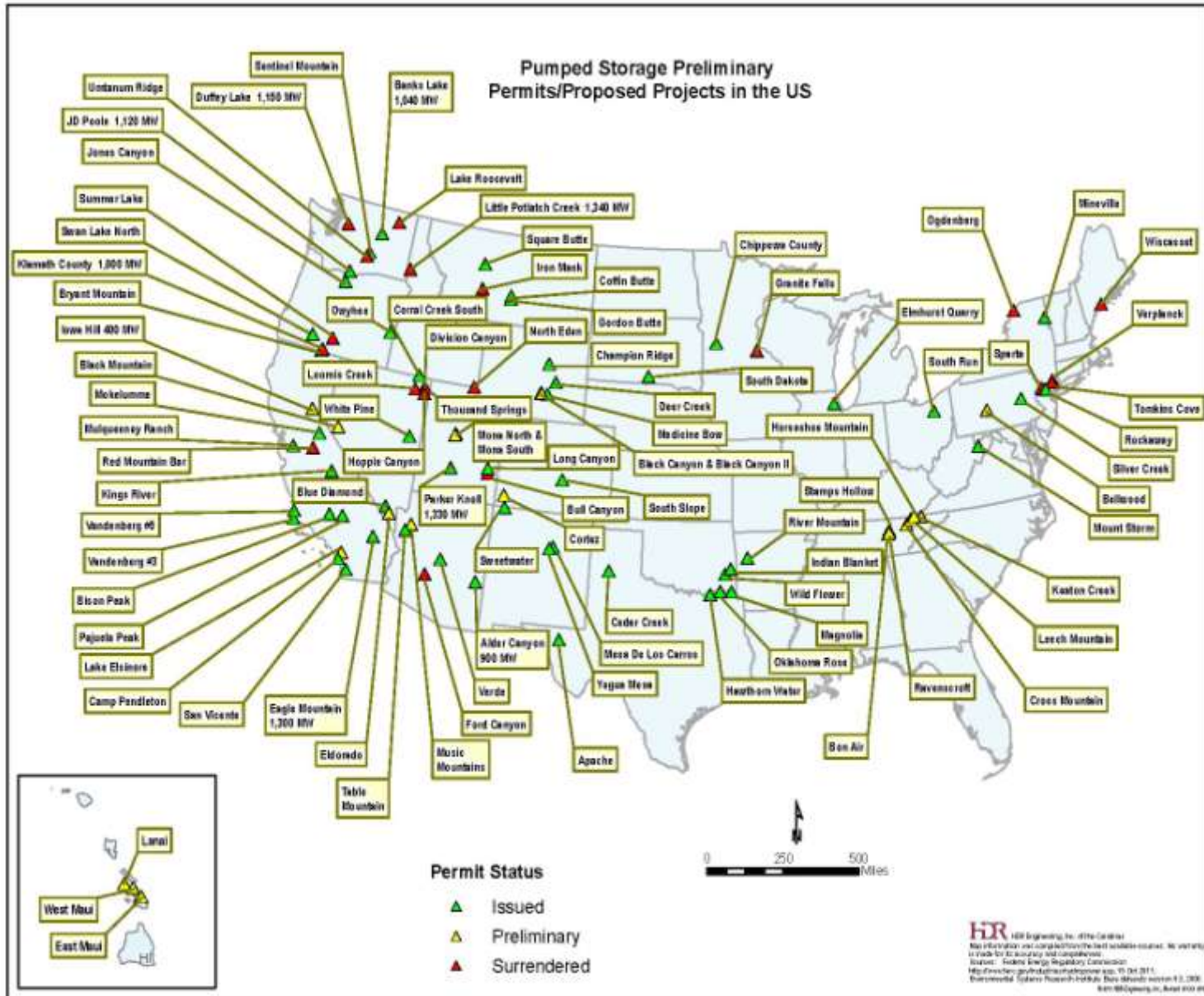
## Storage System Ratings

Real-Time Operations Scale



# Pumped Storage Activity in the United States

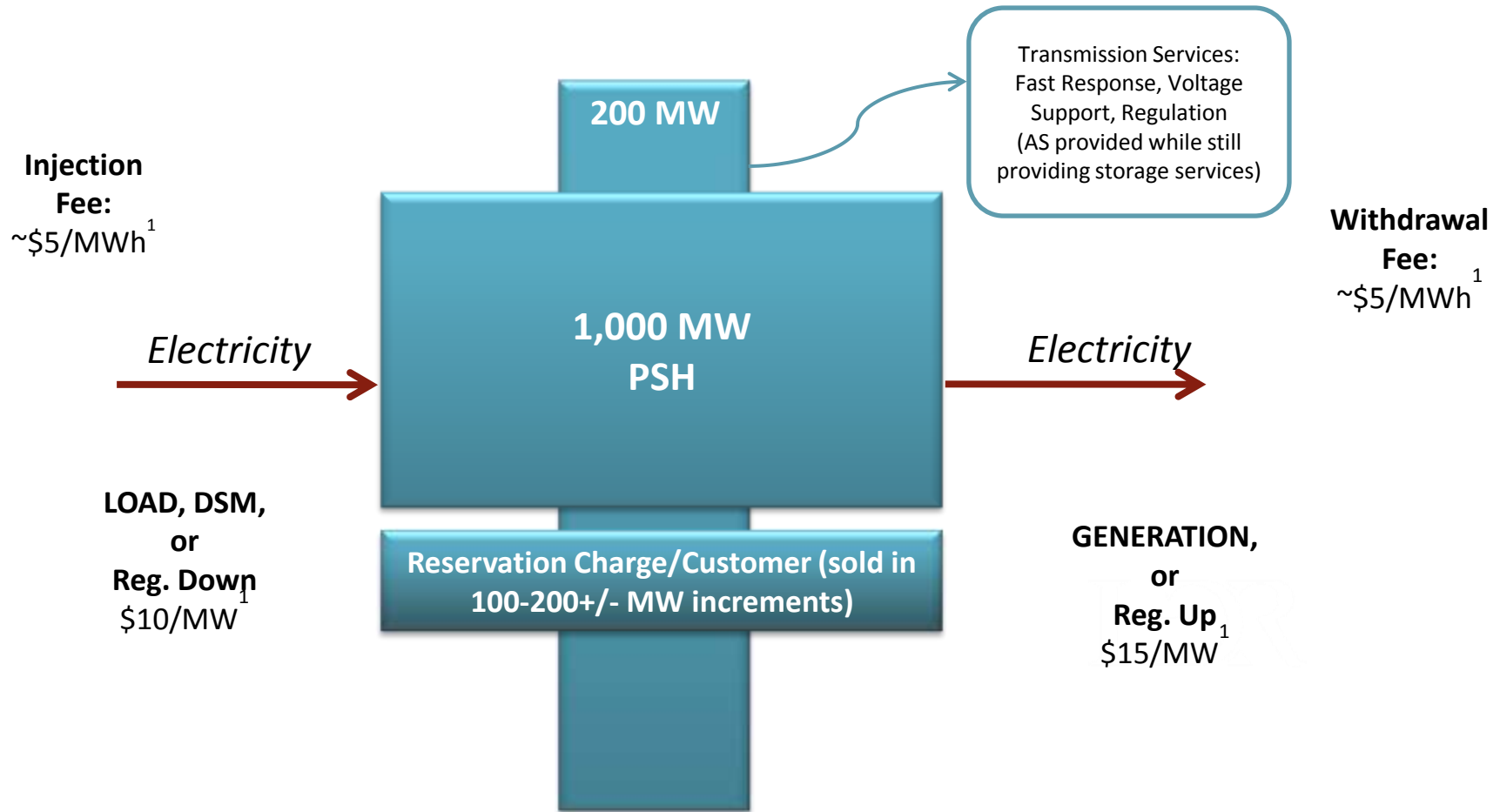
## Proposed/Preliminary Permits for Pumped Storage



# What Can Be Done to Address Challenges?

## Markets: Energy Storage Model

(Similar to Gas Storage Model)



# Contact Info

RICK MILLER, P.E.  
SENIOR VP AND NATIONAL DIRECTOR  
RENEWABLE ENERGY SERVICES  
HDR Engineering, Inc.  
704.248.3686  
rick.miller@hdrinc.com