

AURORA Overview



Resource Planning

Agenda

- General Terms
- Overview
- Long Term Capacity Expansion (LTCE)
- Portfolio Costing Through Zonal Simulation



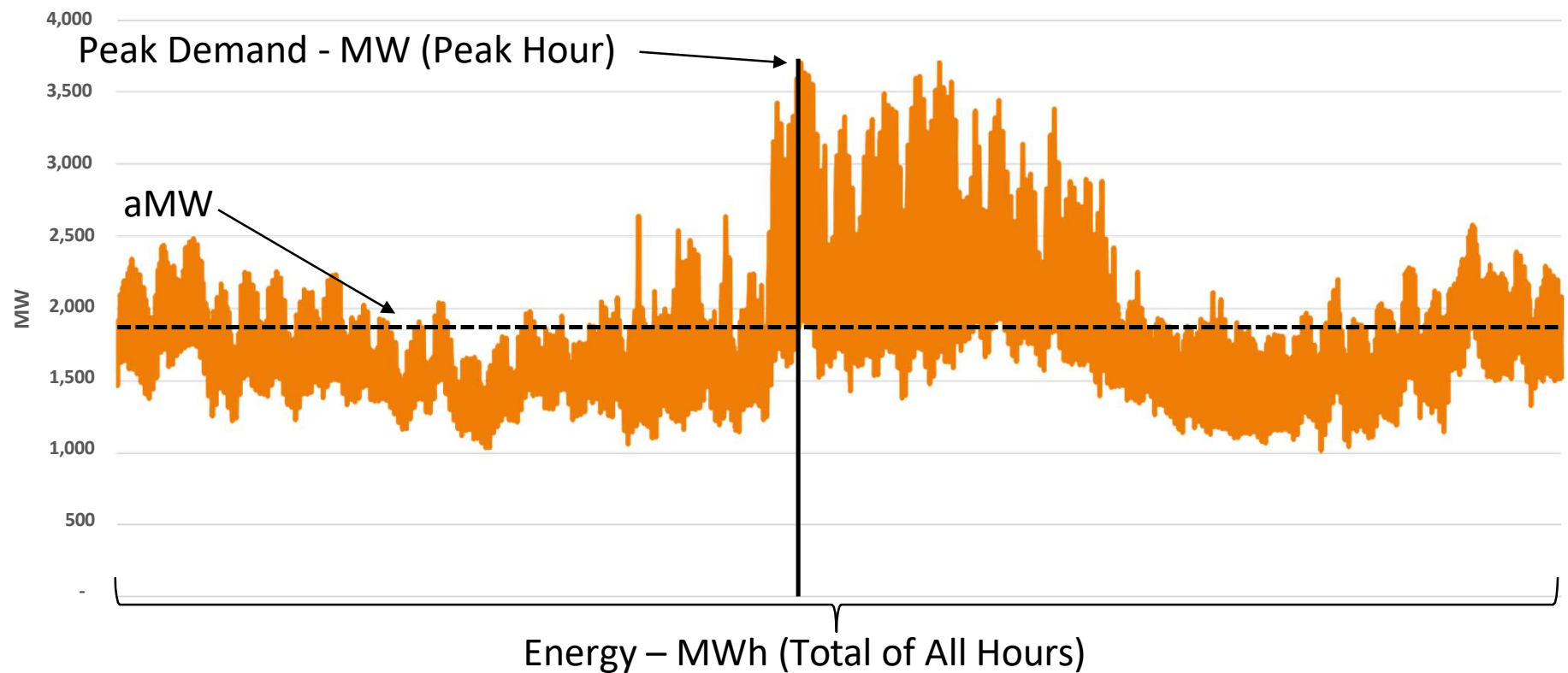
Commonly Used Terms

- ATC – Available Transmission Capability
- aMW – Average Megawatt (average power over a time period)
- Link – Transmission line
- LTCE – Long-Term Capacity Expansion
- Marginal Resource – Last Resource dispatched for the Zone
- MW – Megawatt, (1,000 kilowatts or 1,000,000 watts)
- MWh – Megawatt-hour
- Nameplate – Rated Resource Capacity
- PPA – Power Purchase Agreement
- PURPA – Public Utility Regulatory Policies Act
- WECC – Western Electricity Coordinating Council
- VER – Variable Energy Resource
- Zone – Smallest region modeled by AURORA

Peak Demand Versus Energy

- Peak Demand (MW) = highest demand for energy during a time period
 - PEAK HOUR
 - June 30. 2021: 3,751 MW
- Energy (MWh) = total energy used during a time period
 - ALL HOURS
 - 2021 Total Annual Sales $\approx 16,745,000$ MWh
 - aMW $\approx 1,912$ MW ($16,745,000$ MWh/ $8,760$ hours)

Example: Peak Demand Versus Energy

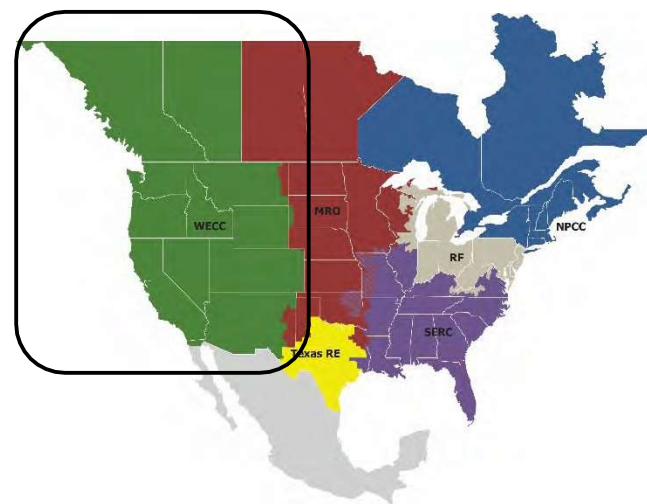




Aurora Overview

Aurora

- Vendor: Energy Exemplar
 - energyexemplar.com
- Energy Exemplar Models
 - Aurora, Plexos
- Used by multiple entities regionally, nationally, and worldwide
- Used for multiple IRP cycles
- Used in various areas within Idaho Power
 - IRP, Regulatory, PURPA pricing, etc.
- Electric Market Forecasting Tool





Modeling Logic



- Basic concept – supply/demand
- Resources supply demand
 - Generation units are dispatched based on economics and constraints
 - Electricity flows based on economics and constraints
 - Resource stacks are calculated every hour
 - Marginal generation units set the zonal price

Resource Stack Example

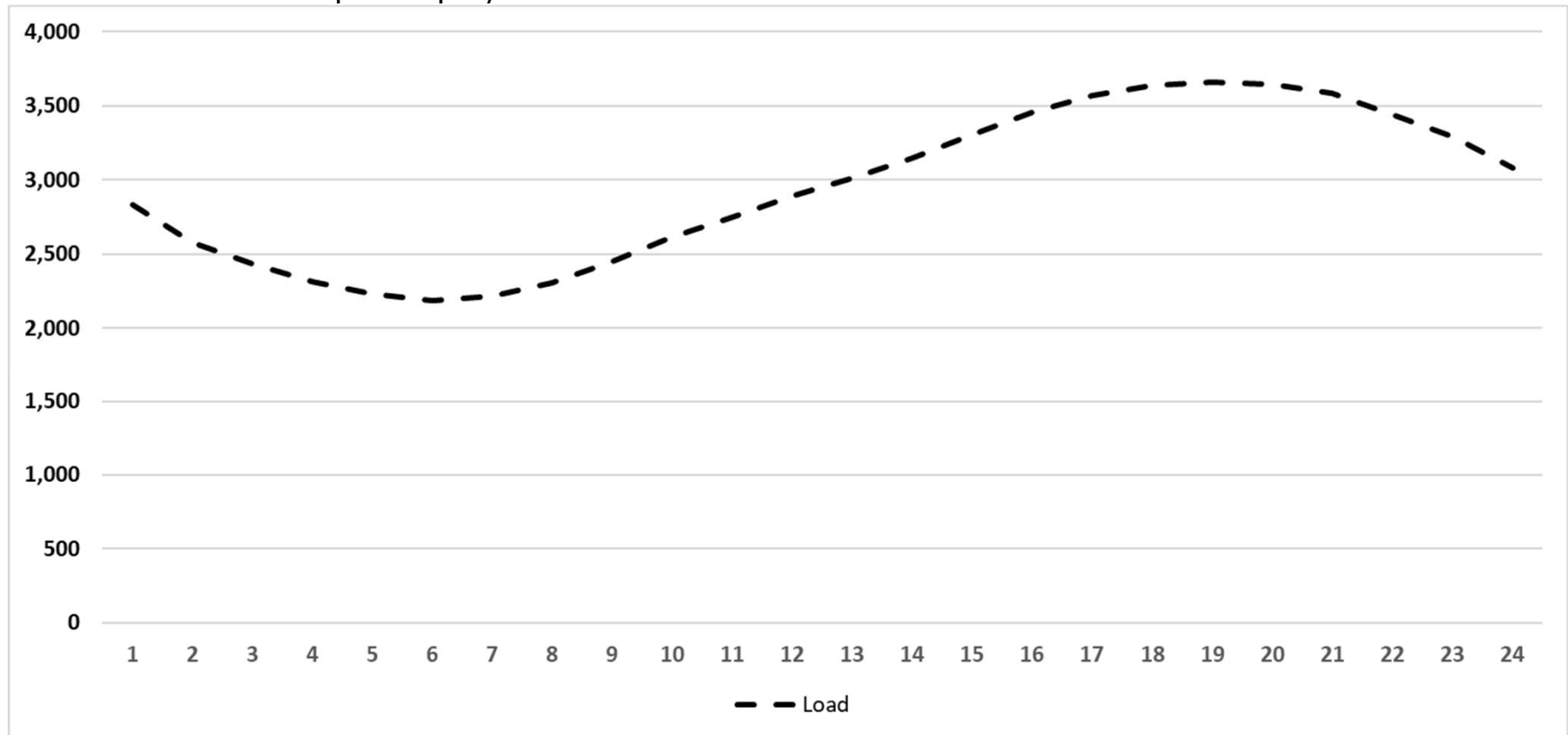
Resource	MW
Winter Demand	2,550
Demand Response	0
Market Purchases	550
Natural Gas (Peaker)	0
Coal	50
Natural Gas (Base)	0
Hydro Generation	1,250
VERs	550
Storage	150

Resource	MW
Summer Demand	3,600
Demand Response	150
Market Purchases	200
Natural Gas (Peaker)	550
Coal	350
Natural Gas (Base)	300
Hydro Generation	1,250
VERs	600
Storage	200

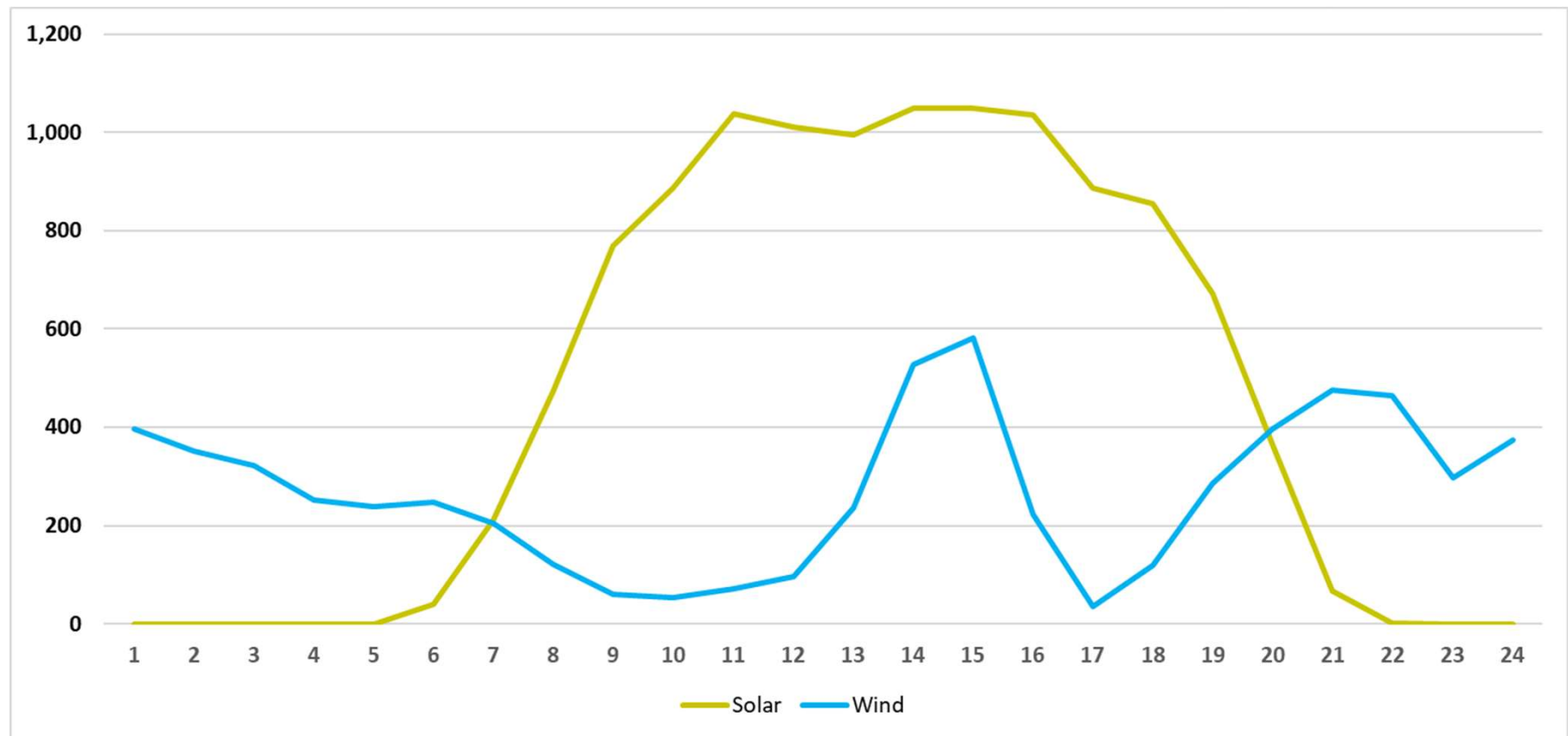
Note: Resource types and resource units are grouped together for this example.

Resource Stack Example

(Aurora Peak Hour - Sample Output)

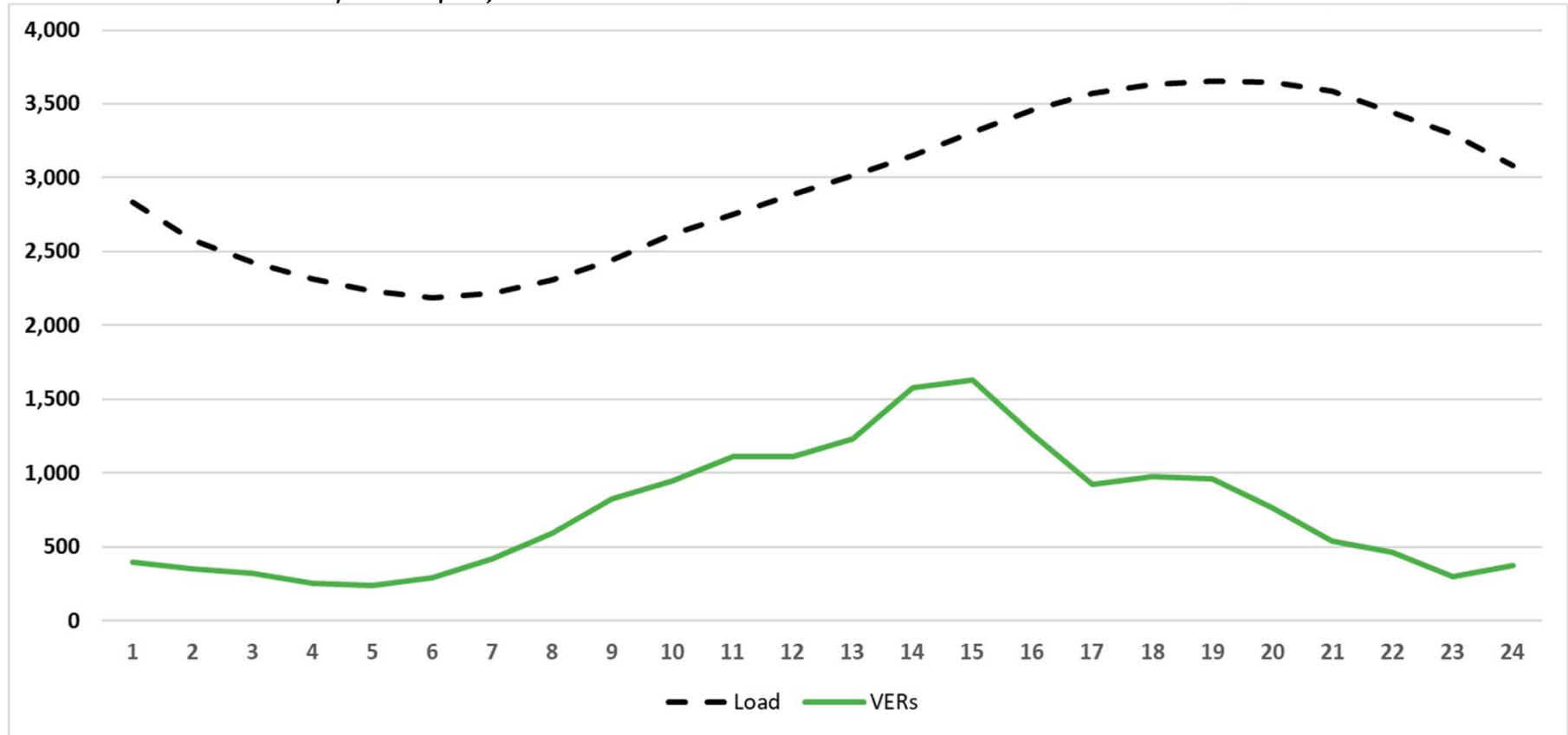


Resource Stack Example: VERs

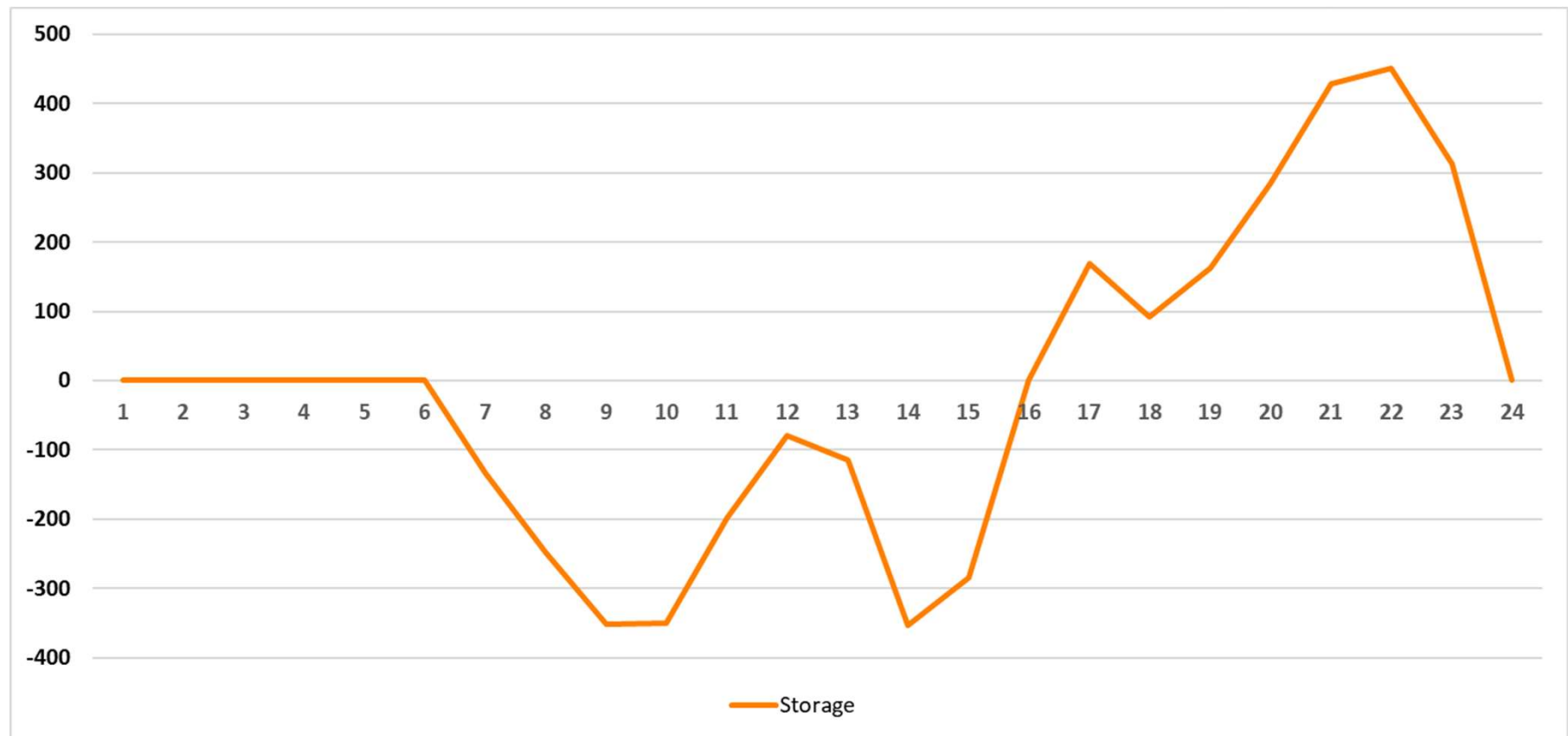


Resource Stack Example

(Aurora Peak Hour - Sample Output)

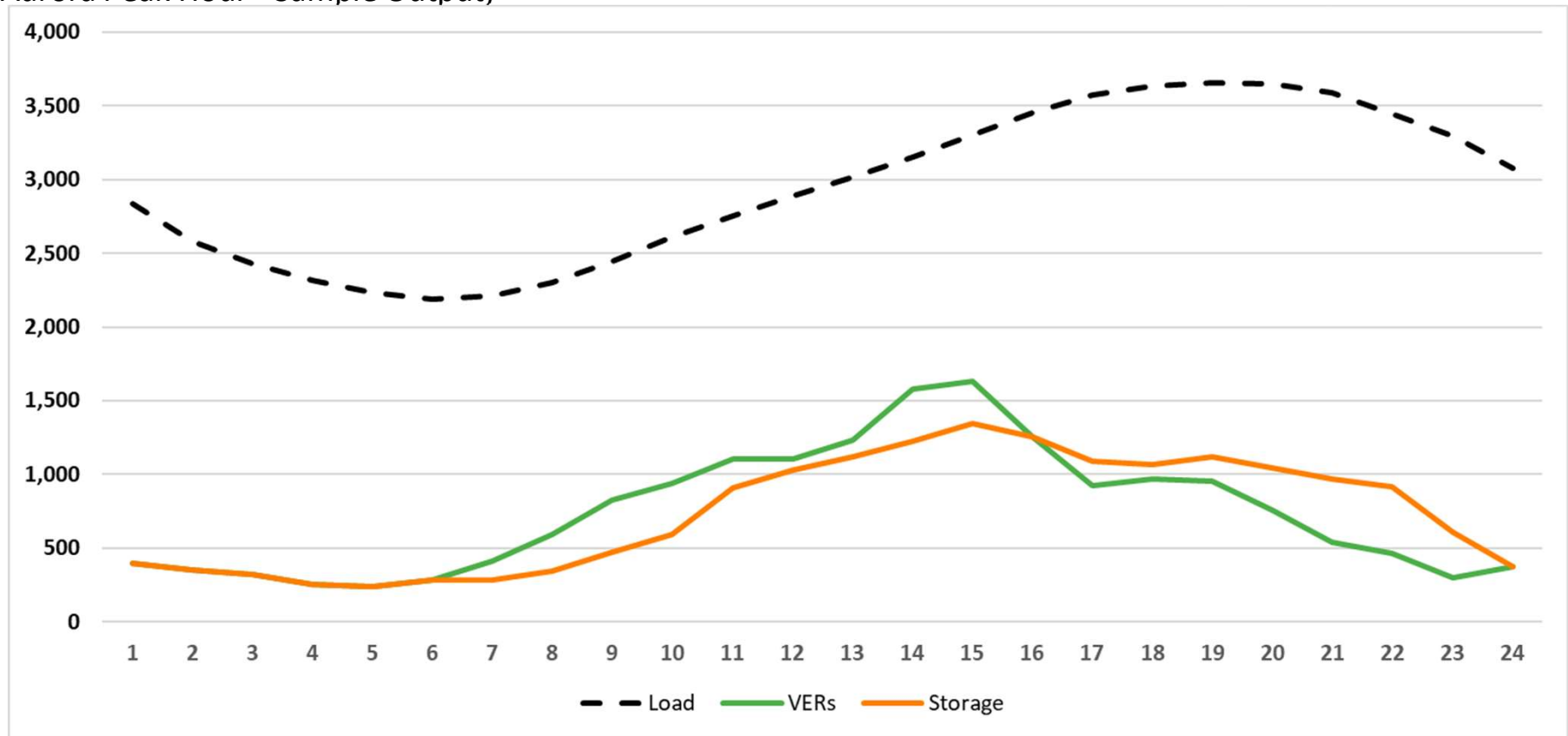


Resource Stack Example: Storage

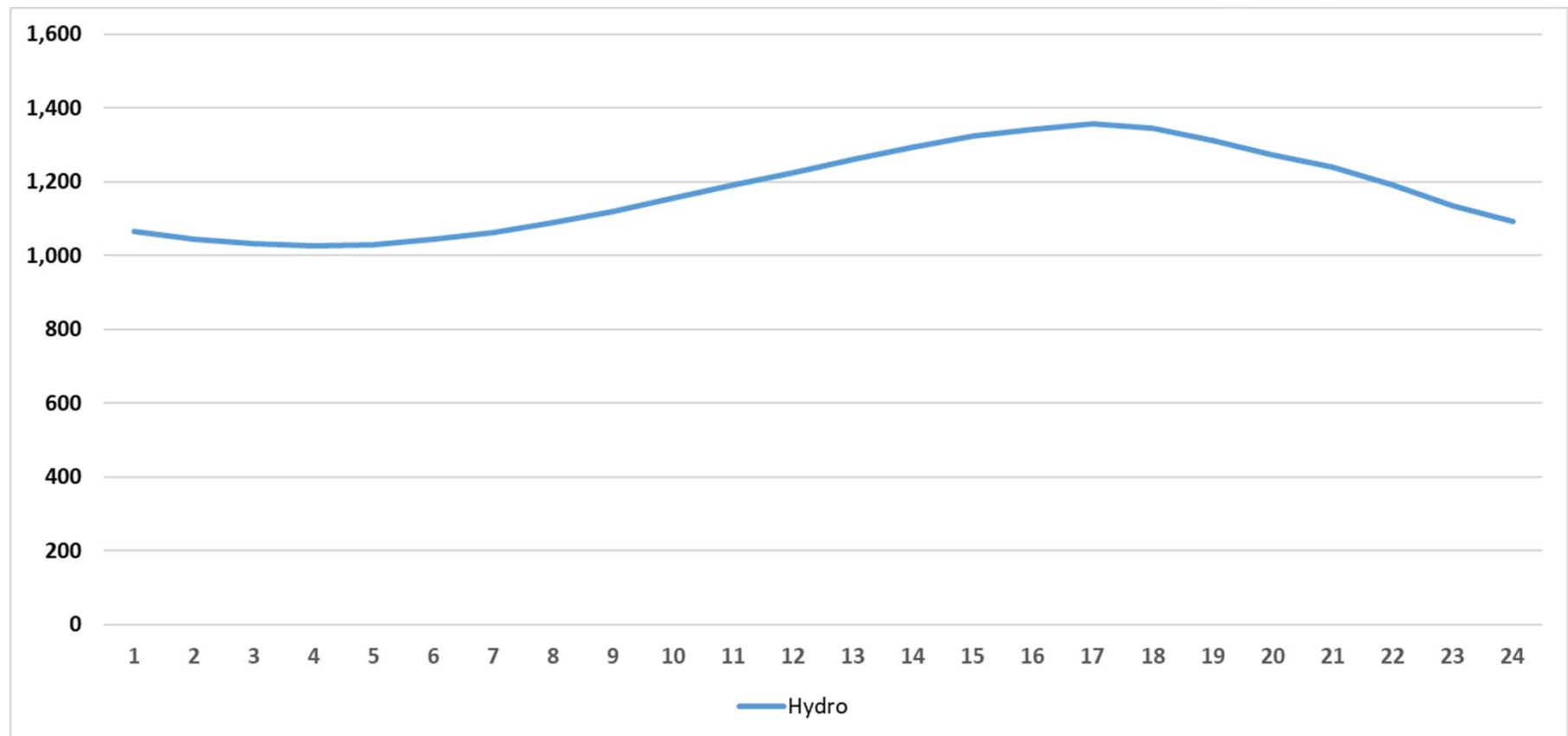


Resource Stack Example

(Aurora Peak Hour - Sample Output)

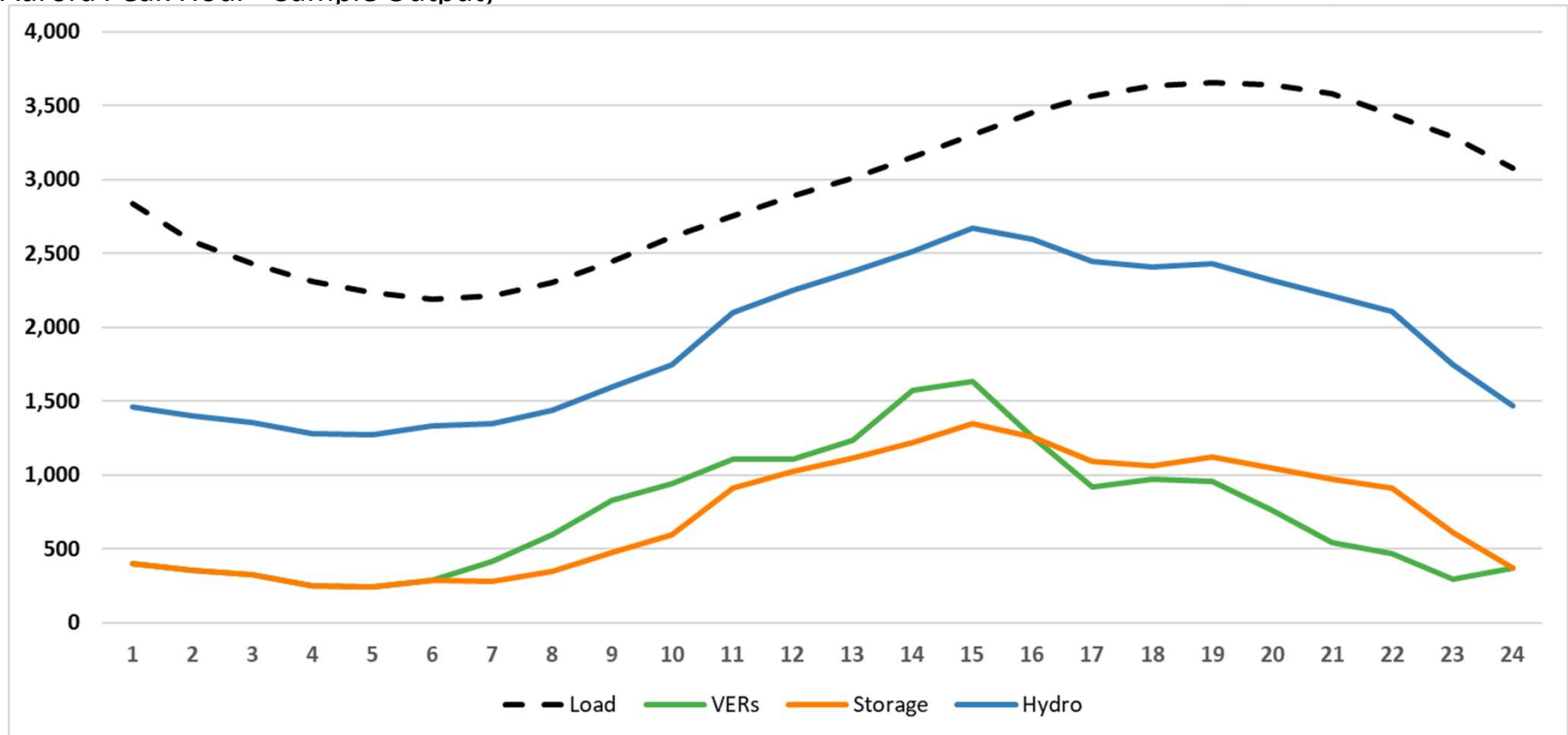


Resource Stack Example: Hydro

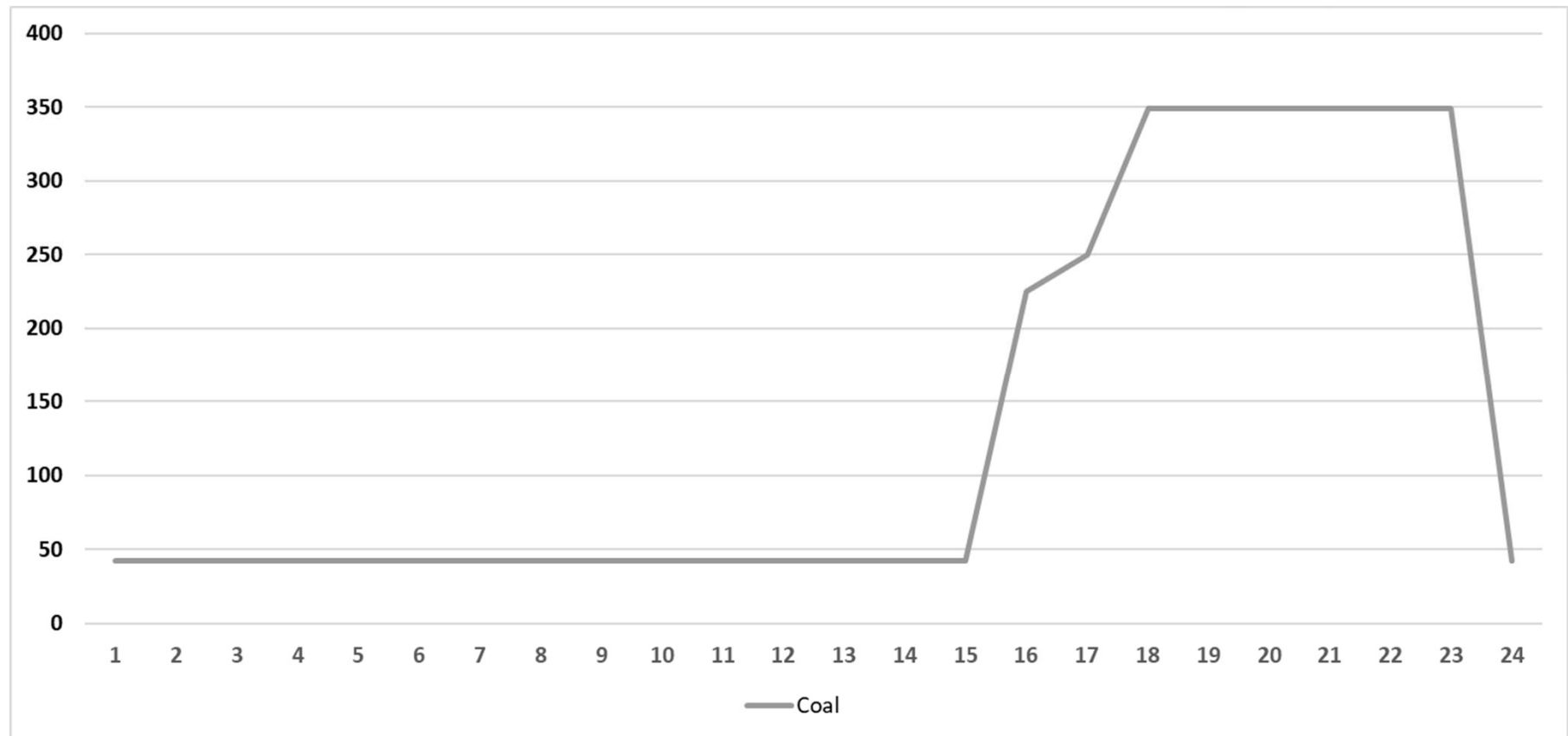


Resource Stack Example

(Aurora Peak Hour - Sample Output)

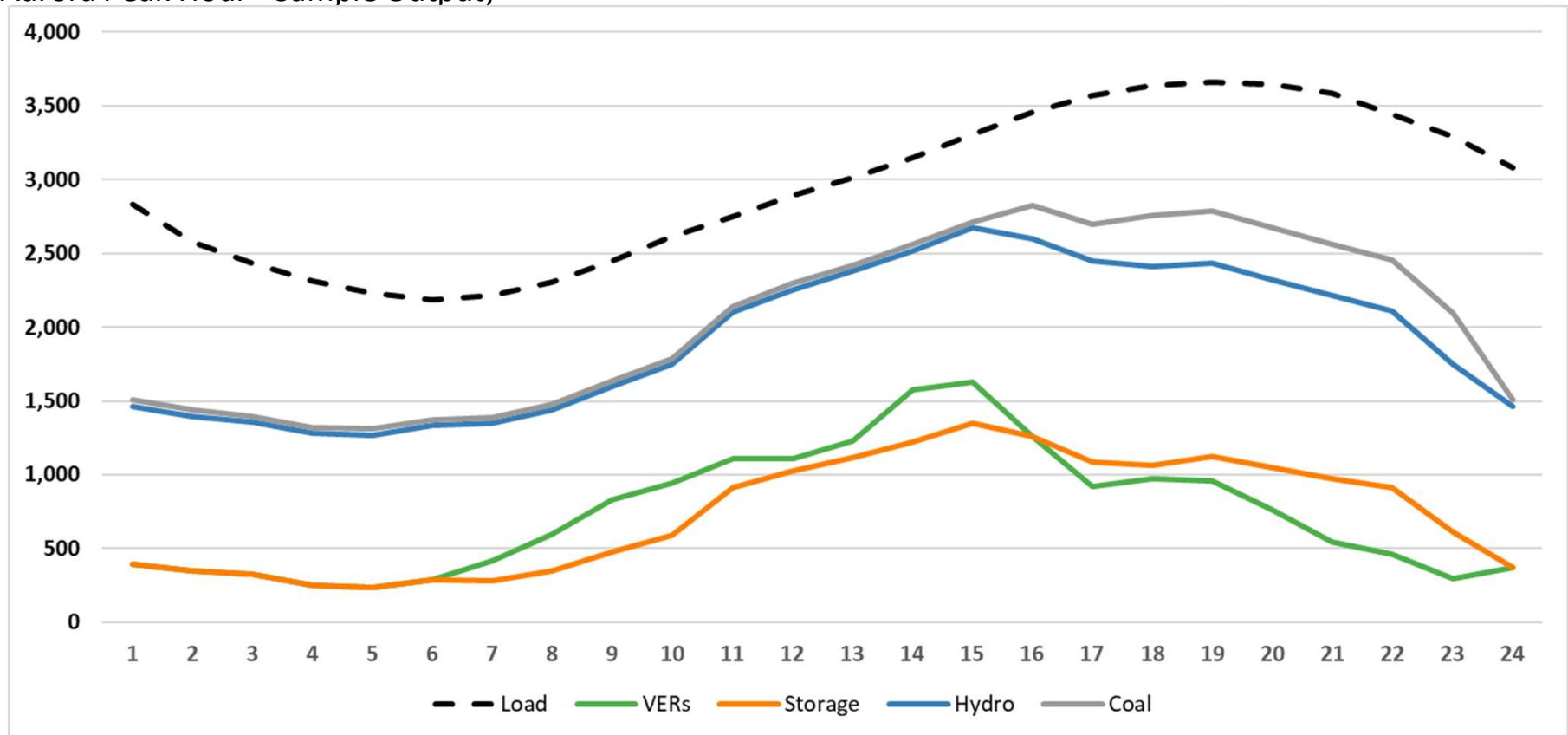


Resource Stack Example: Coal

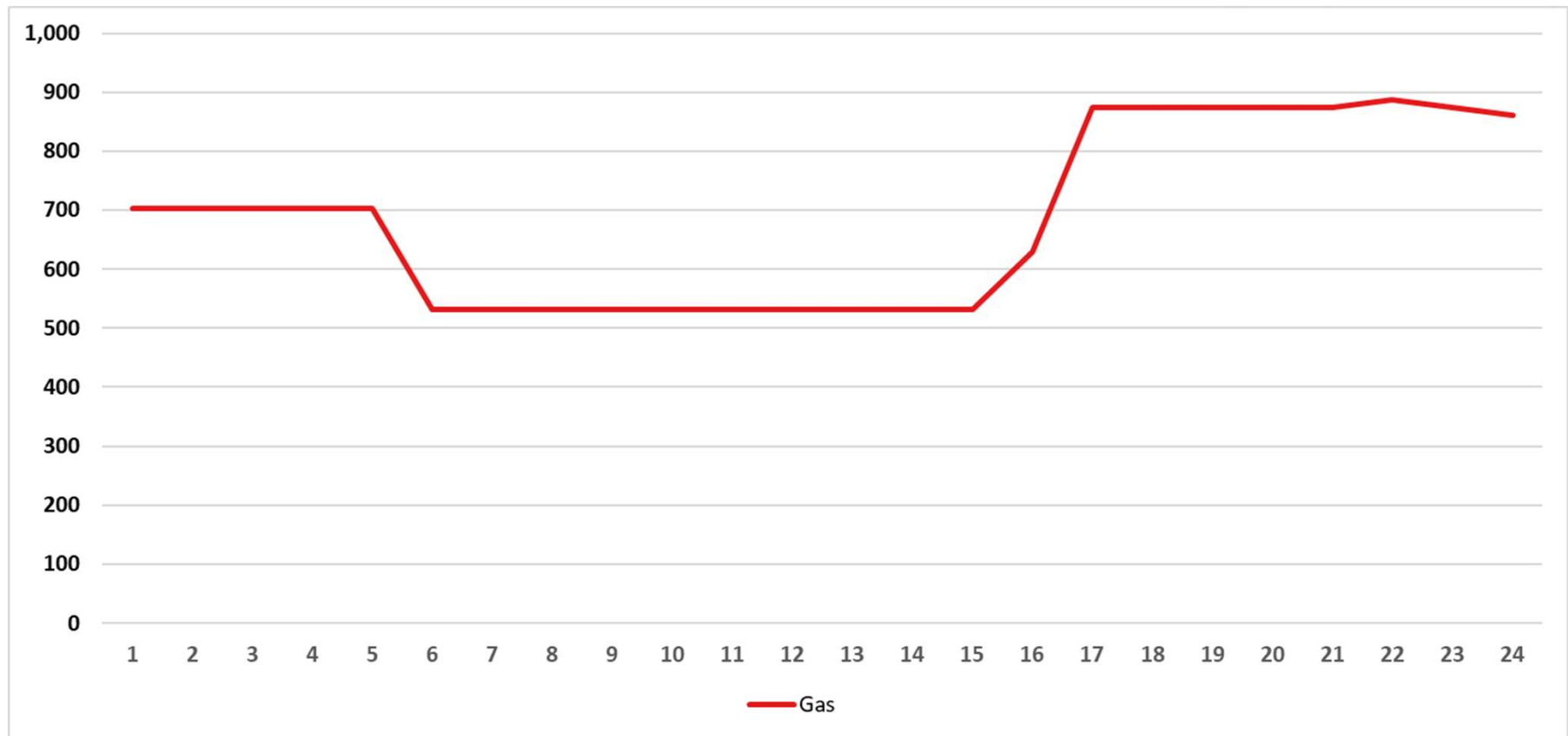


Resource Stack Example

(Aurora Peak Hour - Sample Output)

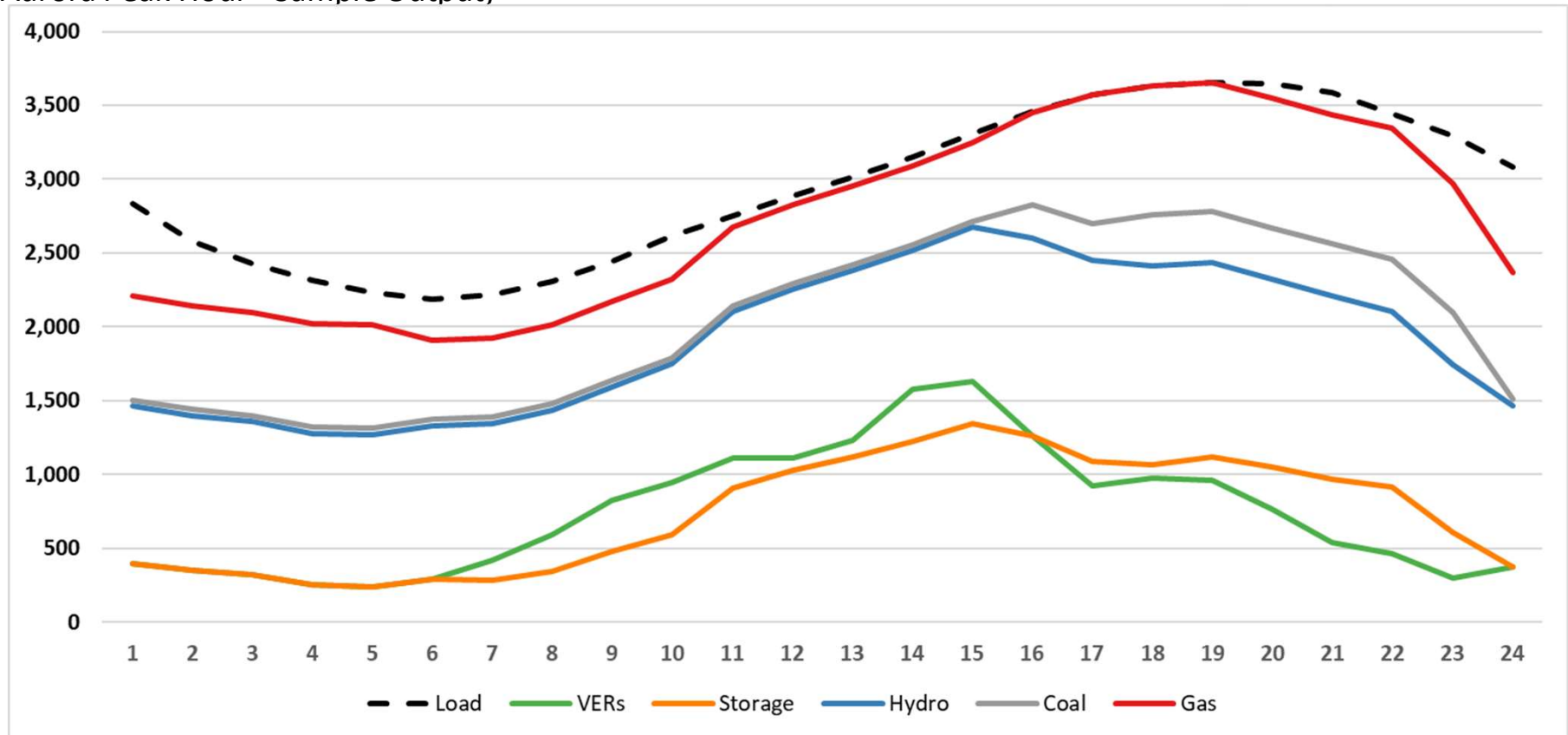


Resource Stack Example: Gas

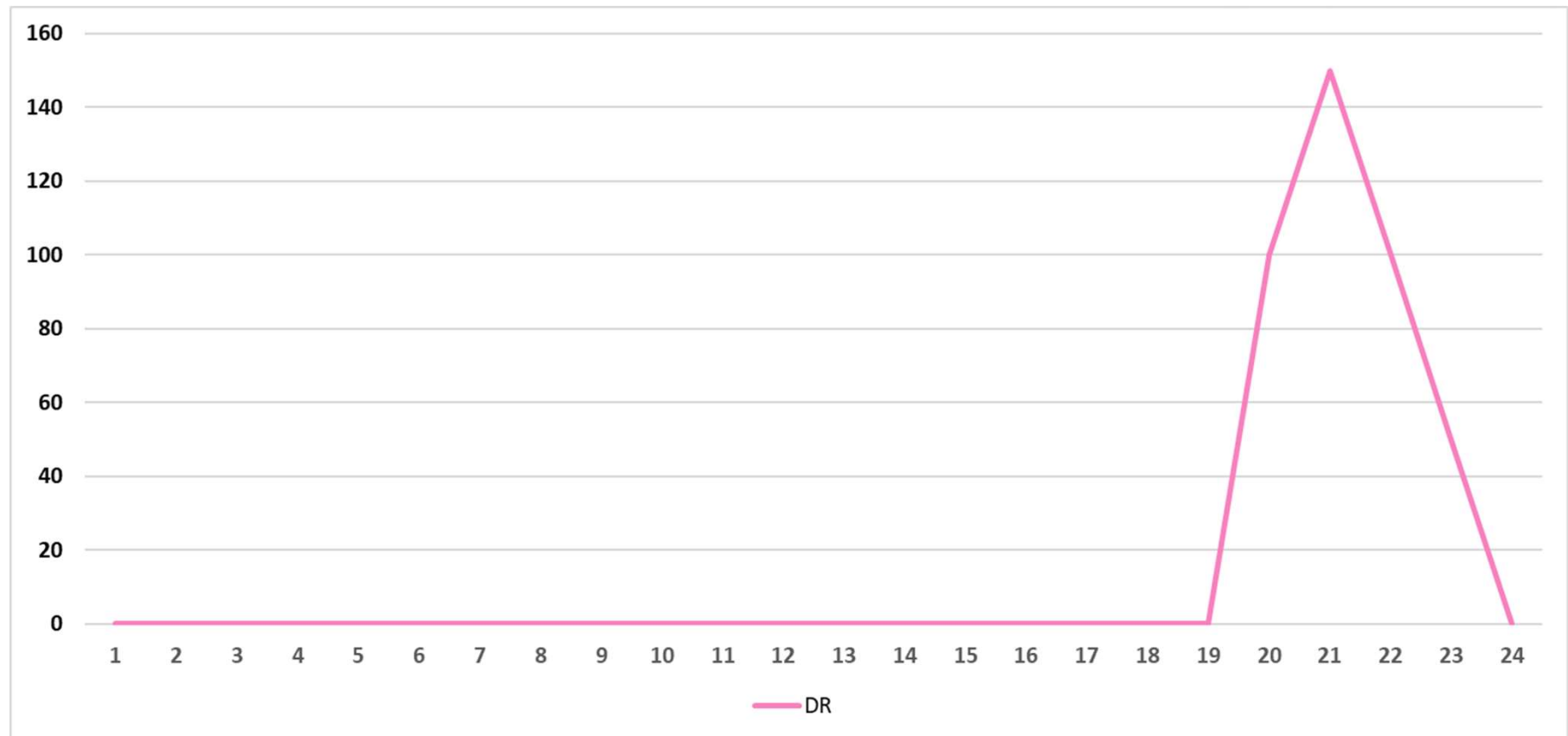


Resource Stack Example

(Aurora Peak Hour - Sample Output)

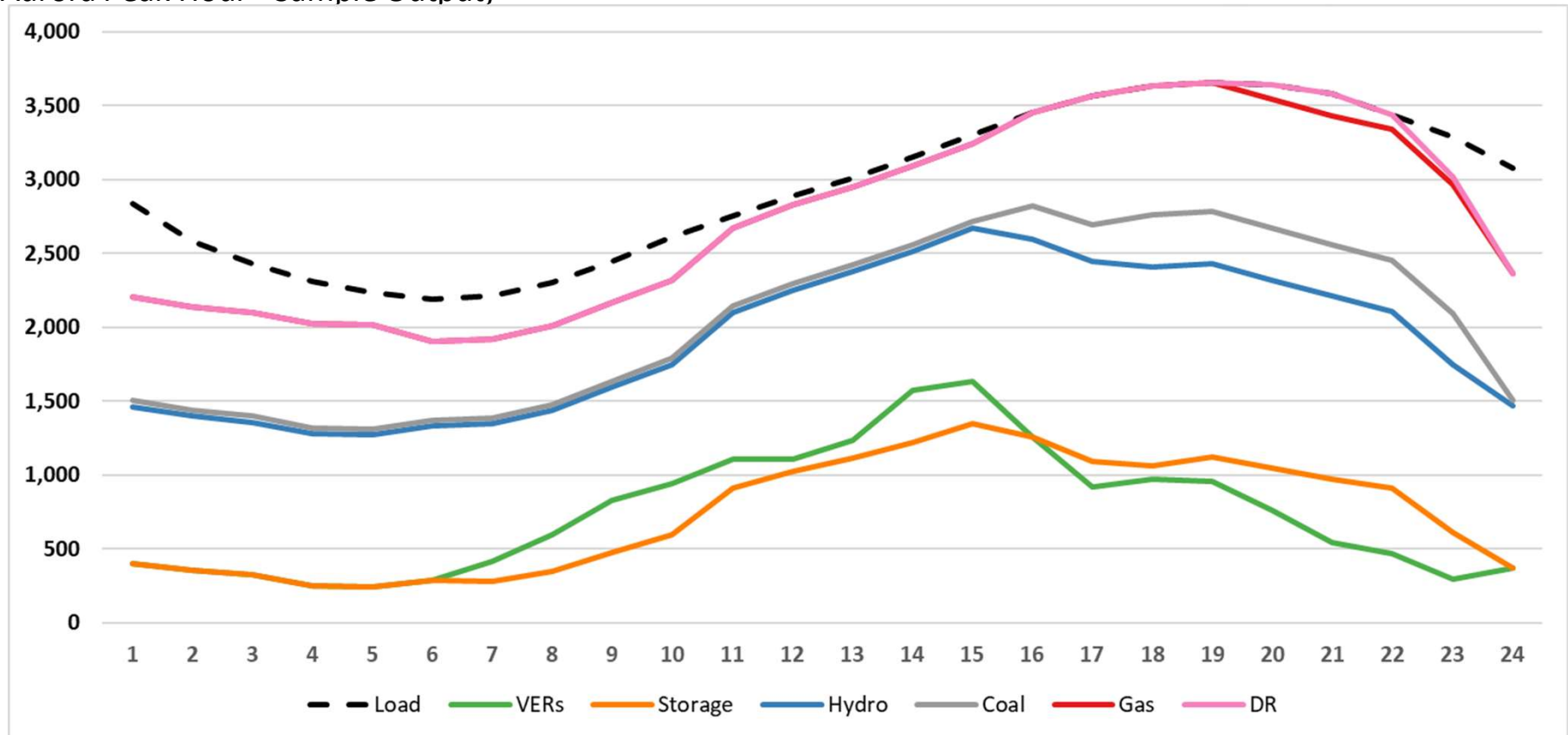


Resource Stack Example: DR

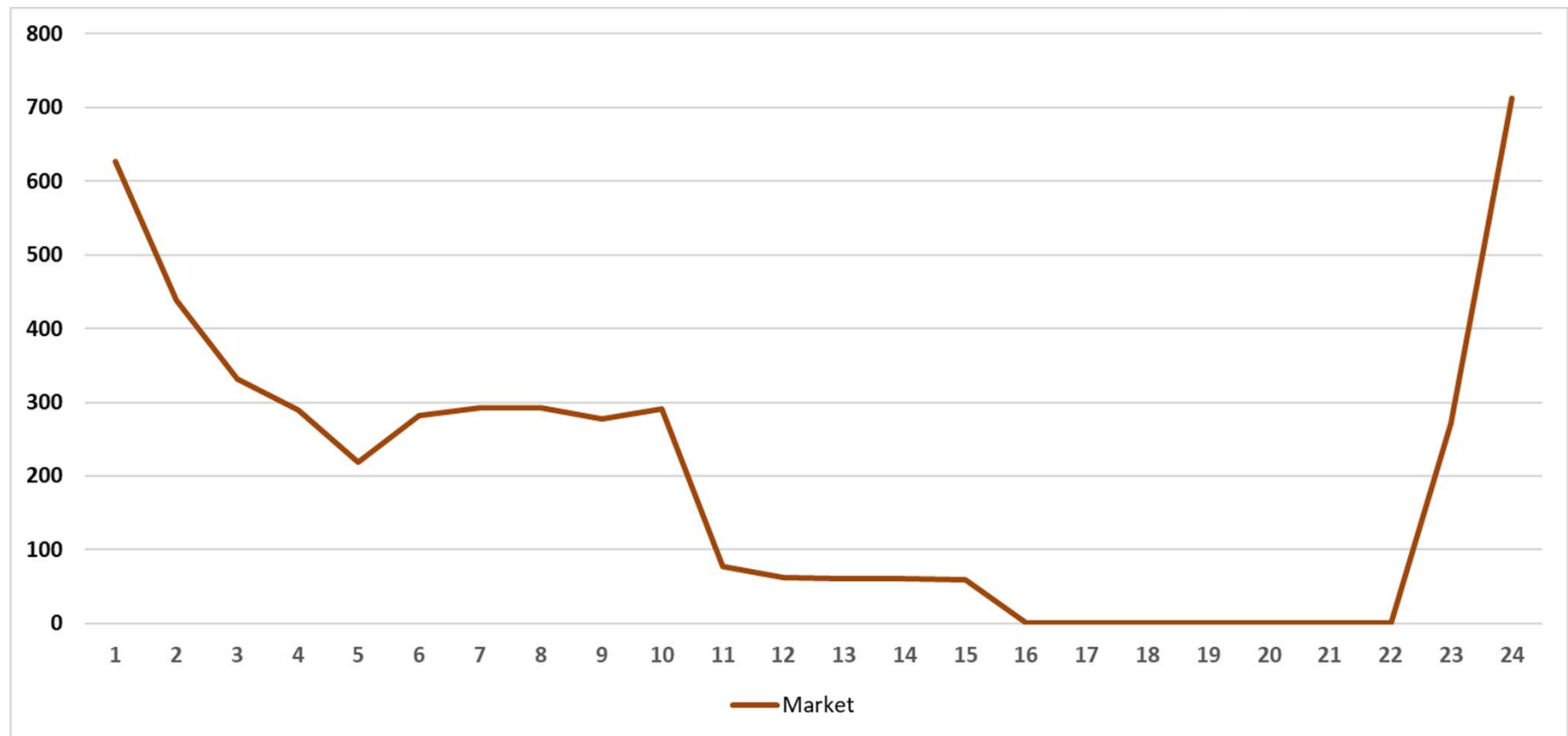


Resource Stack Example

(Aurora Peak Hour - Sample Output)

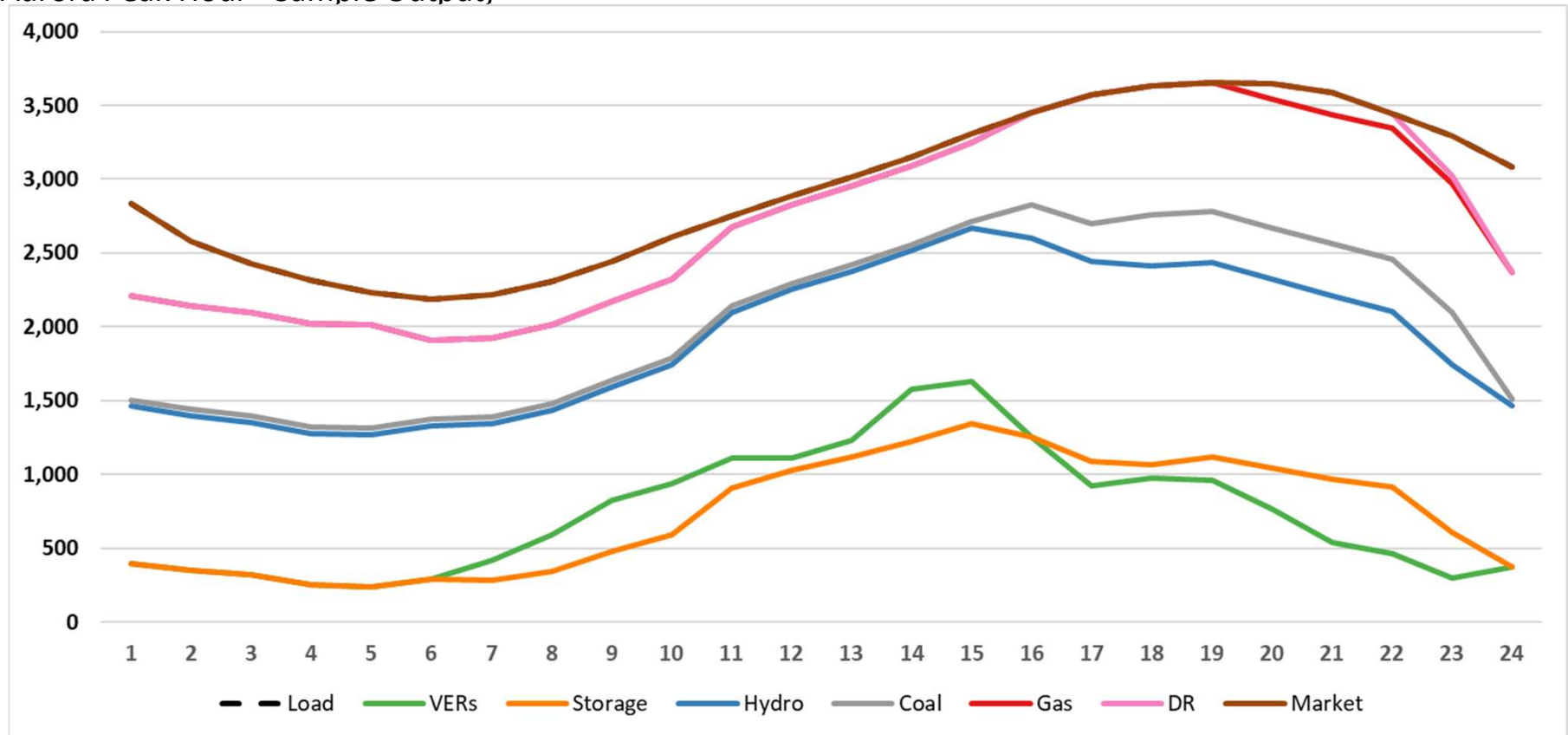


Resource Stack Example: Market Purchases and Sales



Resource Stack Example

(Aurora Peak Hour - Sample Output)



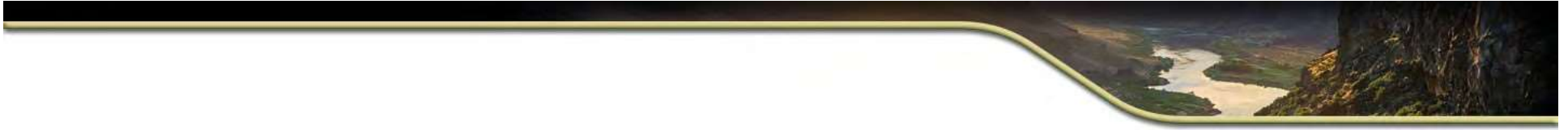
Aurora Database

- Aurora provides a default WECC database
- Data comes from publicly available sources, such as NERC, EIA, WECC, etc.
- Database captures what's happening around us
 - Important to model entire WECC
 - Examples – high carbon cost future, high gas cost future, etc.
 - As futures change – Market prices change

Aurora Database Refinement



- Default database as starting point
- Refined through:
- IRP Process
 - IRPAC recommendations
- Additional reasons for refinements:
 - Newer price forecasts are available
 - Idaho Power system specific data
 - Sensitivity analyses



Long-Term Capacity Expansion (LTCE)

LTCE Description



- Resources are built or retired based on the following:
 - Load and resource balance analysis
 - Planning margin requirements
 - Energy sufficiency for every hour
 - Economics
 - Future/existing resource costs
 - Constraints
 - RPS requirements
 - Emissions limits
 - Resource end of life

Load and Resource Balance Analysis

$$\begin{array}{l} + \text{Supply} \\ - \text{Demand} \\ = \text{Sufficiency / (Deficiency)} \end{array} \left\{ \begin{array}{l} + \text{Existing and future resources} \\ + \text{Existing and future transmission capacity} \\ - \text{Load forecast} \\ = \text{Sufficiency / (Deficiency)} \end{array} \right.$$

Load and Resource Balance Analysis Adjusted for Planning Margin

+ Supply

- Demand

= Sufficiency / (Deficiency)

Demand = Load Forecast * (1+Planning Margin)

Example:

Load Forecast = 3,500 MW

Planning Margin = 15%

Demand= 4,025 MW



Portfolio Costing Through Zonal Simulation

Zonal Simulation

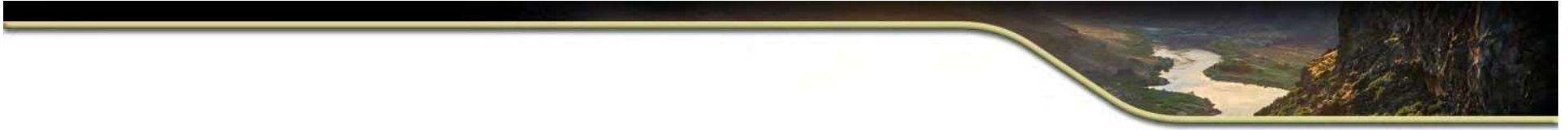


- Hourly simulation for entire WECC (including Idaho Power) is performed
 - Existing and New Resources determined by LTCE
- Resources are dispatched to serve load
- Energy flows based on load/economics

Zonal Simulation

(Continued)

- Hourly dispatch considerations:
 - Economics
 - Ramp rates
 - Regulation services
 - Min Up/Min Down
 - Maintenance schedules
 - Transmission ratings
 - Must-run resources



The End...