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Energy Security Improvements Impact Analysis

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Principal

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Agenda

- New Ancillary Service Bidding
- Changes in Energy Inventory
- Historical Benchmarking Results
- Future Business as Usual Results

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New Ancillary Service Bidding

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Offers for Proposed ESI Products

Two approaches taken

- Under ESI, market participants submit offers to supply the service
- AG will estimate market participant offers for ESI products using two approaches
  - The first approach assumes offers are set to recover the cost (fixed or short-run) of securing fuel inventory to cover an ESI award
  - The second approach assumes that resource offers reflect differences in financial risk faced by market participants when taking the option position (i.e., a risk premium)
  - In addition, in both approaches, offers include a component reflecting the *expected* cost of settling the option against RT LMPs
    - Discuss this component first, then discuss cost and risk components

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Expected Cost of Option Settlement

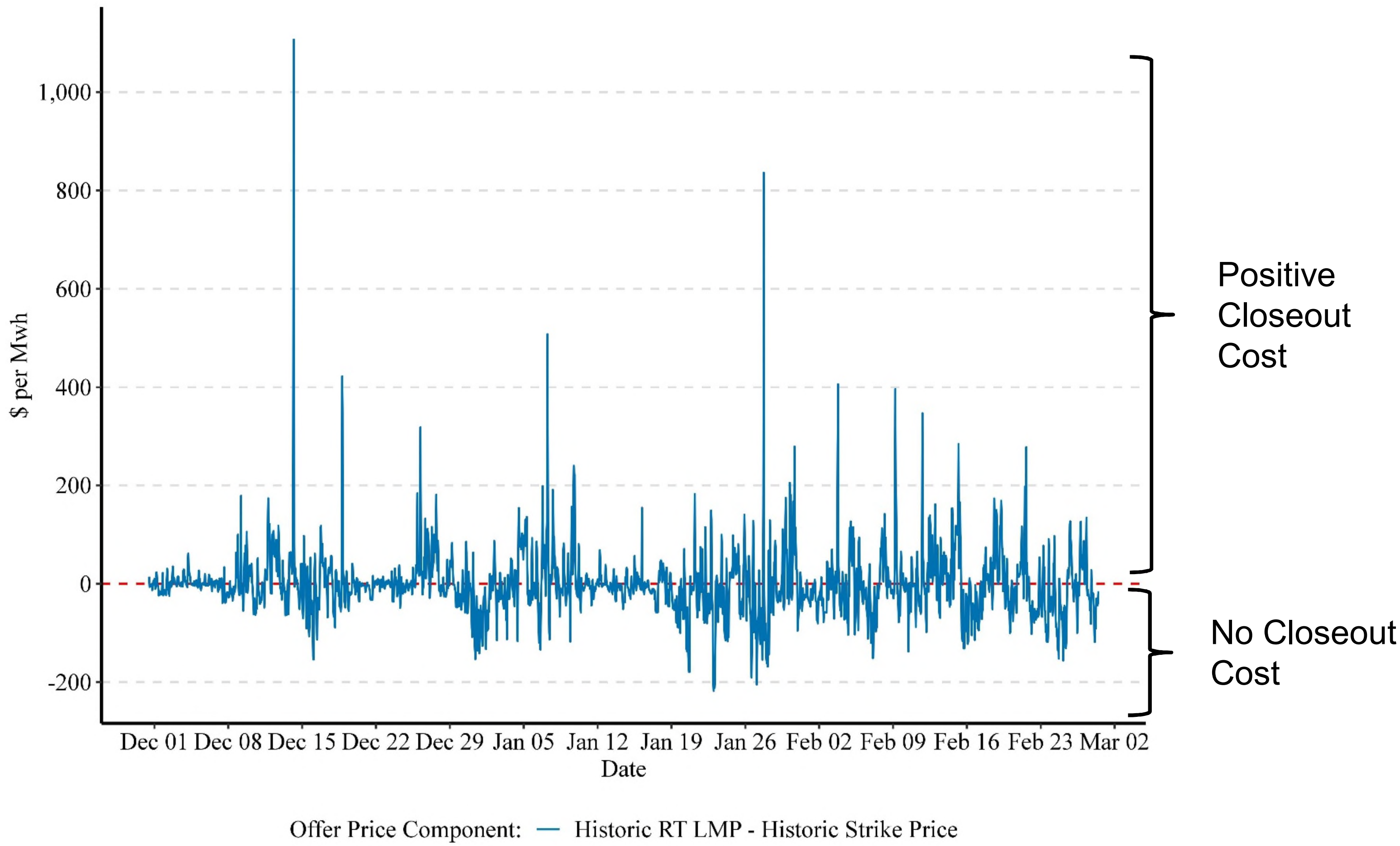
Volatility in Option Settlement

- The proposed ESI products offer the following tradeoff to suppliers
  - Receive fixed compensation for providing energy option, P^{AS}
  - Make payment to closeout the option if option is in the money – that is:
    - Pay out $LMP - K$ if $LMP > K$
    - Pay out 0 if $LMP < K$

- A key driver of bidding for the new ESI products will be the volatility of the real-time settlement – that is: $max(LMP - K, 0)$
  - The following figures show the hourly value of $LMP - K$ for the past three winters
  - *K* calculated as the average of day-ahead on-peak and off-peak LMP

ESI Settlement – Historical Values

Volatility in *LMP* – *K* : Winter 2013/2014



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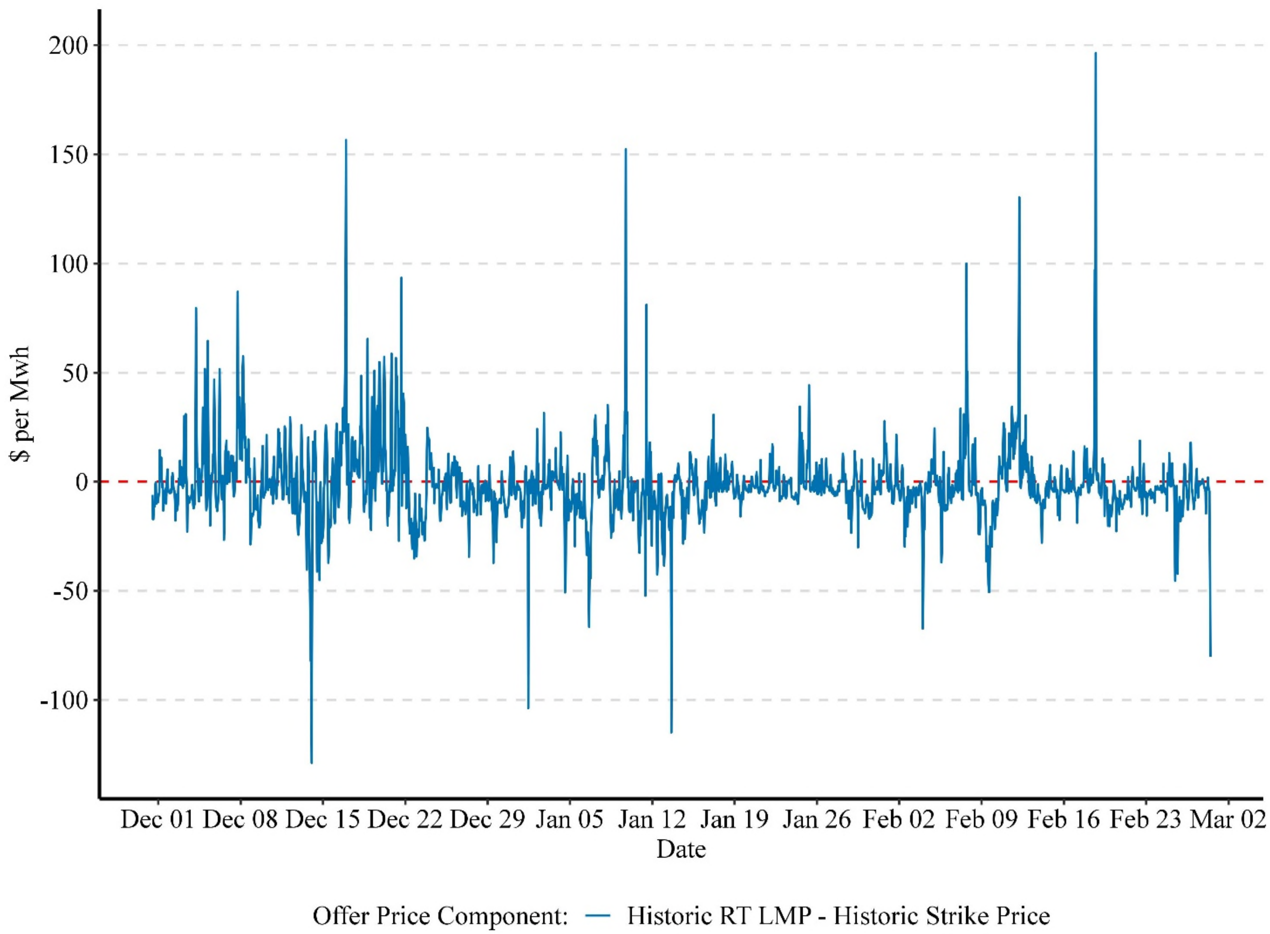
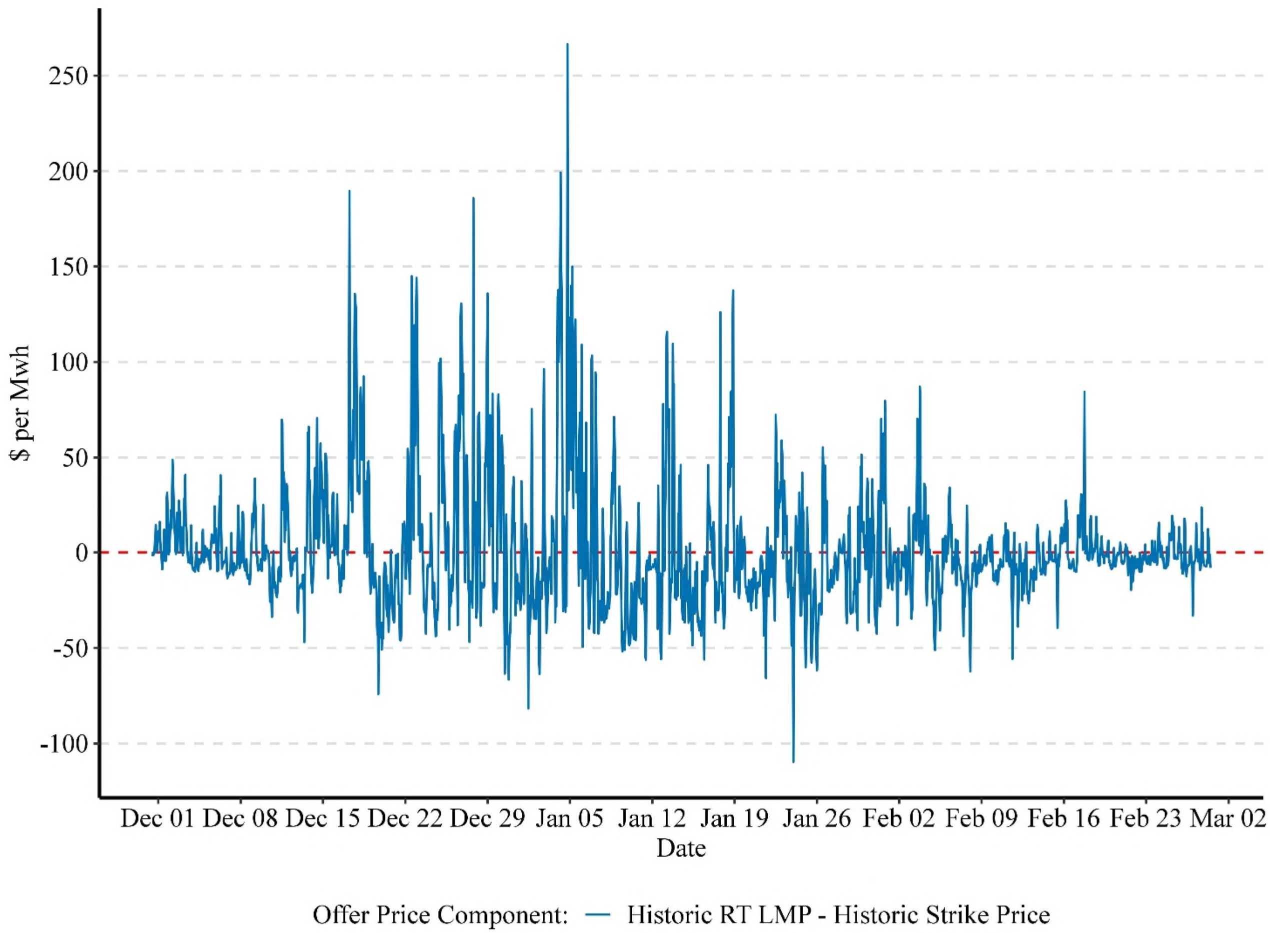
ESI Settlement – Historical Values

Volatility in *LMP – K* : Winter 2016/2017



ESI Settlement – Historical Values

Volatility in *LMP – K* : Winter 2017/2018



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Estimating Expected Cost of Option Settlement

Analysis Accounts for Expected Variability in Likely Closeout Cost

- We estimate the expected settlement for ESI awards
  - Rather than assume a fixed value across the winter, we account for variation in the expected difference between *LMP* and *K* given contemporaneous factors
- Specifically, we estimate the following equation using historical data

$$(LMP - K) = \beta_0 + \beta X + e$$

  - *X* are factors, known to the market participant, that can be accounted for in determining the level of their offer, including:
    - Temperature (measured as Heating Degree Day)
    - Time variables: Hour of Day, Day of Week, Month of Year
  - Regression sample includes winter months only

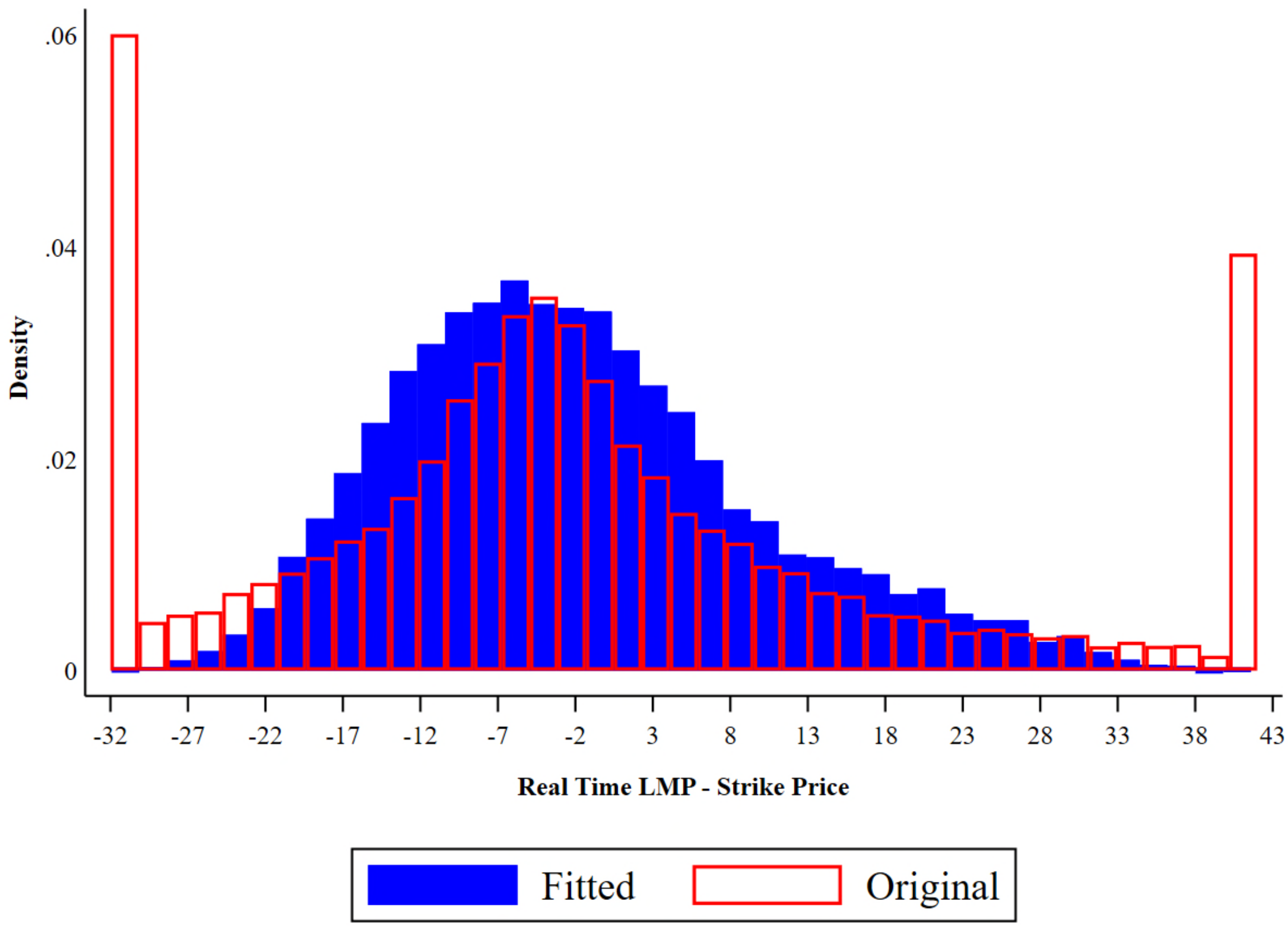
Estimating Expected Cost of Option Settlement

Analysis Accounts for Expected Variability in Likely Closeout Cost

- Calculation of expected closeout cost for each day accounts for such variation through a multiple step process:
  - ***Step 1:*** Estimate fitted values of $LMP - K$ based on estimated regression

ESI Settlement – Historical Values

Comparison Between Actual Values and Fitted Values from Regression Model



Estimating Expected Cost of Option Settlement

Analysis Accounts for Asymmetric Impact of Regression Model Error

- Calculation of expected closeout cost for each day accounts for such variation through a multiple step process:
  - ***Step 1:*** Estimate fitted values of $LMP - K$ based on estimated regression
  - ***Step 2:*** Perform a Monte Carlo analysis that estimates expected closeout cost based on the modeled closeout costs in a large number (1,000) of simulations. Each simulation calculates closeout cost ($max(LMP-K, 0)$) based on (1) the fitted value from the regression plus (2) an error term from the distribution of regression residuals.
  - ***Step 3:*** Calculated the expected closeout cost based on the distribution of values from the Monte Carlo simulation
  - Steps 2 and 3 account for model error, which has a positive impact on expected closeout cost due to the asymmetry in closeout of the option position (i.e., closeout cost is positive (if LMP – K > 0) or zero)

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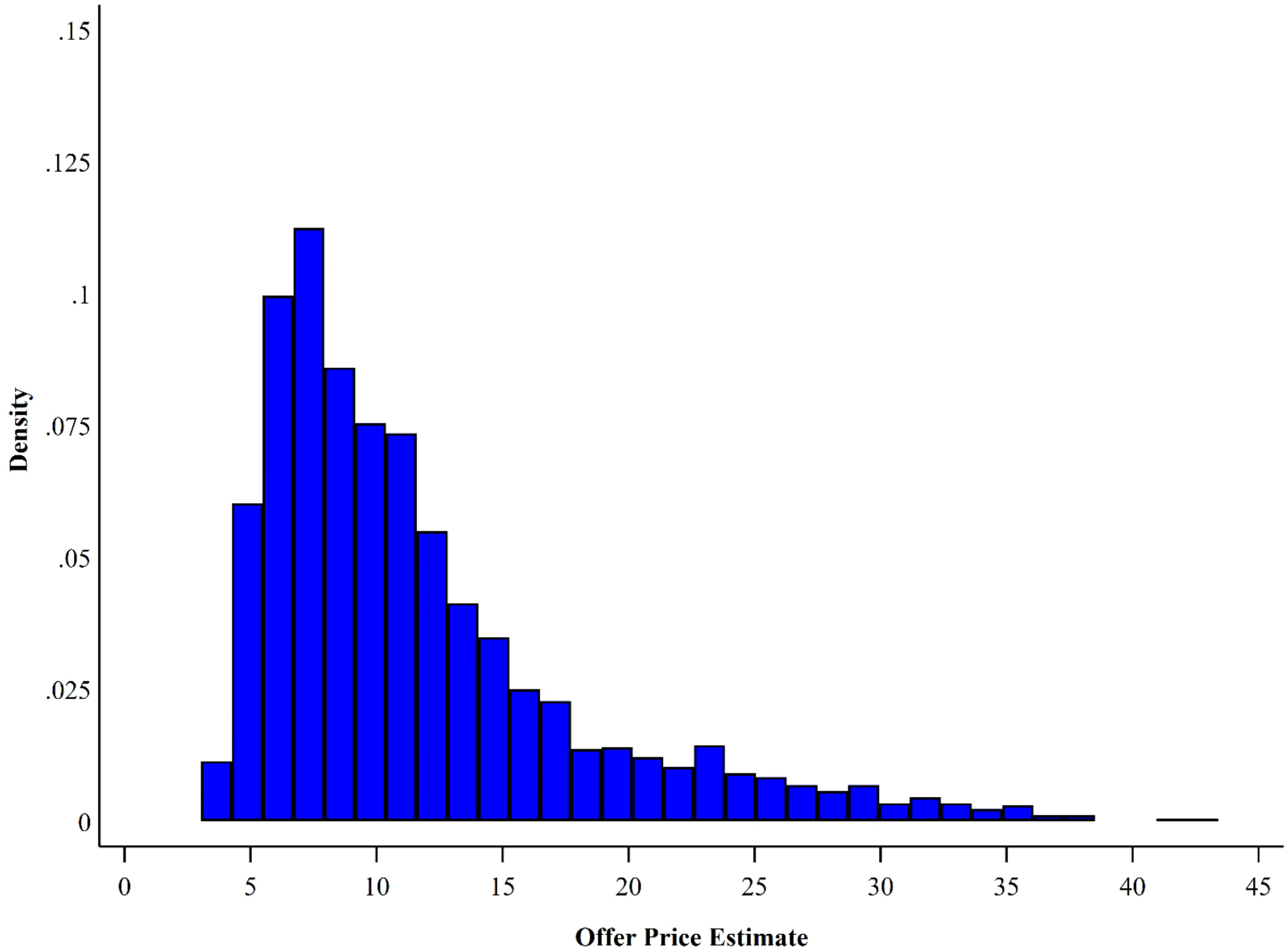
ESI Settlement – Historical Values

Estimates of Expected ESI Energy Option Closeout – Winter 2013/2014



Offers for Proposed ESI Products

Approach 1

- Offer prices for AS reflect costs of settlement plus net cost of supplying service – that is:

$$ESI\ AS\ Offer = Expected\ Cost\ of\ Settlement + Expected\ Cost\ of\ Supplying\ Service$$

$$= E[Max(LMP - K, 0)] + Cost\ of\ Supply\ (net\ of\ incremental\ expected\ profit\ )$$

`

- Expected cost of settlement is the expected cost of closing out the option in real time
  - *Expected* cost is positive because option pays zero or a positive amount
  - Estimated using statistical analysis based on historical prices
- Expected cost of energy inventory (net of incremental expected profit from securing energy inventory) will vary across different types of resources (e.g., oil-fired resources, resources with forward LNG contracts)

Estimating Cost of Securing Energy Inventory

Analysis Accounts for Certain But Not All Actions to Secure Energy Inventory

- Our analysis explicitly accounts for two types of incremental actions to secure energy inventory
  - Incremental fuel oil inventory and arrangements
  - Forward LNG contract

- We do not account for other potential actions – for example:
  - Incremental day-ahead (timely nomination) NG purchases
  - Incremental pumping by pumped storage
  - Positioning of hydro (reservoir) resources
  - Incremental storage at biomass facilities (waste- or wood-burning)

Estimating Cost of Securing Energy Inventory

Rely on Interim Compensation Treatment Analyses

- The cost of securing energy inventory is estimated using analysis developed in the context of Interim Compensation Treatment ("Chapter 2")
  - ICT rate based on unrecovered cost of a forward contract with an LNG terminal (given assumption that some energy would be reserved for supplying inventoried energy)
  - ICT analysis also evaluated unrecovered cost of incremental fuel inventory
    - Further details provided in ICT supporting materials (see *Testimony of Todd Schatzki*, FERC ER19-1428, and attachments)

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Estimating Cost of Securing Energy Inventory

Rely on Interim Compensation Treatment Analyses

- Cost/rate depends on number of hours over which cost is recovered
  - ICT rate calculated assuming recovery of unrecovered cost over Inventoried Energy Hours, expected to be 10 hours ➔ rate = $82.49 per MWh
  - With ESI products, cost recovery occurs over larger number of hours because ESI products clear in all hours
    - Assume costs recovered on days when fuel supplies are relatively tight
      - Tight NG market creates risk of RT LMP spikes that increase value of physical inventory to hedge risk
    - Example:
      - Historically, 20% of winter days with Algonquin Citygate price above $15/MMBtu (2012/2013 – 201/2018)
      - Offers clear only during portion of day with higher demand (e.g., 12 hours)
      - Total Hours per Winter to Recover: ~ **220** (= 90 days * 12 Hours * 20%)

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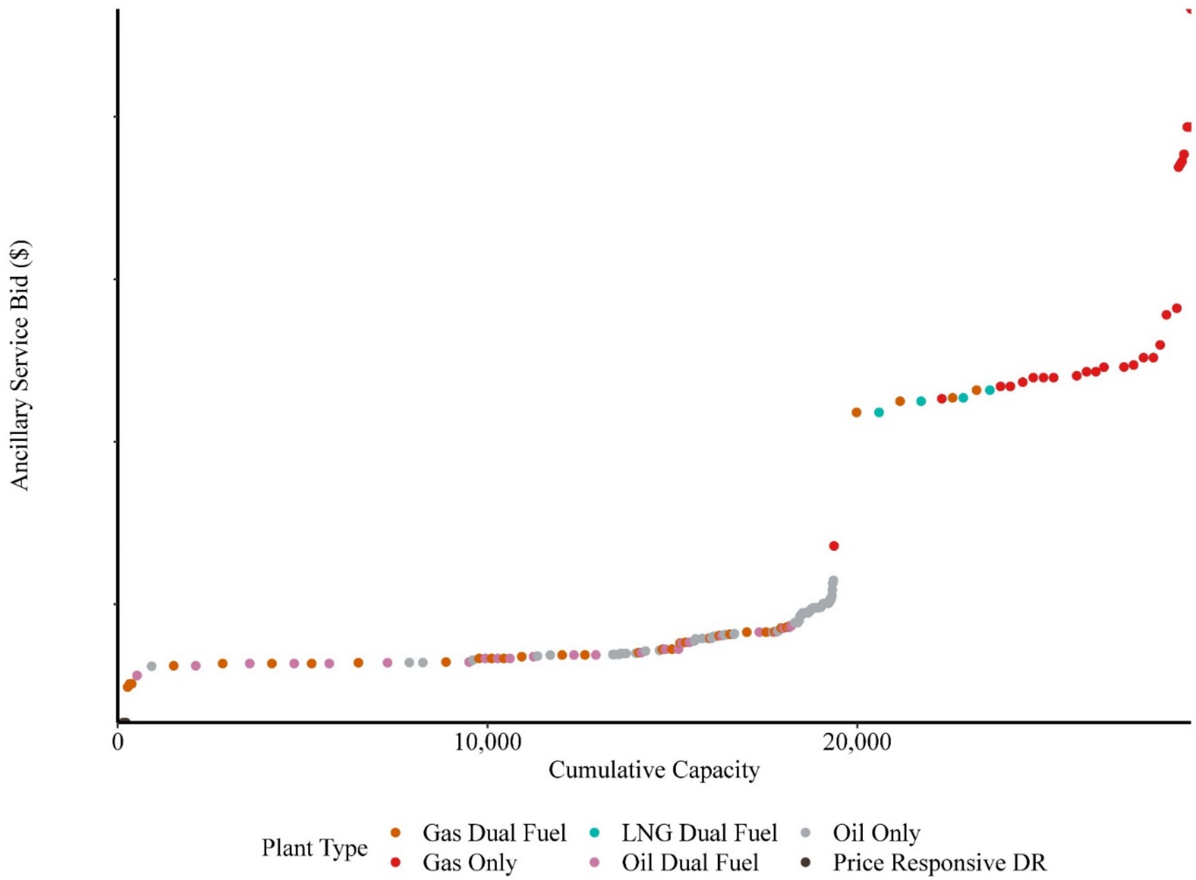
Estimating Cost of Securing Energy Inventory

Depend on Type of Inventoried Energy, Heat Rate and Other Assumptions

- Cost of securing energy inventory depends on many factors
- Illustration:
  - Unrecovered cost of forward LNG contract for 7.8 MMBtu / MWh heat rate plant is $247.46 (given ITC assumptions)
  - Bid adder to recover unrecovered cost:
    - $247.46 / 220 hours = $1.12 / MWh
  - Depends on many factors: heat rate, hours over which cost is recovered, unrecovered cost, forward LNG contract terms, LNG prices, etc.

ESI Supply Curve

Illustrative DA Energy Option Offer Prices



- Equilibrium DA energy option price will reflect remaining supply "after" DA energy clears (given co-optimization)
- Some supply represented in illustrative supply curve will clear DA energy, not DA energy option

Note: Not all capacity able to offer DA energy option is represented

Day-Ahead Market

Resource offers – Approach 2

- New ESI ancillary services
  - Offer prices for AS reflect costs of settlement plus a risk premium – that is:

$$ESI\ AS\ Offer = Expected\ Cost\ of\ Settlement + Risk\ Premium$$

$$= Max(LMP - K, 0) + RP(K, MC_{inv}, MC_{no\ inv}, \sigma_{LMP})$$

  - Here, the risk premium depends on many factors that affect the riskiness of the option position, including:
    - LMP volatility (σ_{LMP})
    - Marginal production costs (*MC*) with and without fuel inventory
    - *K*, the option strike price

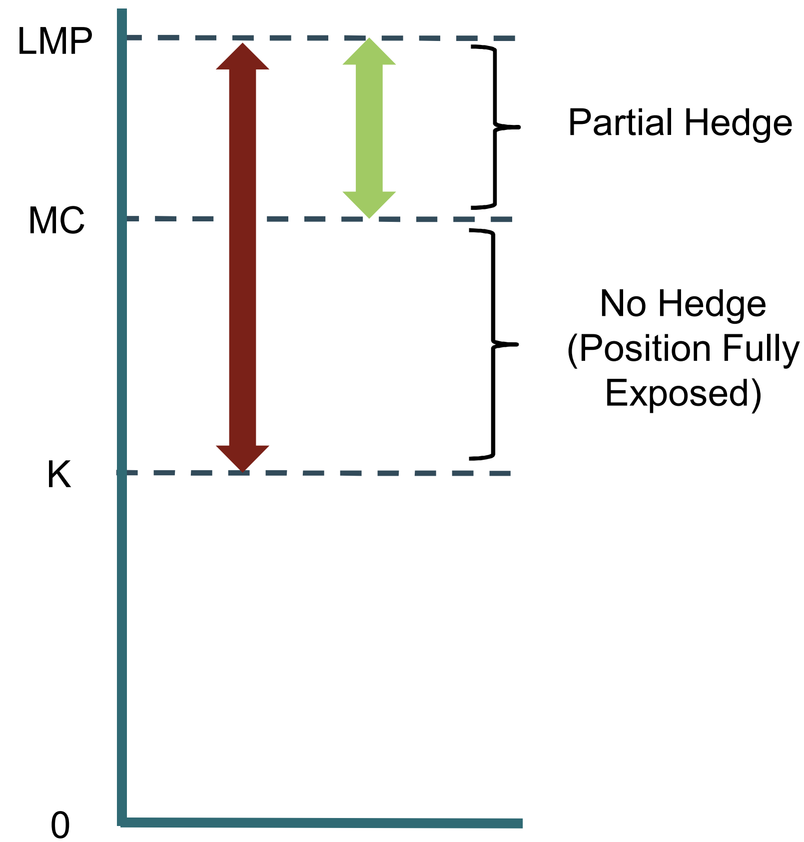
ESI Risk Premium

Risk Premium Depends on Exposure Created by Option Position

For each unit, net position reflects energy and ESI positions:

- Energy:
  - Earn Max (0, LMP – MC)
- ESI:
  - Pay Max (0, LMP – K)

- Thus, the degree to which an ESI position creates exposed risk varies with marginal cost of supply
  - As MC decreases, exposure decreases
  - As MC increases, exposure increases



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Day-Ahead Market

Resource offers – Approach 2

- Effectiveness of the hedge on option settlement risk depends on the marginal costs (MC) of supplying energy underlying the option position
  - A resource with no inventory faces very high MC as it either buys fuel at spot or cannot get fuel on intraday market
  - A resource with inventory, but high MC, has a only partial (or no) hedge
  - A resource with inventory, but low MC, has a more effective hedge and lower risk as the likelihood that resource supplies in RT is greater
- Implications
  - Incentives to sell ESI energy option are greatest for those resources that can supply inventoried energy with lowest MC
  - Creates incentives to secure energy in advance, to mitigate close cost risks
  - Incentives are aligned (even if there is no physical requirement)
- Approach to capturing risk premium quantitatively is being developed

Changes in Energy Inventory

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Impacts on Energy Security

Potential impacts given conceptual design

- The proposed Energy Security Improvements potentially change market participant resource decisions and economic offers in ways that improve energy security
- One way in which ESI products affect energy supply is by creating incentives for resources to physically cover the sale of these options

Changes in Energy Inventory

Model accounts for potential inventory changes through several mechanisms

- In DA market, resource owners with physical inventory face lower financial risk when making offers for DA energy options
- Resource owners can take many steps to improve physical inventory to cover DA energy option positions
  - Resources relying on fuel oil (oil-only or dual fuel) can:
    1. Increase fuel inventories at the beginning of winter
    2. Increase replenishment of depleted inventories, including making arrangements to improve service from fuel suppliers
  - Resources relying on NG only can:
    3. Enter into a forward LNG forward contracts
    4. Purchase NG day-ahead (timely nomination) to cover an DA energy option position
- Our analysis includes quantitative assessment of #1 to #3

Short-Term (Day-Ahead) Fuel Arrangements

- In the short-term (e.g., day-ahead), resources have limited options to improve energy inventory to cover a day-ahead ESI position
  - Resources with fuel oil can purchase incremental fuel oil (replenish to higher levels, with greater frequency, etc.)
    - But, ability to obtain fuel on-demand day-ahead is generally limited (particularly during cold snaps)
  - Gas-only resources can purchase day-ahead gas
    - For resources with an EIR position, we would expect them to take such a position (if fuel supply is available)
      - In BAU, absent ESI, market participants may face limited liquidity for supply in later nominations under tight market conditions
    - For other ESI positions, cost-benefit to purchasing day-ahead gas is more complex, given likelihood that fuel is needed (and resulting net revenue) and cost of unused day-ahead purchase (given pipeline balancing rules, etc.)

Fuel Arrangements in Advance of Winter

- Forward contract with LNG terminal (Canaport, DOMAC)
  - Assume ESI incentivizes forward LNG contracts sufficient to utilize all available pipeline transport
    - Some LNG supply used to meet LDC load
    - Assume that remaining LNG supply enters into forward contracts
    - Contracts assumed to have 10 call options (similar to contracts analyzed for ICT)
  - Assume that absent ESI and associated LNG forward contracts, LNG terminals will not deliver full potential supply
    - Quantity of LNG in BAU (absent ESI) is being developed
- Forward contracting net costs and incremental ESI revenues will be compared (across scenarios) to evaluate expected cost recovery

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Fuel Arrangements in Advance of Winter

- Fuel oil (oil-only and dual fuel)
  - Assume beginning winter inventory level consistent with levels during Winter Fuel Program with ESI
    - Winter Fuel Program appears to have increased starting inventory, as is expected for ESI
    - Without ESI, levels assumed to be consistent with 2018/19 beginning of year inventory
  - Assume greater fuel oil replenishment with ESI – 33% increase in quantity per refill
- Like LNG forward contracting, net costs and incremental ESI revenues will be compared (across scenarios) to evaluate expected cost recovery
- Sensitivity analysis will consider alternative assumptions for forward LNG contracts and fuel oil replenishment

Historical Benchmarking

Historical Analysis

Model benchmarked to historical periods

- Model and actual market outcomes compared for past winter periods
  - 2013/2014
  - 2016/2017
  - 2017/2018
- These winters form the basis for Future Low, Medium and High Scenarios
- Results for 2013-14 are provided below, while results for other years are in an appendix

Historical and Modeled Average LMPs

	Mean DA LMP		Mean RT LMP	
Winter	Historical	Modeled	Historical	Modeled
2013-2014	$138.71	$139.32	$137.59	$136.81
2016-2017	$41.57	$45.95	$39.89	$44.22
2017-2018	$74.33	$84.48	$76.04	$82.03

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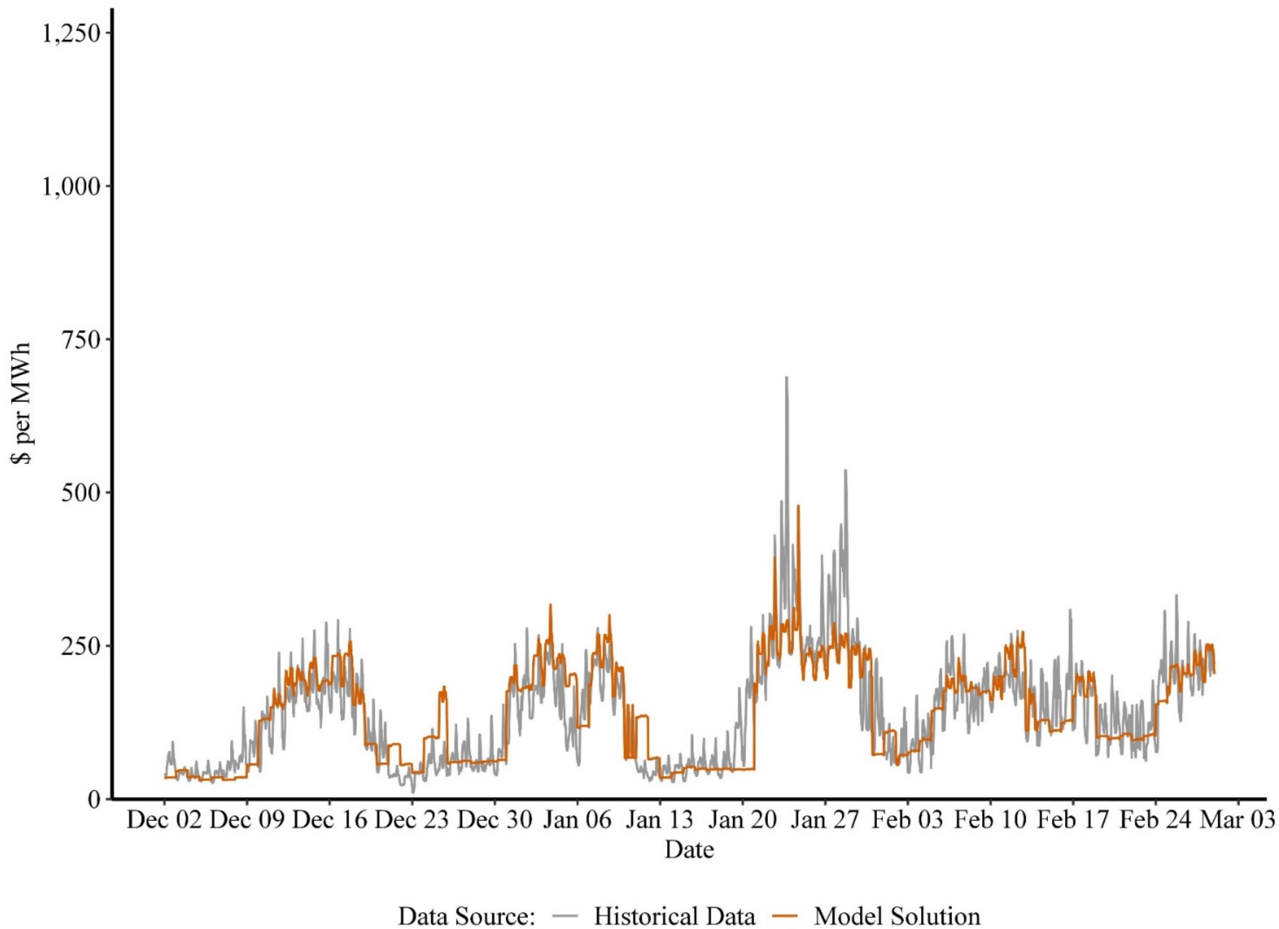
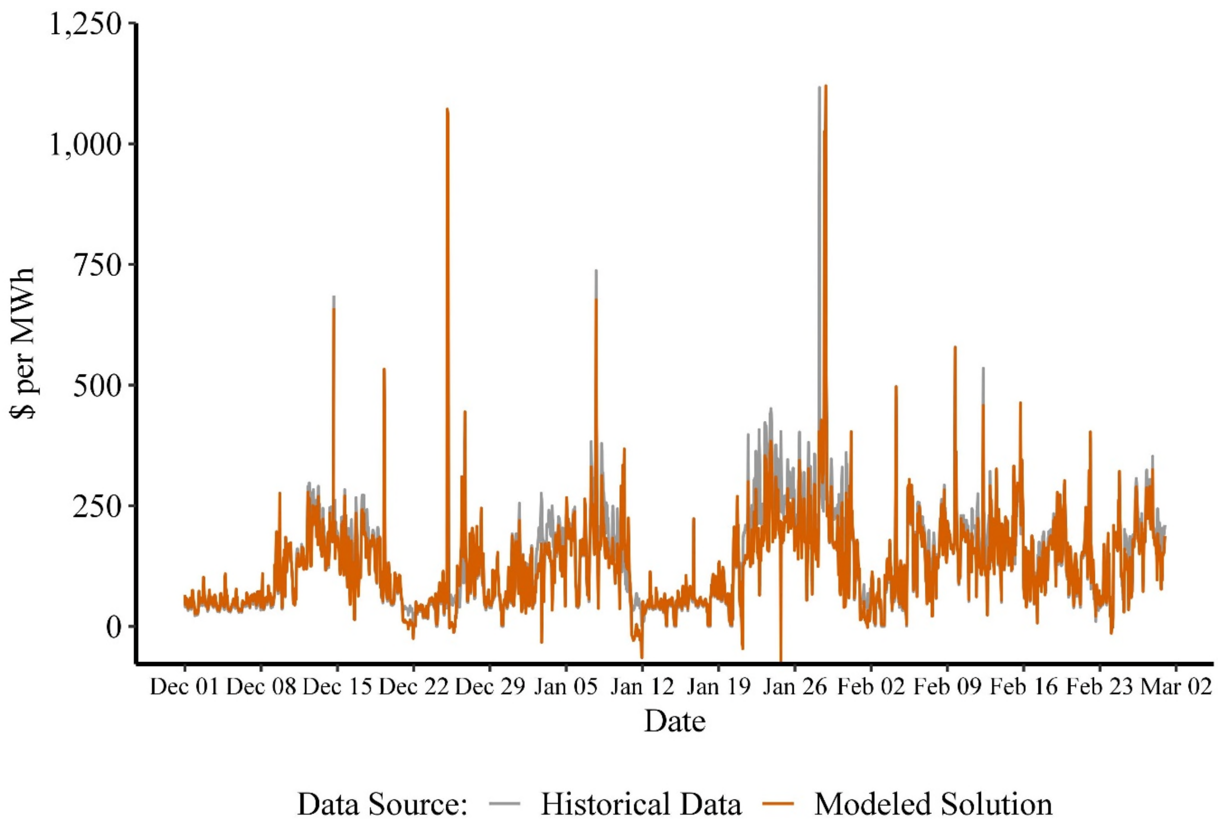
Hourly Day-Ahead LMP

2013-2014



Hourly Real-Time LMP

2013-2014



Reflects modeled price plus a volatility component (used for closeout of DA energy option)

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Total Winter Generation

2013-2014

Plant Type	Model DA Generation (MWh) [A]	Model RT Generation (MWh) [B]	Model DA Capacity Factor [C]	Model RT Capacity Factor [D]
Dual-Fuel	3,569,161	3,363,569	19.39%	18.07%
Gas Only	4,674,722	4,265,531	20.13%	18.16%
Oil Only	960,322	881,641	5.66%	5.14%
Nuclear	9,870,083	9,980,983	99.24%	99.24%
Coal	3,872,897	3,921,392	78.83%	78.93%
Biomass/Refuse	1,518,979	1,535,157	90.54%	90.49%
Hydro	1,266,824	1,570,941	-	-
Solar	0	20,067	0.00%	4.44%
Wind	232,082	549,174	14.05%	32.88%
Pumped Storage	273,108	355,011	-	-
Battery Storage	0	0	-	-
Fuel Cell	14,000	13,990	60.00%	59.30%
Active Demand Response	14,575	14,453	-	-
Imports	6,551,752	6,682,810	-	-

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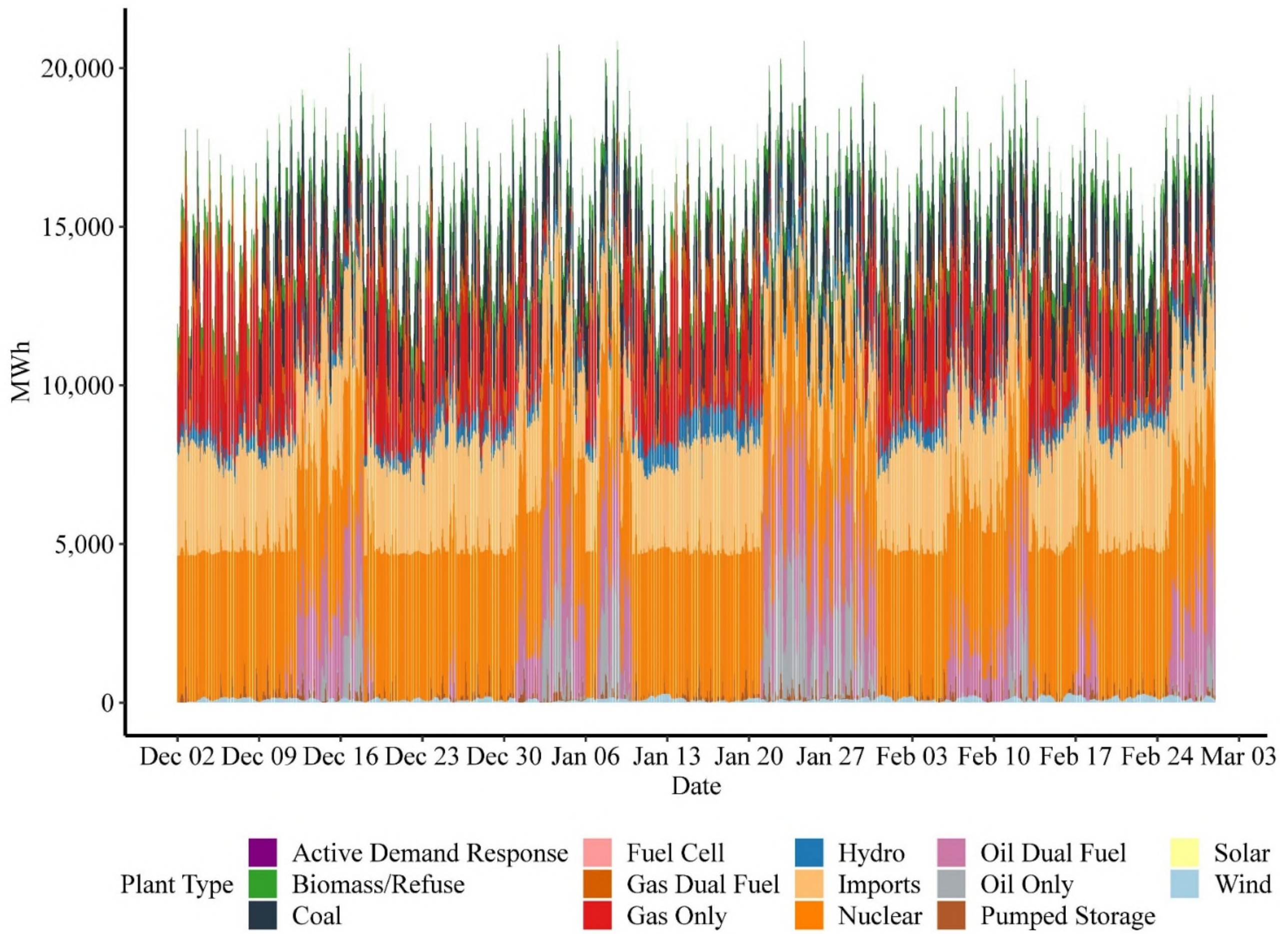
Total Winter Generation Comparison

2013-2014

Plant Type	Model DA Generation (MWh) [A]	DA Historical Generation (MWh) [B]	Difference in DA Generation (%) [C]
Dual-Fuel	3,569,161	2,121,666	68.22%
Gas Only	4,674,722	6,006,226	-22.17%
Oil Only	960,322	1,558,269	-38.37%
Nuclear	9,870,083	9,819,173	0.52%
Coal	3,872,897	3,475,044	11.45%
Biomass/Refuse	1,518,979	1,490,744	1.89%
Hydro	1,266,824	1,266,824	0.00%
Solar	0	0	0.00%
Wind	232,082	232,082	0.00%
Pumped Storage	273,108	273,108	0.00%
Battery Storage	0	0	0.00%
Fuel Cell	14,000	23,616	-40.72%
Active Demand Response	14,575	-	-
Imports	6,551,752	6,551,752	0.00%

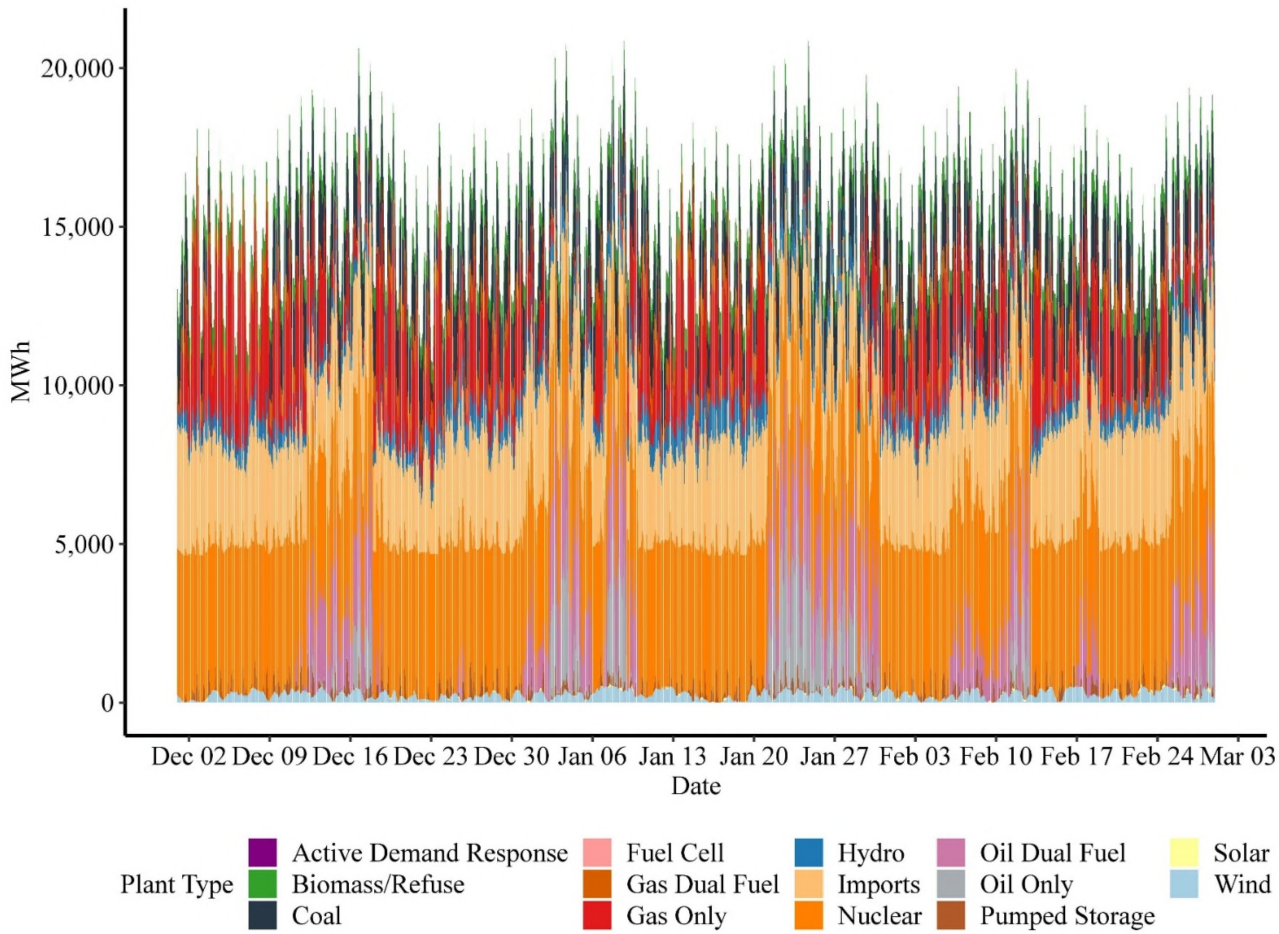
Hourly Winter Day-Ahead Generation Positions

2013-2014



Hourly Winter Real-Time Generation

2013-2014



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Future Cases – Preliminary Results

Future Cases

Future cases rely on historical winter outcomes with adjustments

- Future cases will use market conditions from past winters as a starting point
  - Load, variable renewable (solar, wind) output, and natural gas prices will be based on historical values from past winters
- Values will be adjusted to account for changes in market conditions between past year and future year:
  - Load will be adjusted to account for growth (positive or negative) in load
  - Renewable output will reflect hourly output profile, scaled to account for changes in capacity
  - Natural gas prices will be unchanged, although sensitivity analysis may explore more severe (higher-priced) market outcomes

Future Cases

Future cases rely on historical winter outcomes with adjustments

- Base analysis will consider different levels of winter severity :
  - Low 2016/2017
  - Moderate 2017/2018
  - High 2013/2014

- Resources – "Business as Usual"
  - Resources clearing in FCA 13
  - Announced retirements (for FCA 14)

Summary of Hourly LMPs

2025-2026 Scenarios – Business as Usual

Winter	Mean LMP DA	Mean LMP RT
2025-2026 High	$130.47	$128.22
2025-2026 Medium	$91.86	$83.34
2025-2026 Low	$56.06	$56.52

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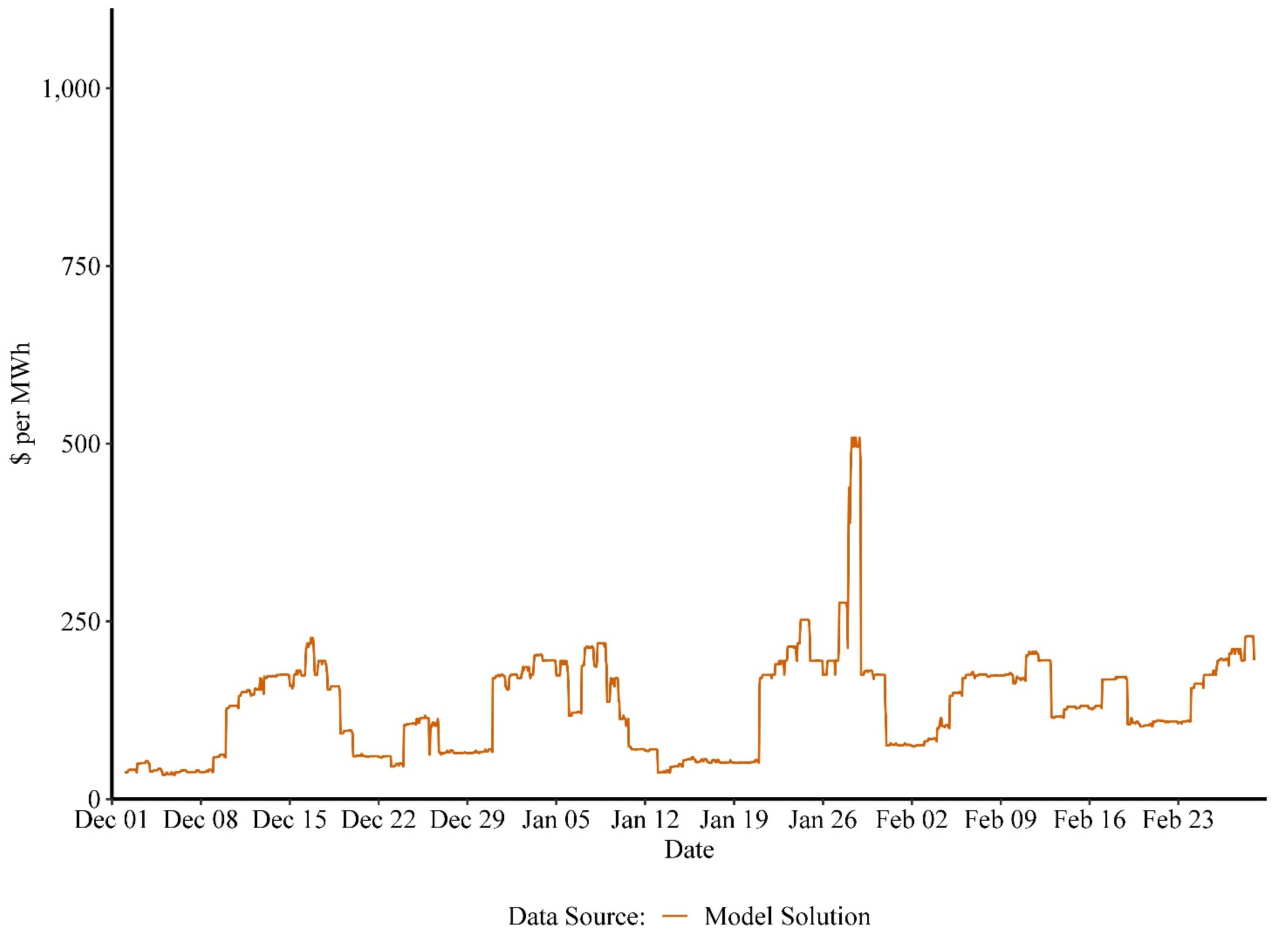
Hourly Day-Ahead LMP

2025-2026 High Severity – Business as Usual



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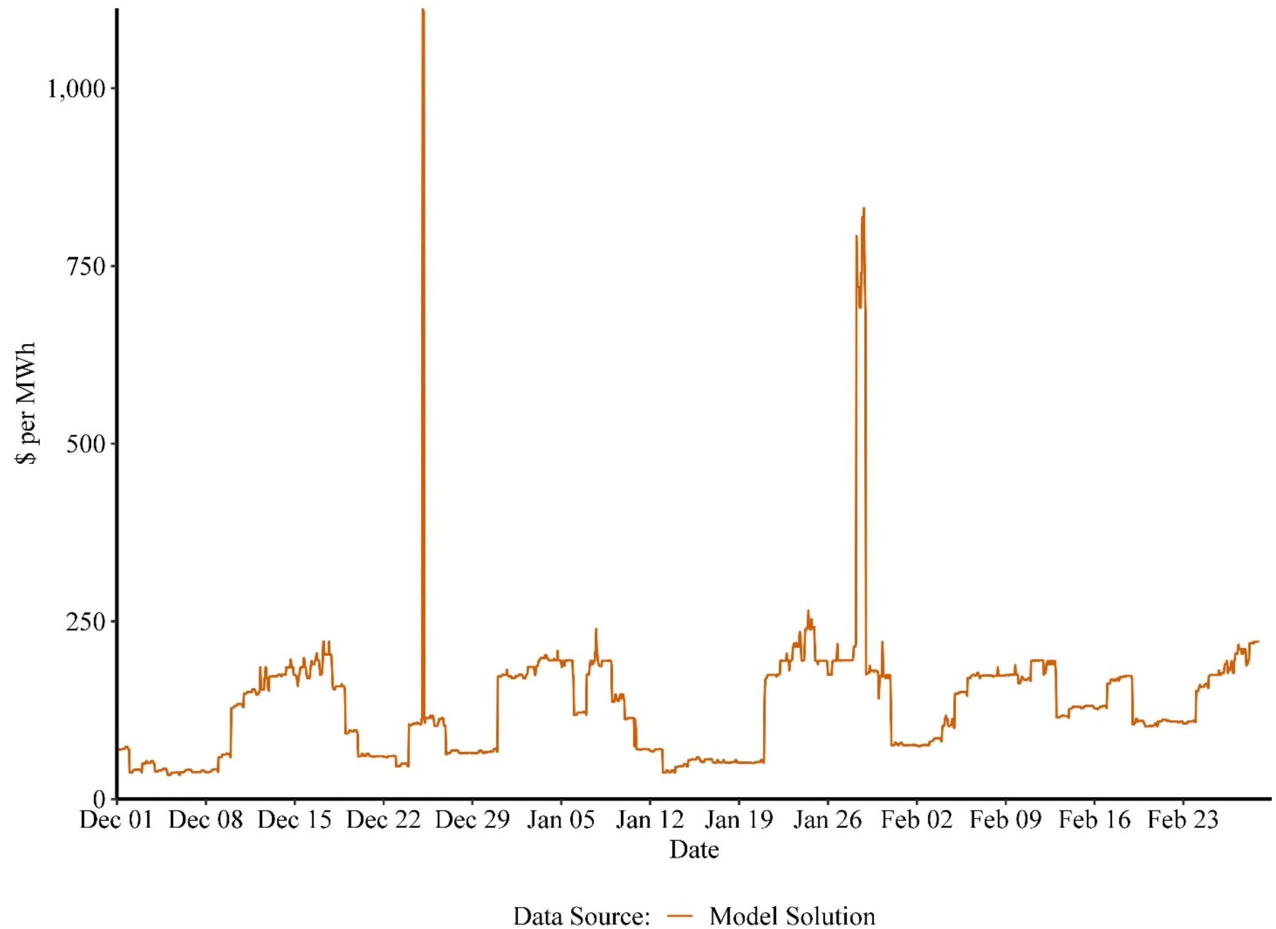
Hourly Real-Time LMP

2025-2026 High Severity – Business as Usual



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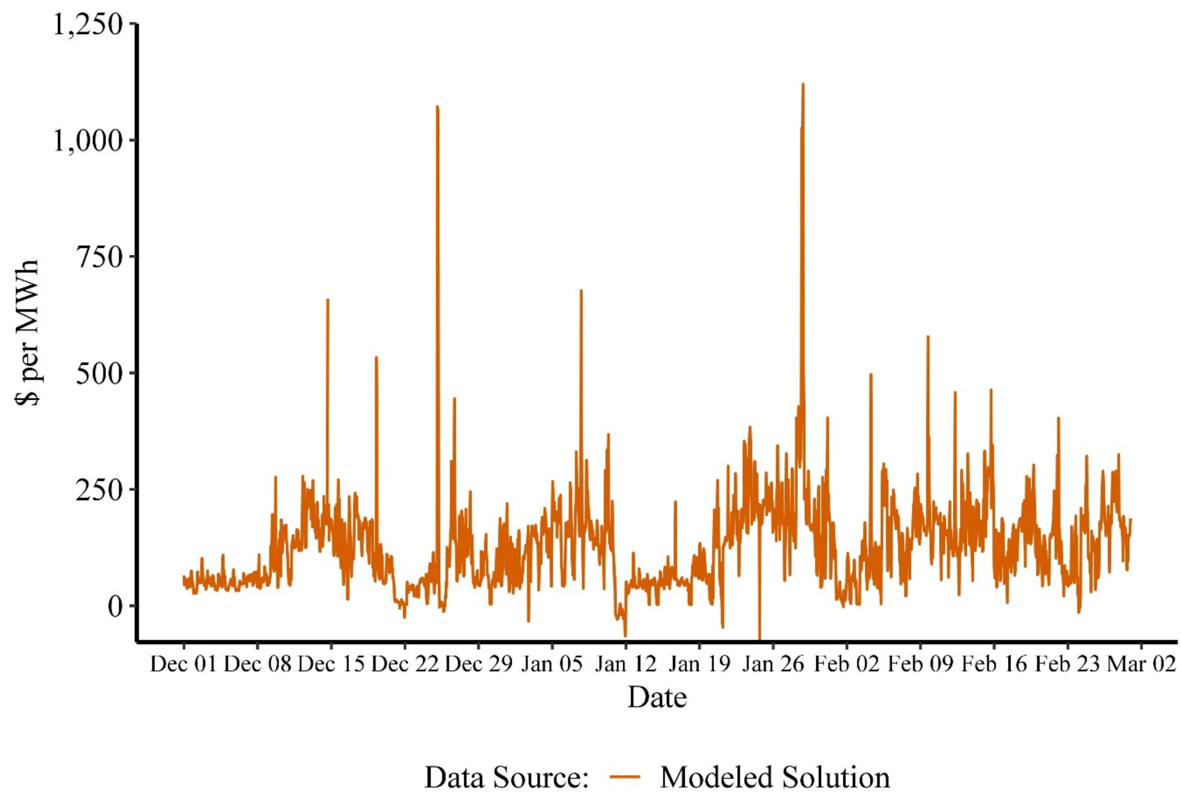
Hourly Real-Time LMP (with RT Price Volatility)

2025-2026 High Severity – Business as Usual



For closeout of DA energy option, we rely on a modeled price plus a volatility component

Total Winter Generation

2025-2026 High Severity – Business as Usual

Plant Type	Model DA Generation (MWh) [A]	Model RT Generation (MWh) [B]	Model DA Capacity Factor [C]	Model RT Capacity Factor [D]
Dual-Fuel	6,892,191	7,419,886	20.35%	21.67%
Gas Only	4,502,314	4,632,883	24.50%	24.93%
Oil Only	1,923,409	1,930,535	14.29%	14.18%
Nuclear	7,104,576	7,184,403	99.46%	99.46%
Coal	953,280	968,822	83.46%	83.88%
Biomass/Refuse	1,521,809	1,538,452	90.71%	90.69%
Hydro	1,241,219	1,544,463	-	-
Solar	0	152,197	0.00%	4.22%
Offshore Wind	867,965	879,483	50.79%	50.90%
Wind	419,629	992,964	14.02%	32.81%
Pumped Storage	-29,552	-29,884	-	-
Battery Storage	-20,009	-20,234	-	-
Fuel Cell	34,814	35,277	78.73%	78.89%
Active Demand Response	15,325	15,415	4.29%	4.27%
Imports	6,032,748	6,103,632	-	-

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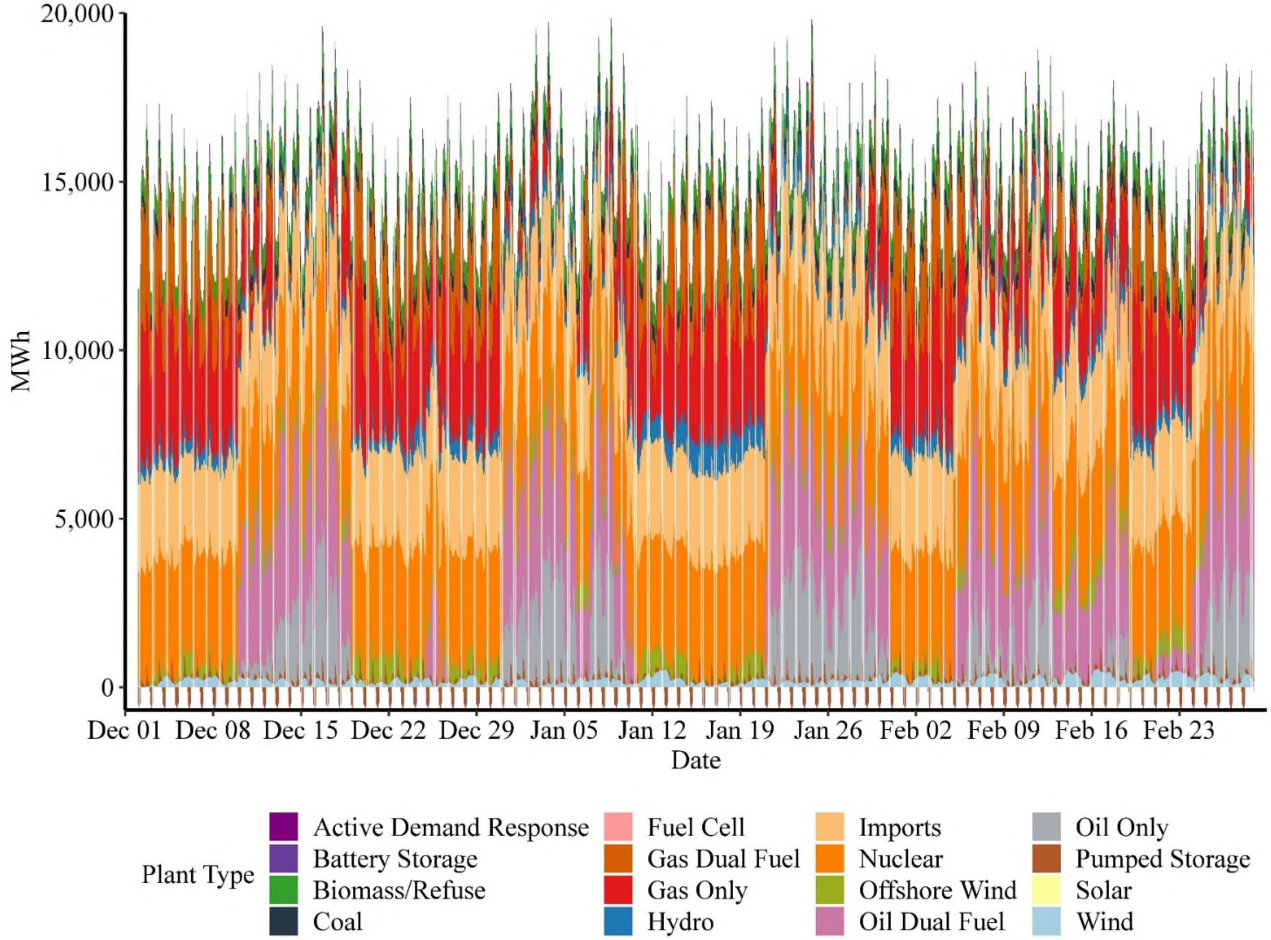
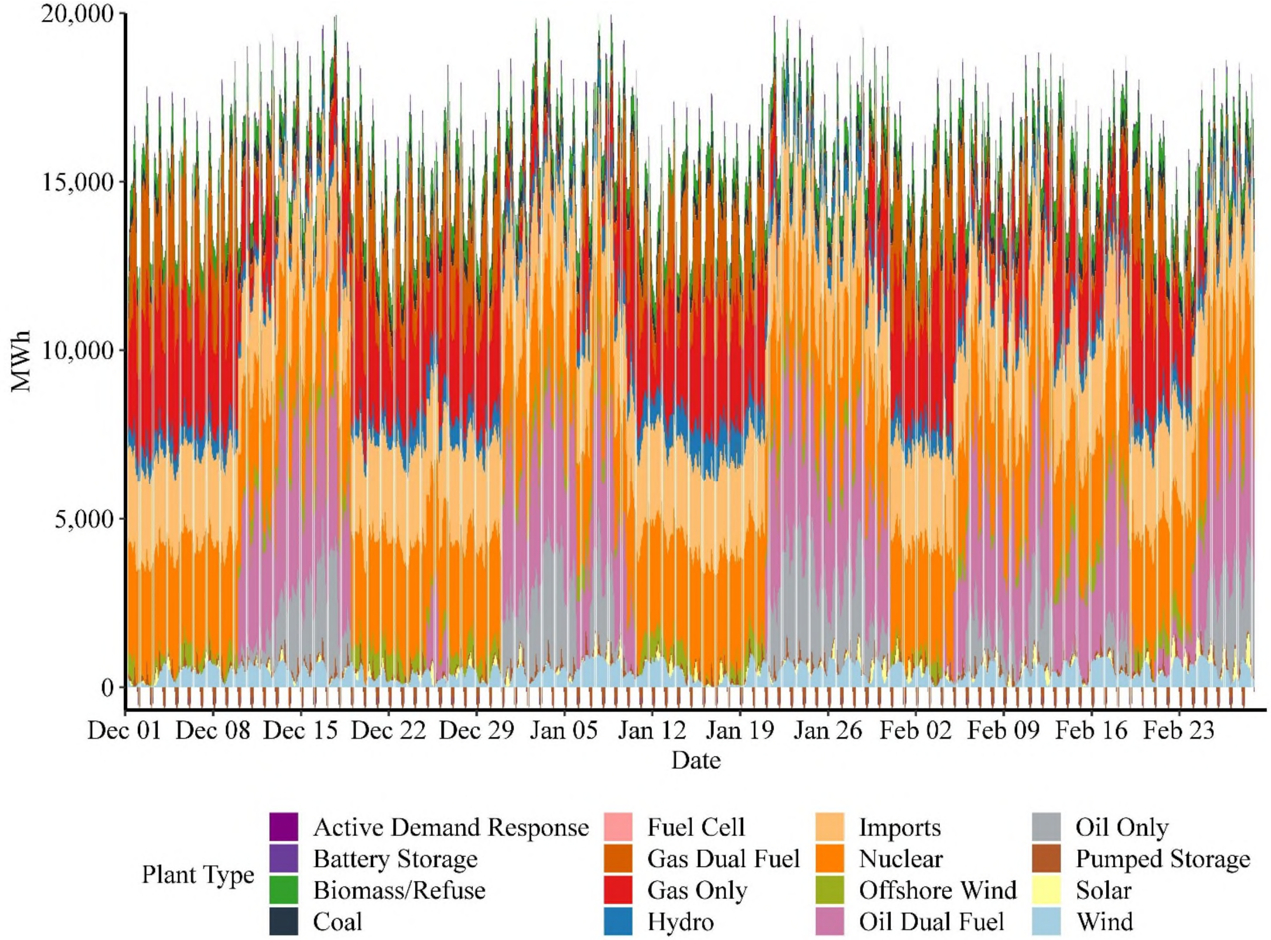
Hourly Winter Day-Ahead Generation Positions

2025-2026 High Severity – Business as Usual



Hourly Winter Real-Time Generation

2025-2026 High Severity – Business as Usual



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Operational Constraints

System Constraints

- As we evaluate ESI, we begin the focus on factors that affect energy security
- For example, gas system infrastructure constrains gas delivery, based on the following equation:

$$\begin{aligned}&\mathit{Natural\ Gas\ Available\ for\ Generators}\\&\leq \mathit{Pipeline\ Capacity} - \mathit{Net\ LDC\ Load} - \mathit{LNG\ Terminal\ Supply}\end{aligned}$$

- We can use this relationship to evaluate gas pipeline constraints and how ESI affects this this constraint and energy security (given this constraint)

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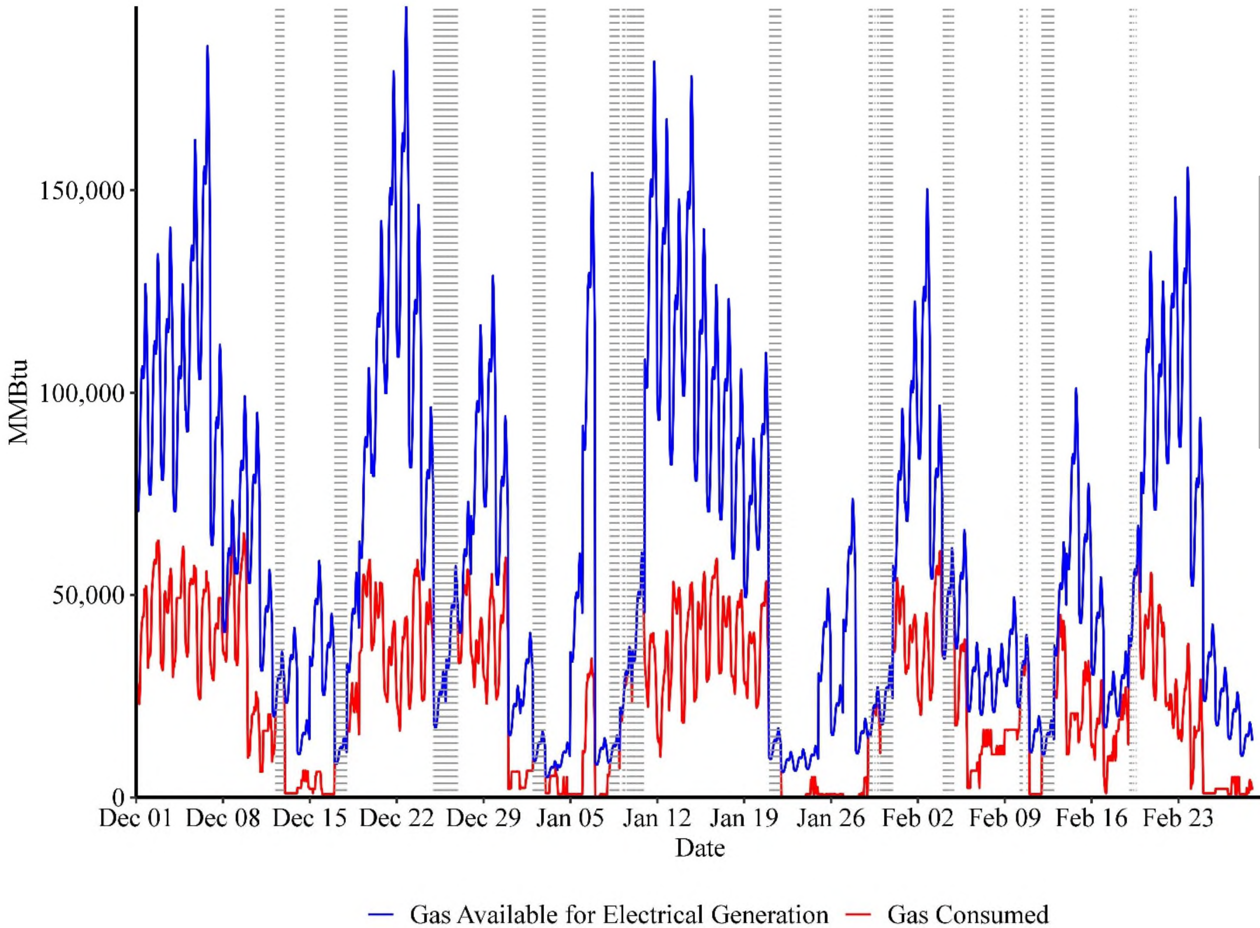
Hourly Winter Gas Availability and Consumption

2025-2026 High Severity – Business as Usual



Grey cross-hatch represents periods when NG supply is fully utilized

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Next Steps

A Range of Scenarios Will be Evaluated

- July
  - Further preliminary results, including comparison between Future BAU and ESI scenarios
- August
  - Preliminary scenario results
  - Respond to stakeholder feedback from July results
- September
  - Draft Report (summarizing presented material)
- October
  - Filing

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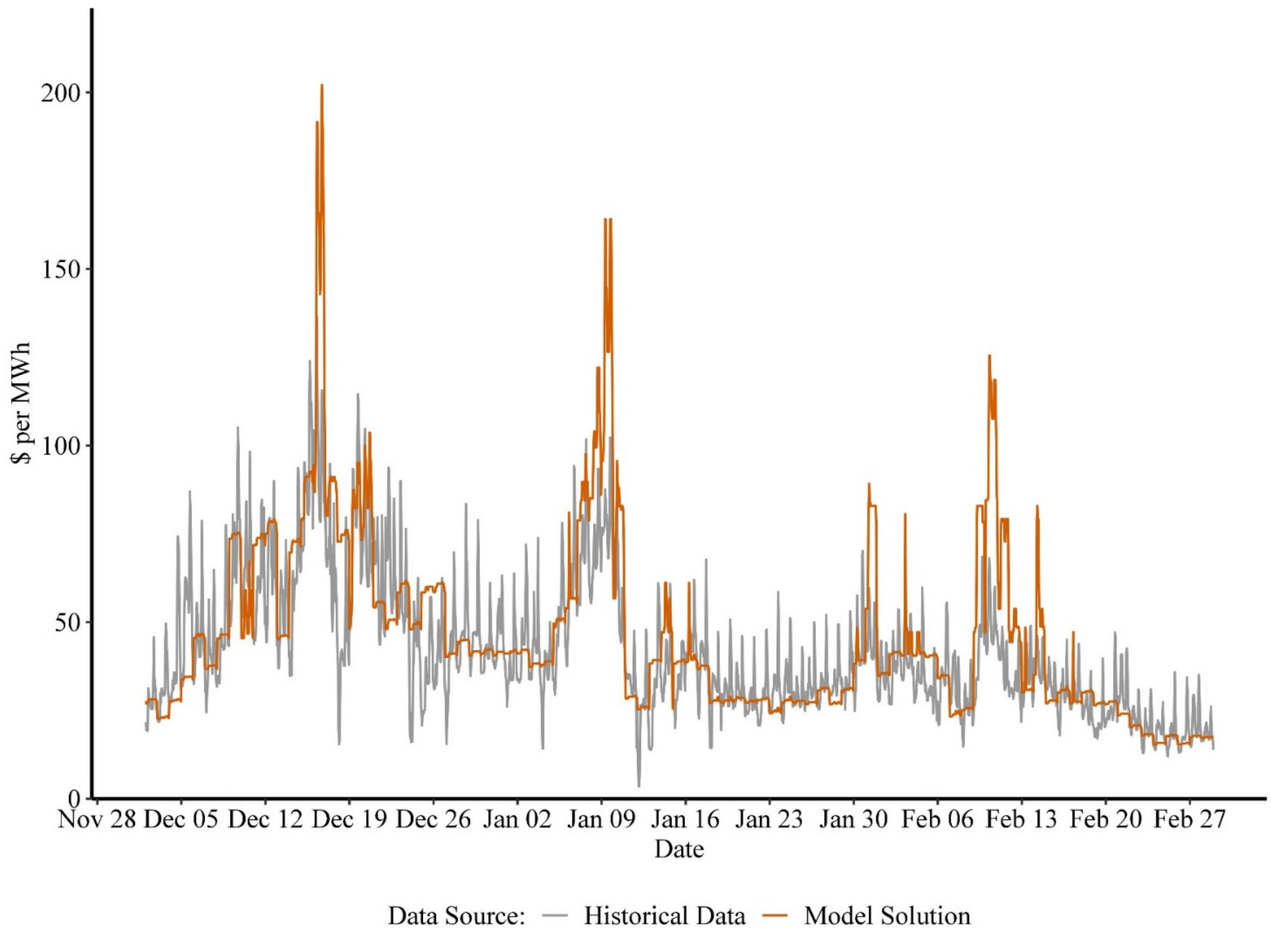
Appendices

Historical Benchmarking – 2016-2017

Hourly Day-Ahead LMP

2016-2017



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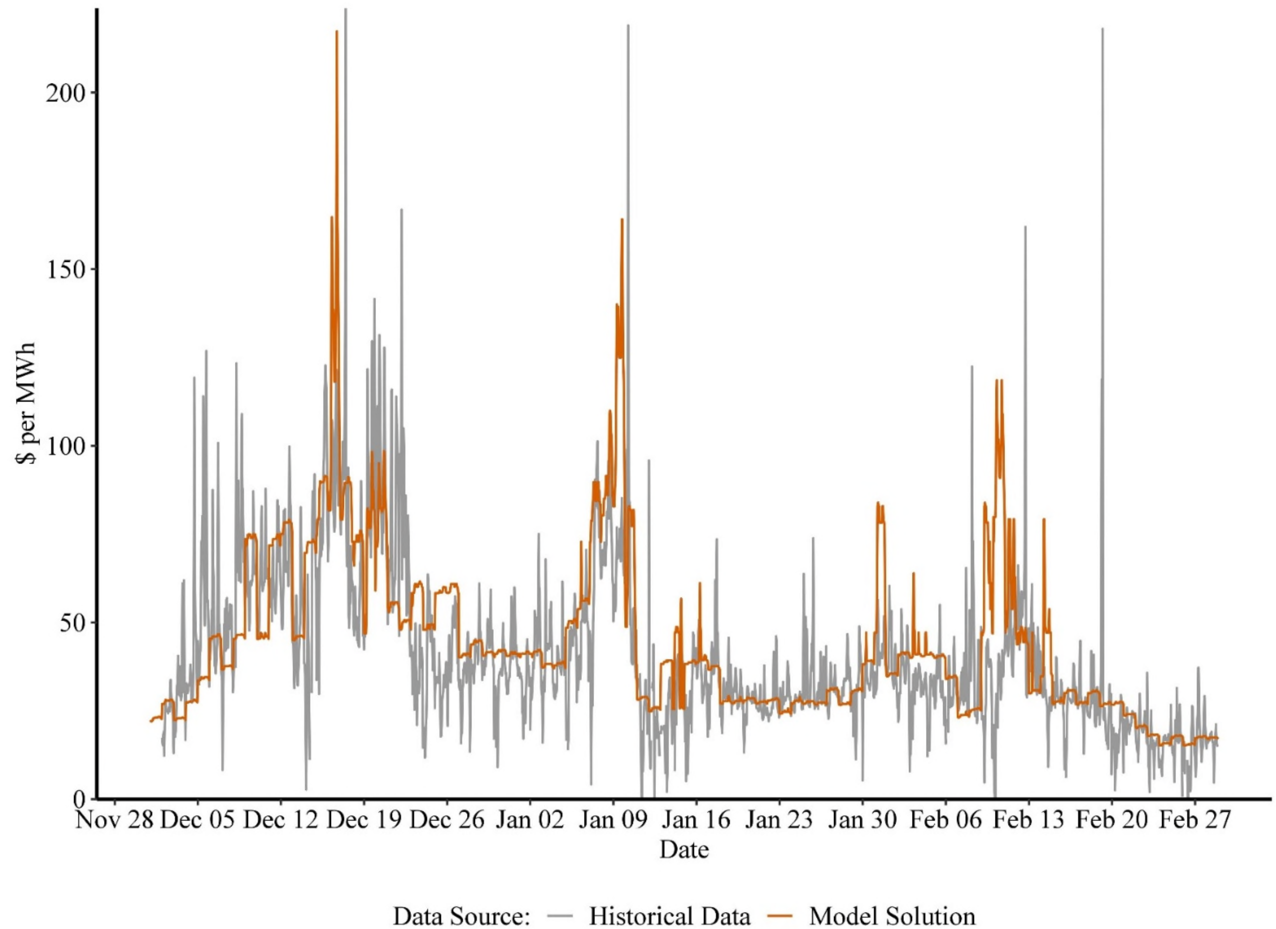
Hourly Real-Time LMP

2016-2017



Total Winter Generation

2016-2017

Plant Type	Model DA Generation (MWh) [A]	Model RT Generation (MWh) [B]	Model DA Capacity Factor [C]	Model RT Capacity Factor [D]
Dual-Fuel	2,751,789	2,605,170	12.00%	11.23%
Gas Only	7,782,649	6,994,038	38.56%	34.26%
Oil Only	82,574	58,547	0.50%	0.35%
Nuclear	8,536,223	8,632,135	99.28%	99.28%
Coal	1,085,075	1,010,821	25.73%	23.70%
Biomass/Refuse	1,468,873	1,484,800	87.56%	87.52%
Hydro	1,425,124	1,582,260	-	-
Solar	0	114,632	0.00%	8.04%
Wind	230,809	944,125	8.31%	33.61%
Pumped Storage	228,886	318,841	-	-
Battery Storage	0	0	-	-
Fuel Cell	8,303	7,693	16.82%	15.41%
Active Demand Response	758	539	-	-
Imports	6,181,131	6,343,229	-	-

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Total Winter Generation Comparison

2016-2017

Plant Type	Model DA Generation (MWh) [A]	DA Historical Generation (MWh) [B]	Difference in DA Generation (%) [C]
Dual-Fuel	2,751,789	2,732,419	0.71%
Gas Only	7,782,649	7,652,360	1.70%
Oil Only	82,574	74,952	10.17%
Nuclear	8,536,223	8,358,692	2.12%
Coal	1,085,075	1,236,760	-12.26%
Biomass/Refuse	1,468,873	1,639,015	-10.38%
Hydro	1,425,124	1,425,124	0.00%
Solar	0	0	0.00%
Wind	230,809	230,809	0.00%
Pumped Storage	228,886	228,886	0.00%
Battery Storage	0	0	0.00%
Fuel Cell	8,303	22,045	-62.33%
Active Demand Response	758	-	-
Imports	6,181,131	6,181,131	0.00%

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Hourly Winter Day-Ahead Generation Positions

2016-2017

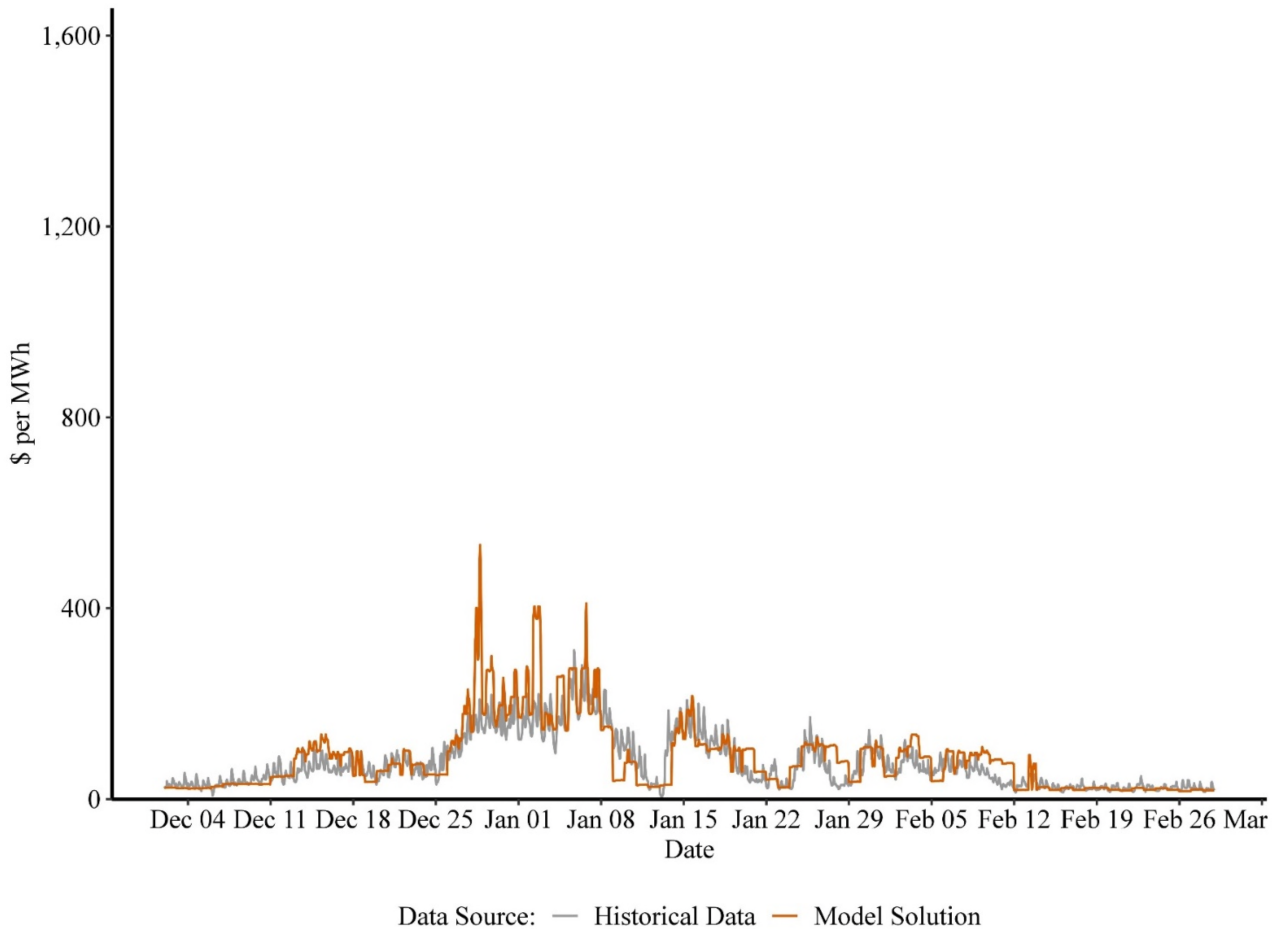
Hourly Winter Real-Time Generation

2016-2017

Historical Benchmarking – 2017-2018

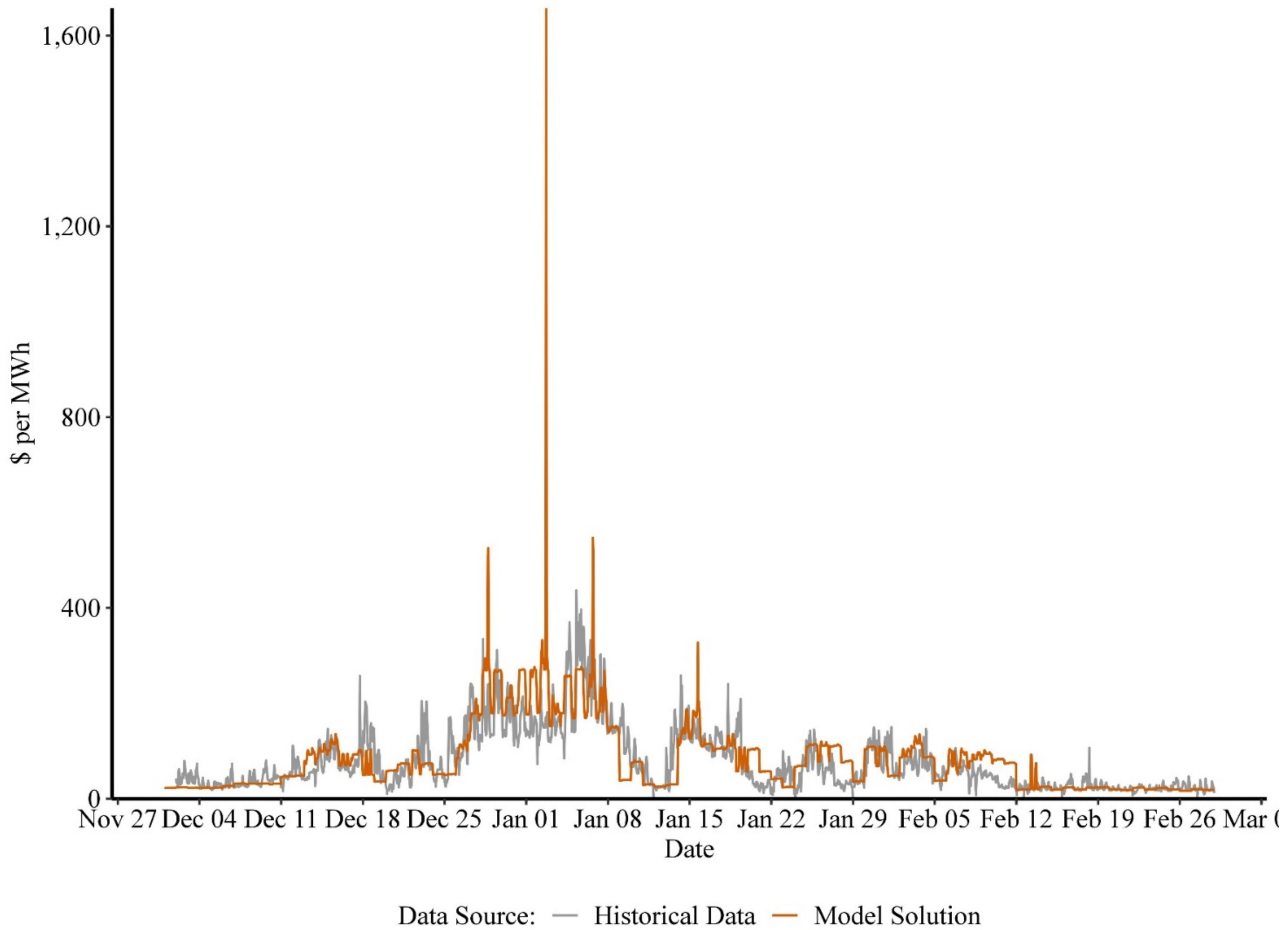
Hourly Day-Ahead LMP

2017-2018



Hourly Real-Time LMP

2017-2018



Total Winter Generation

2017-2018

Plant Type	Model DA Generation (MWh) [A]	Model RT Generation (MWh) [B]	Model DA Capacity Factor [C]	Model RT Capacity Factor [D]
Dual-Fuel	3,972,613	3,580,543	17.46%	15.56%
Gas Only	6,915,846	6,330,618	33.97%	30.75%
Oil Only	992,600	978,945	6.51%	6.34%
Nuclear	8,538,519	8,634,457	99.28%	99.28%
Coal	780,828	749,013	39.75%	37.70%
Biomass/Refuse	1,490,956	1,504,090	88.87%	88.66%
Hydro	1,536,759	1,715,458	-	-
Solar	0	138,374	0.00%	6.81%
Wind	193,416	1,041,140	6.72%	35.79%
Pumped Storage	218,468	302,859	-	-
Battery Storage	3,089	3,123	-	-
Fuel Cell	16,682	15,487	36.76%	33.75%
Active Demand Response	8,480	7,819	-	-
Imports	6,143,535	6,123,254	-	-

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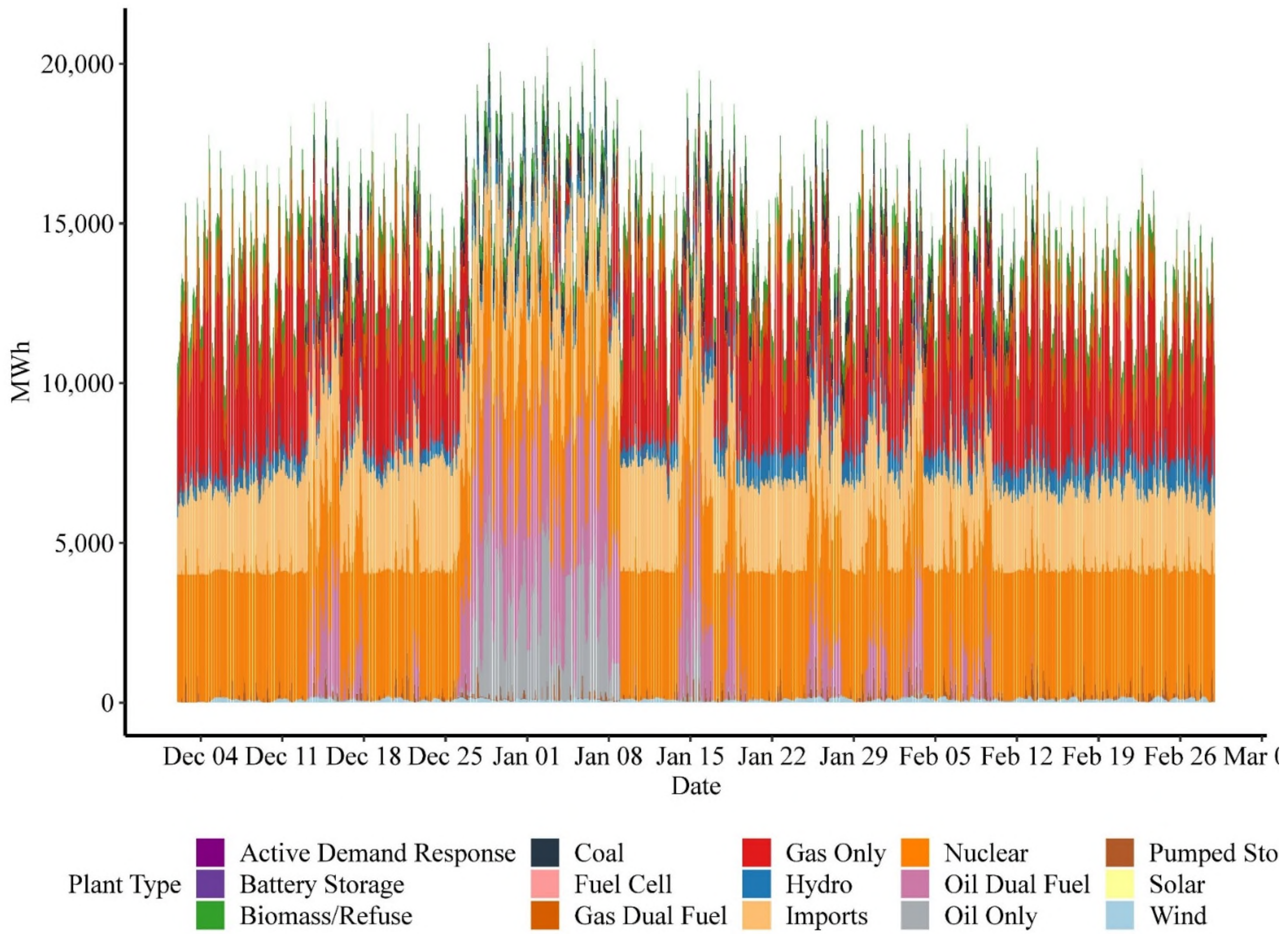
Total Winter Generation Comparison

2017-2018

Plant Type	Model DA Generation (MWh) [A]	DA Historical Generation (MWh) [B]	Difference in DA Generation (%) [C]
Dual-Fuel	3,972,613	3,087,210	28.68%
Gas Only	6,915,846	7,542,574	-8.31%
Oil Only	992,600	1,121,760	-11.51%
Nuclear	8,538,519	8,511,780	0.31%
Coal	780,828	793,543	-1.60%
Biomass/Refuse	1,490,956	1,639,755	-9.07%
Hydro	1,536,759	1,536,759	0.00%
Solar	0	0	0.00%
Wind	193,416	193,416	0.00%
Pumped Storage	218,468	218,468	0.00%
Battery Storage	3,089	0	0.00%
Fuel Cell	16,682	22,991	-27.44%
Active Demand Response	8,480	-	-
Imports	6,143,535	6,143,535	0.00%

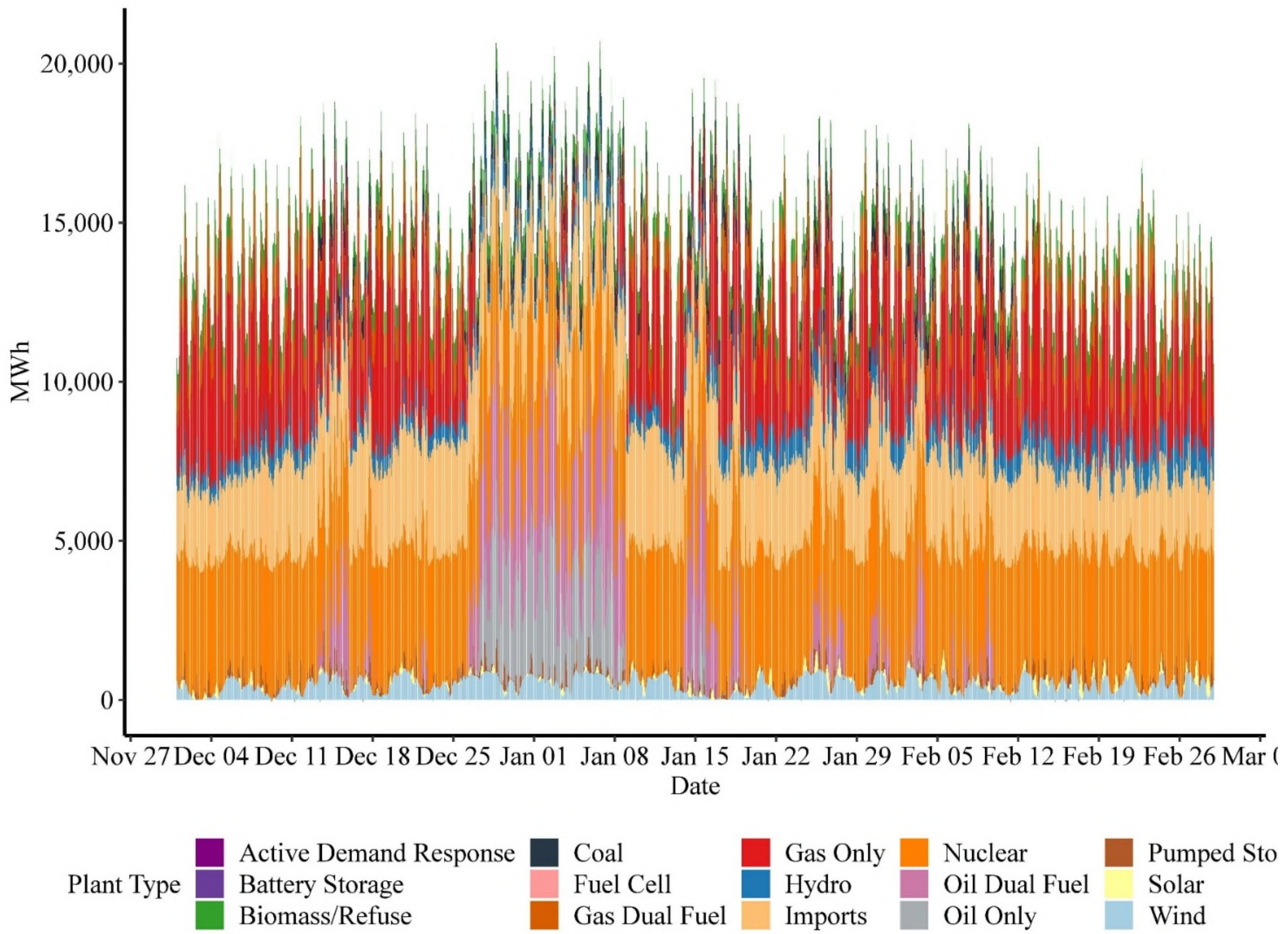
Hourly Winter Day-Ahead Generation Positions

2017-2018



Hourly Winter Real-Time Generation

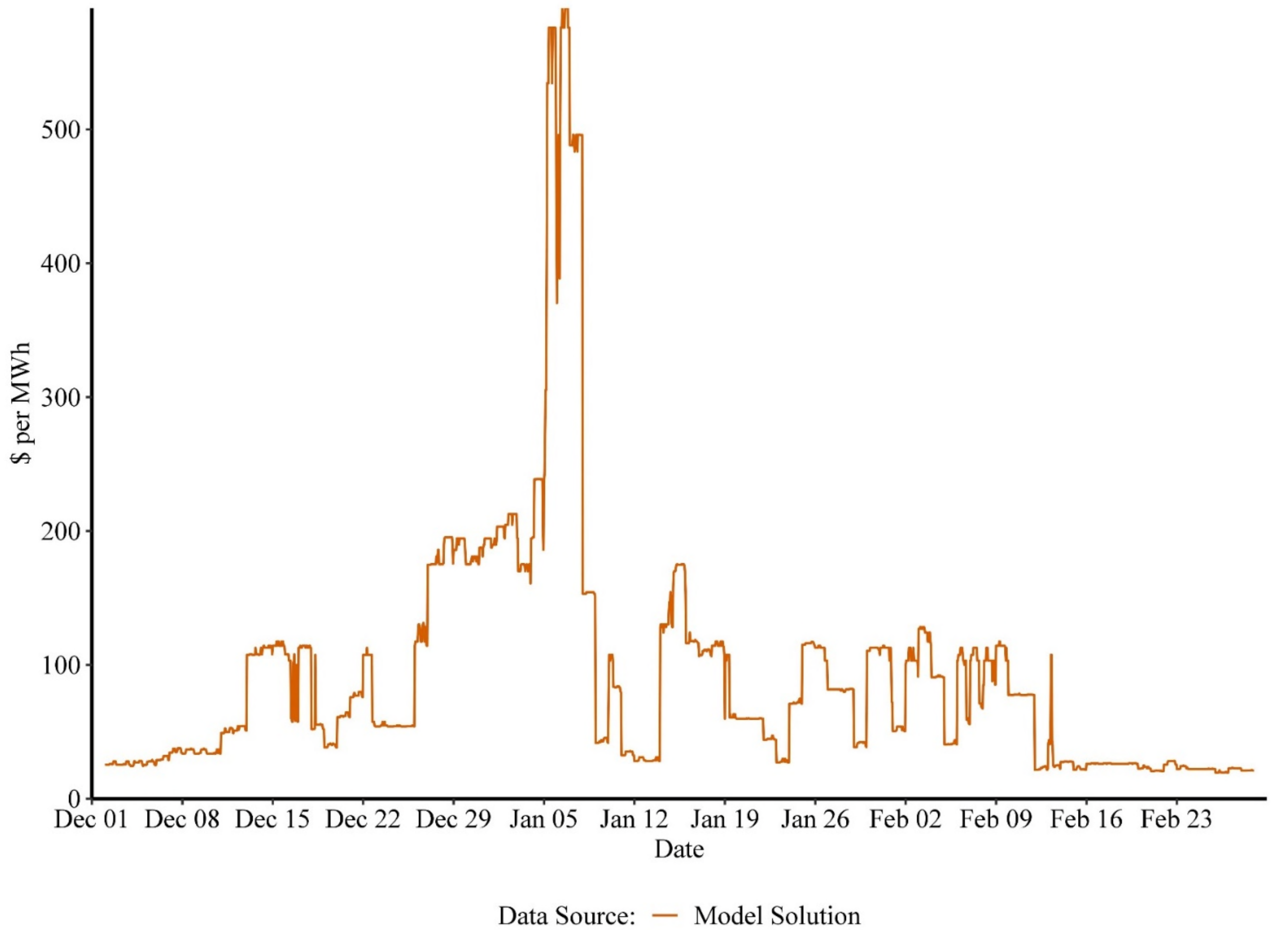
2017-2018



Future Cases – Further Preliminary Results: Business as Usual – Medium Severity

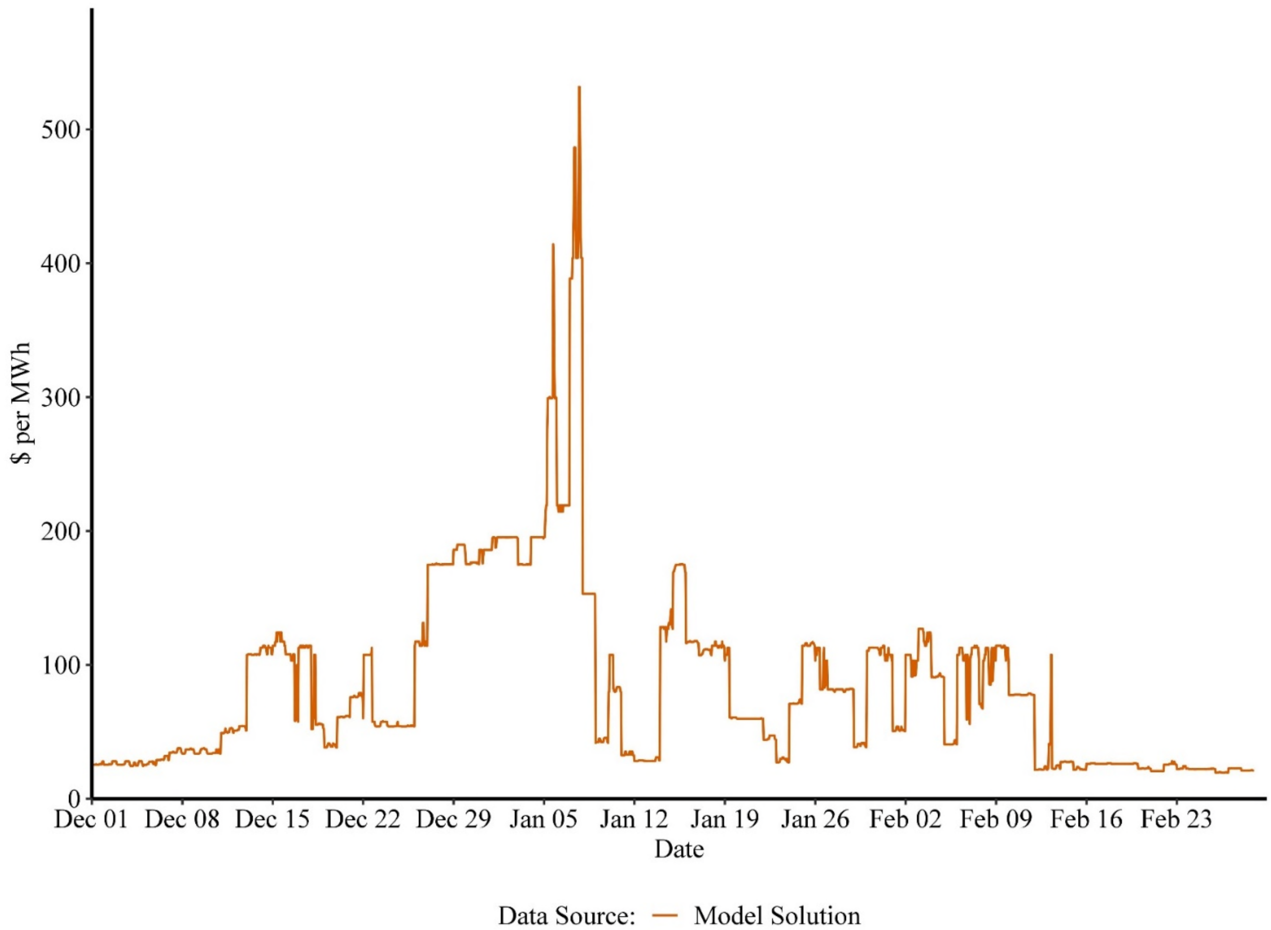
Hourly Day-Ahead LMP

2025-2026 Medium Severity – Business as Usual



Hourly Real-Time LMP

2025-2026 Medium Severity – Business as Usual



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Total Winter Generation

2025-2026 Medium Severity – Business as Usual

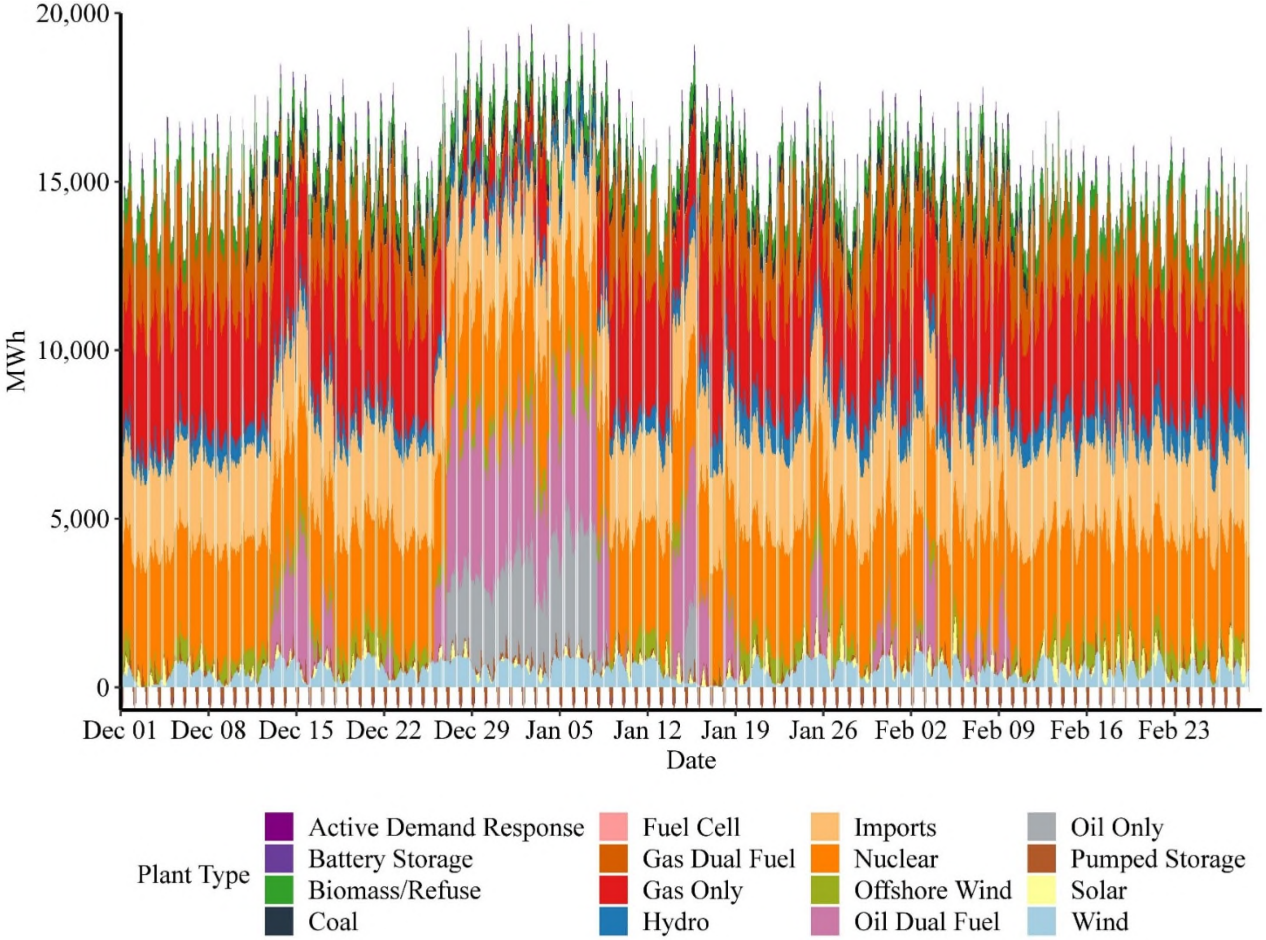
Plant Type	Model DA Generation (MWh) [A]	Model RT Generation (MWh) [B]	Model DA Capacity Factor [C]	Model RT Capacity Factor [D]
Dual-Fuel	6,328,779	6,406,218	18.69%	18.71%
Gas Only	6,346,249	6,319,745	34.53%	34.01%
Oil Only	966,824	907,184	7.18%	6.66%
Nuclear	7,104,576	7,184,403	99.46%	99.46%
Coal	654,061	649,409	57.26%	56.22%
Biomass/Refuse	1,504,191	1,518,116	89.66%	89.49%
Hydro	1,513,896	1,690,874	-	-
Solar	0	245,603	0.00%	6.81%
Offshore Wind	867,965	879,483	50.79%	50.90%
Wind	201,217	1,083,132	6.72%	35.79%
Pumped Storage	-29,552	-29,884	-	-
Battery Storage	-20,009	-20,234	-	-
Fuel Cell	23,359	23,355	52.83%	52.23%
Active Demand Response	9,654	9,226	2.70%	2.55%
Imports	5,872,425	5,933,698	-	-

Hourly Winter Day-Ahead Generation Positions

2025-2026 Medium Severity – Business as Usual

Hourly Winter Real-Time Generation

2025-2026 Medium Severity – Business as Usual



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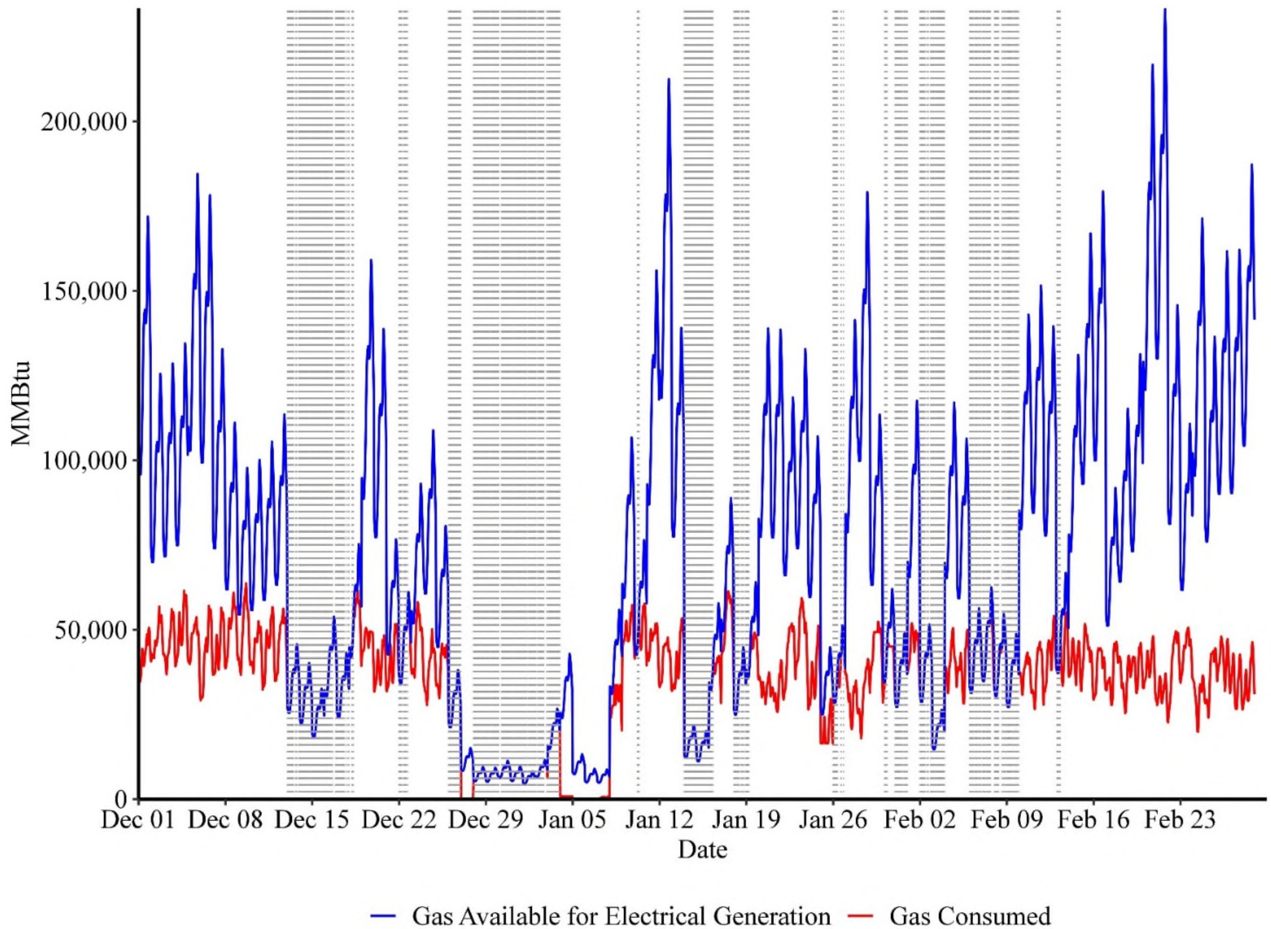
Hourly Winter Gas Availability and Consumption

2025-2026 Medium Severity – Business as Usual



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Future Cases – Further Preliminary Results: Business as Usual – Low Severity

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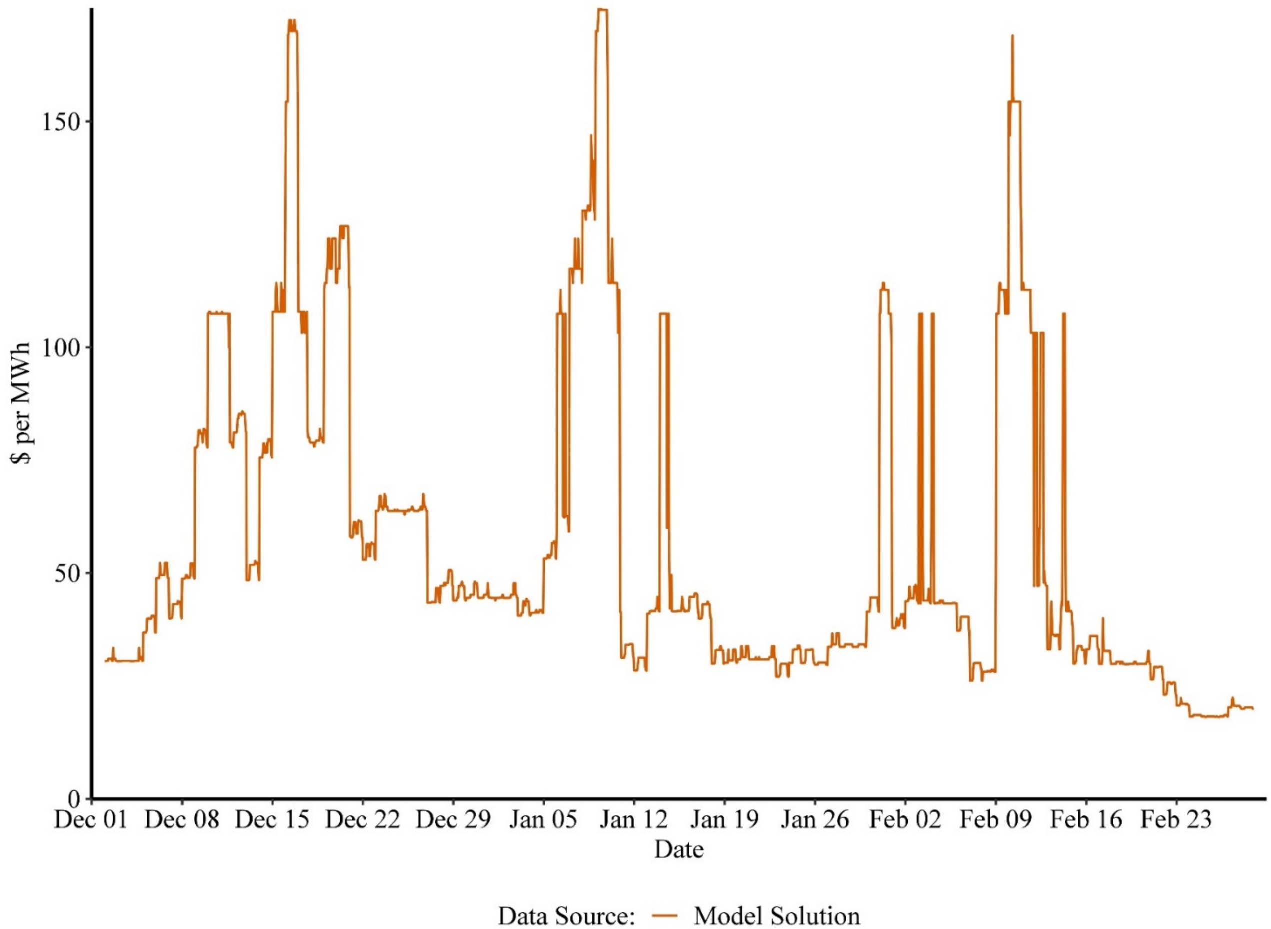
Hourly Day-Ahead LMP

2025-2026 Low Severity – Business as Usual



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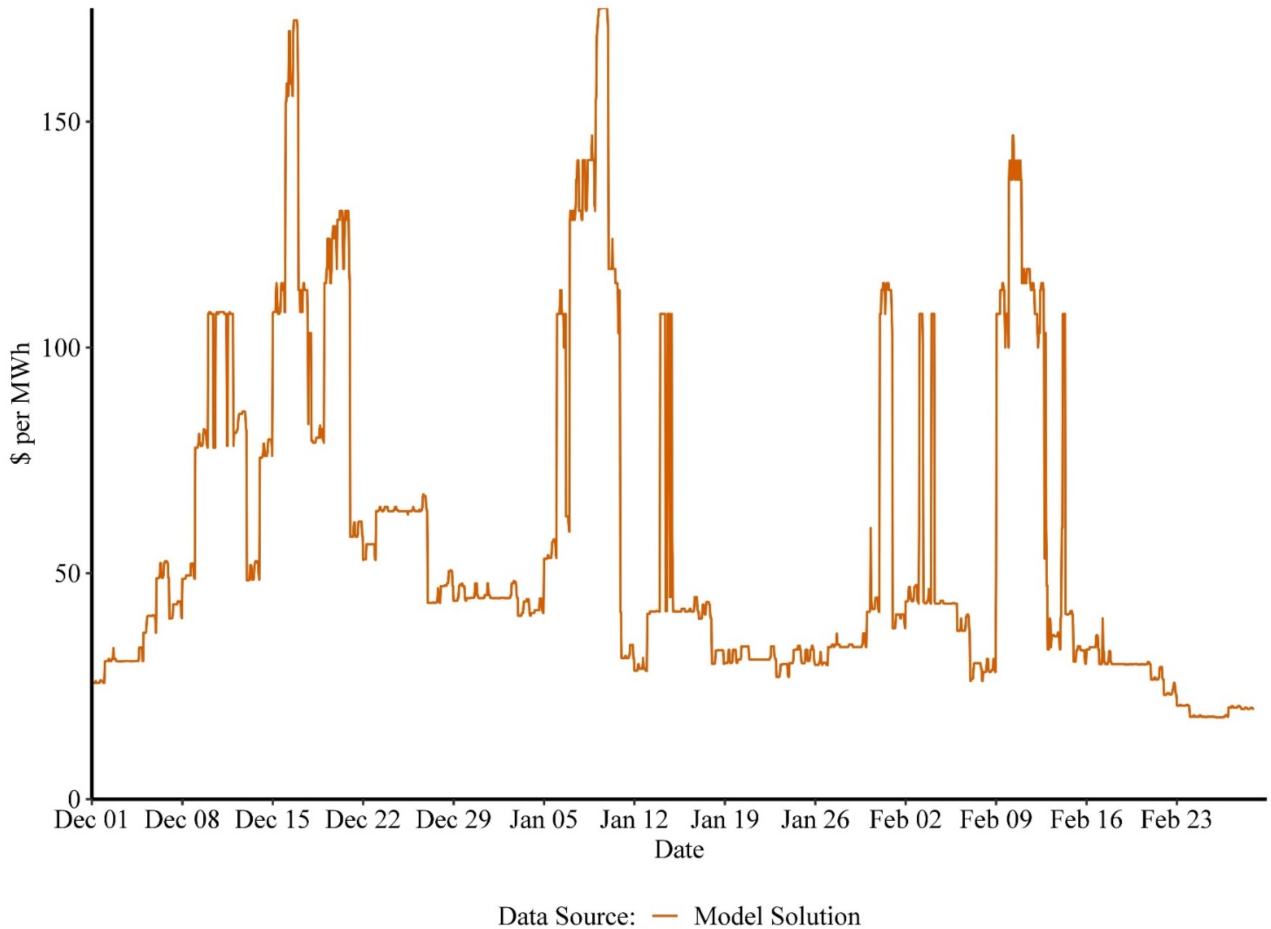
Hourly Real-Time LMP

2025-2026 Low Severity – Business as Usual



Total Winter Generation

2025-2026 Low Severity – Business as Usual

Plant Type	Model DA Generation (MWh) [A]	Model RT Generation (MWh) [B]	Model DA Capacity Factor [C]	Model RT Capacity Factor [D]
Dual-Fuel	5,899,067	6,000,253	17.42%	17.52%
Gas Only	7,217,318	7,242,386	39.27%	38.97%
Oil Only	101,074	107,066	0.75%	0.79%
Nuclear	7,104,576	7,184,403	99.46%	99.46%
Coal	565,247	564,818	49.49%	48.90%
Biomass/Refuse	1,482,765	1,500,011	88.39%	88.42%
Hydro	1,403,771	1,558,984	-	-
Solar	0	289,960	0.00%	8.04%
Offshore Wind	924,946	931,752	54.13%	53.92%
Wind	248,681	1,017,230	8.31%	33.61%
Pumped Storage	-29,552	-29,884	-	-
Battery Storage	-20,009	-20,234	-	-
Fuel Cell	13,300	13,547	30.08%	30.30%
Active Demand Response	4,302	4,620	1.20%	1.28%
Imports	5,794,371	5,858,949	-	-

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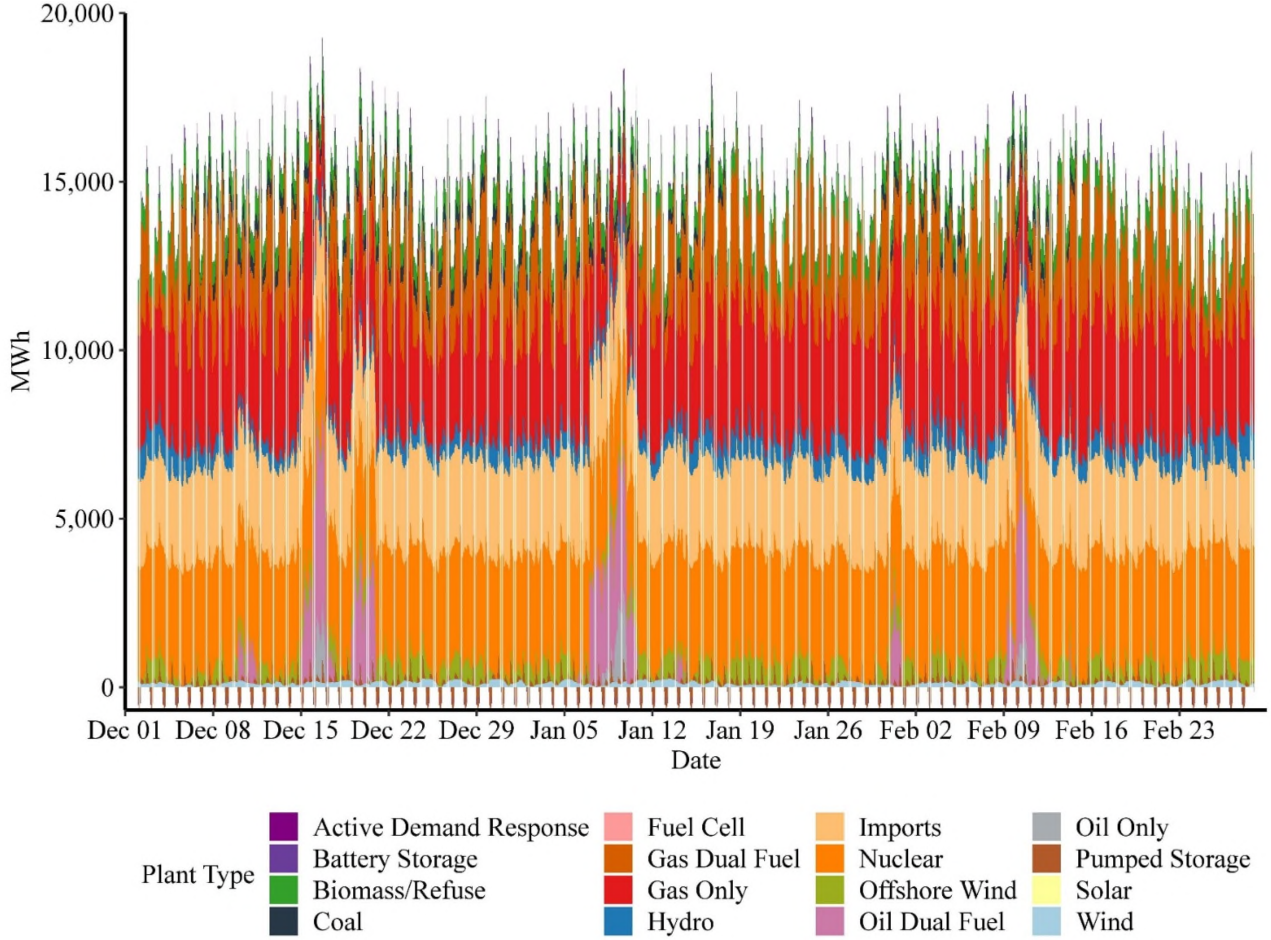
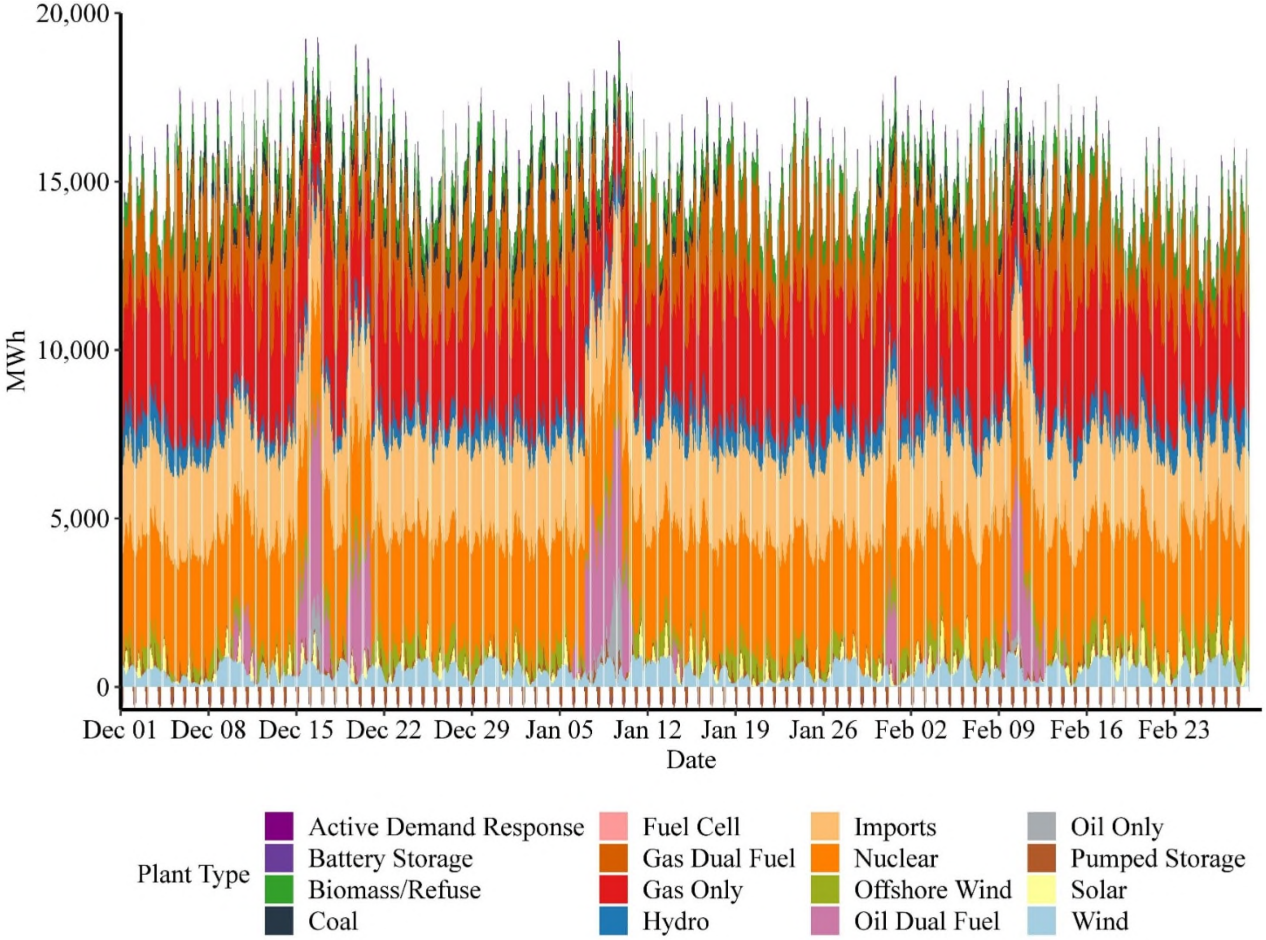
Hourly Winter Day-Ahead Generation Positions

2025-2026 Low Severity – Business as Usual



Hourly Winter Real-Time Generation

2025-2026 Low Severity – Business as Usual



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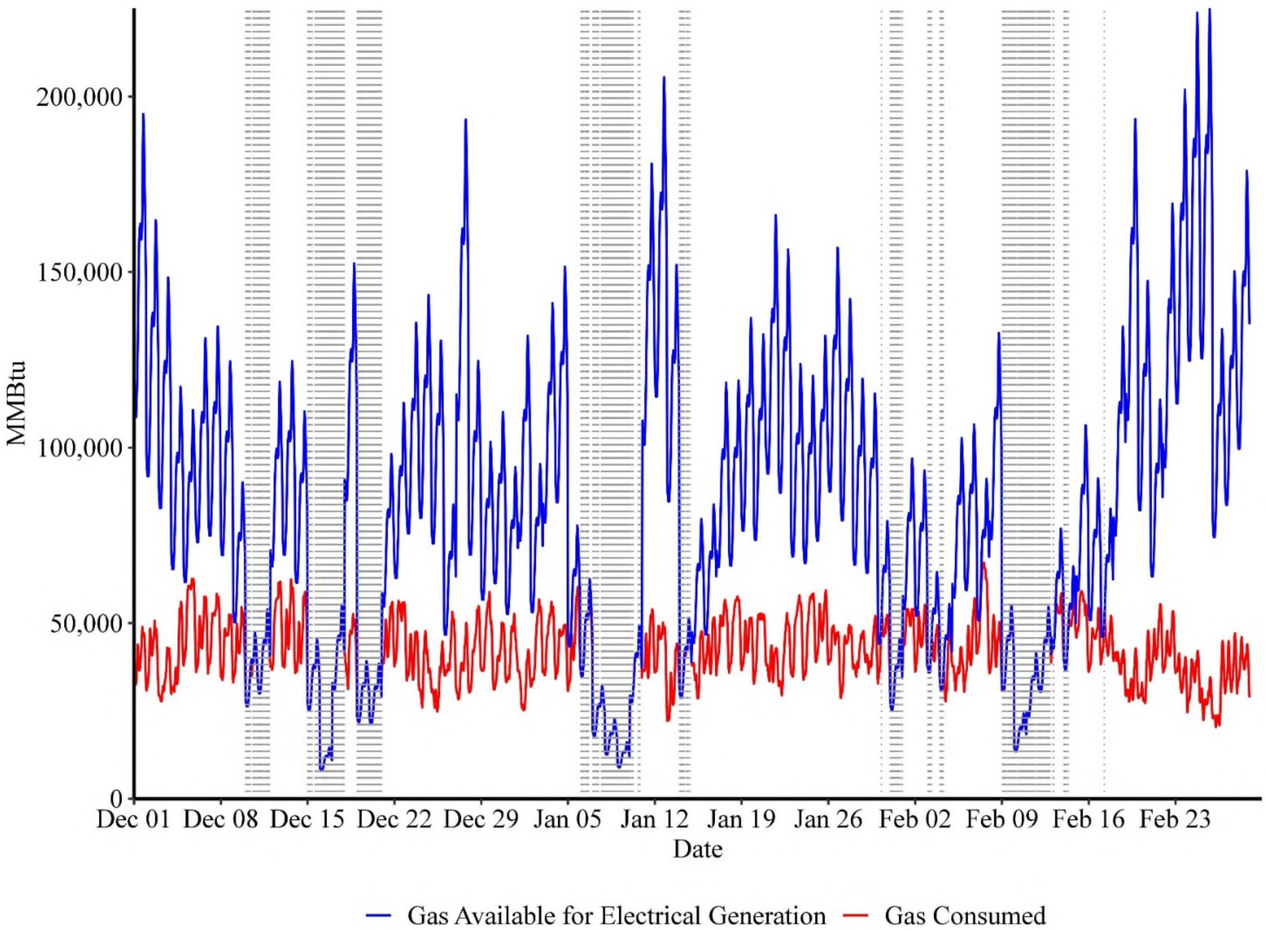
Hourly Winter Gas Availability and Consumption

2025-2026 Low Severity – Business as Usual



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