Generator Performance Analysis Report

MISO Market

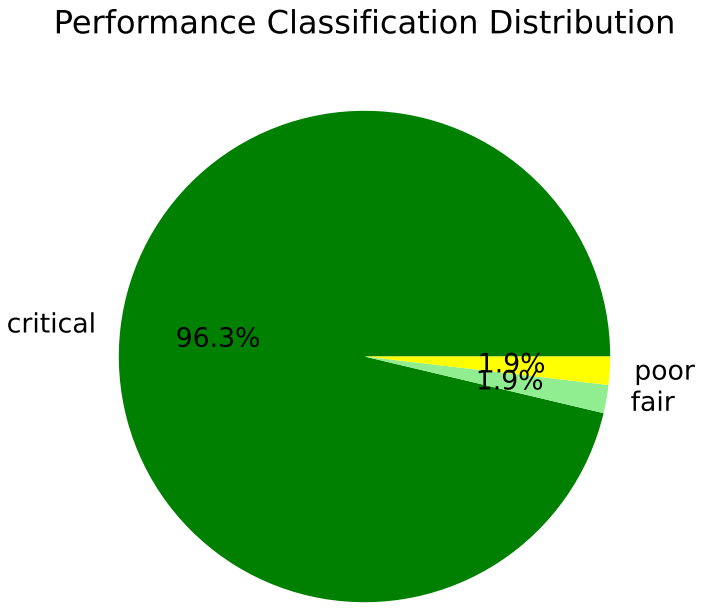
Analysis Date: 2025-08-12

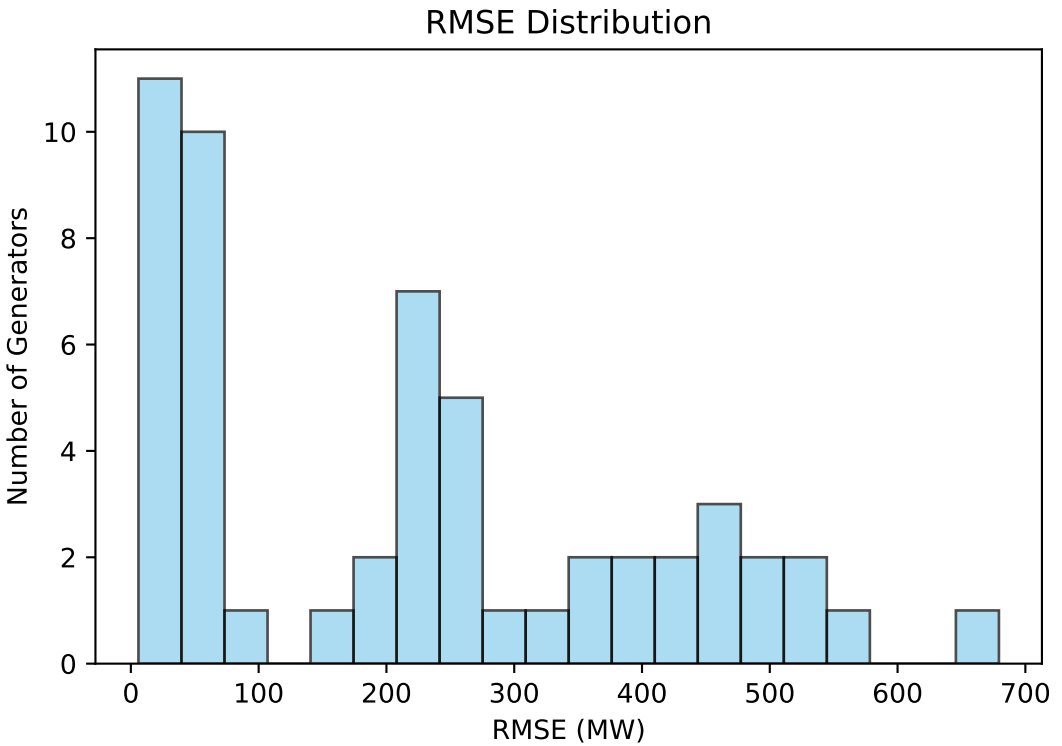
This report provides a comprehensive analysis of generator forecast performance, including performance classifications, anomaly detection, chronic error patterns, and bid validation results. The analysis identifies generators requiring attention and provides actionable recommendations for improvement.

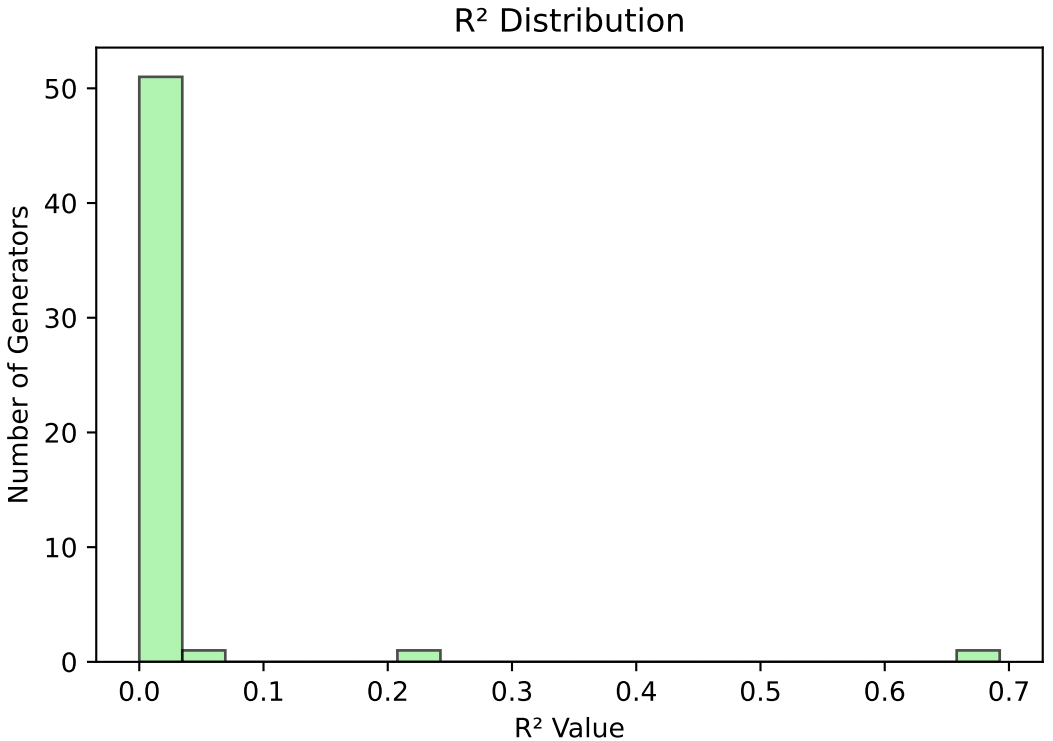
FILTERING APPLIED: Small generators are excluded from all tables if they meet ALL three criteria: Pmax < 700 MW, max actual generation < 700 MW, and max predicted generation < 700 MW.

Generated by Advanced Generator Analysis System

Executive Summary







Key Statistics

Metric	Value
Total Generators (Raw)	54
Generators Analyzed	54
Small Generators Excluded	0
Anomalies Detected	54
Total Alerts	1980
Poor/Critical Performers	53
Average RMSE (MW)	218.97
Average R²	0.018

Performance Classification System

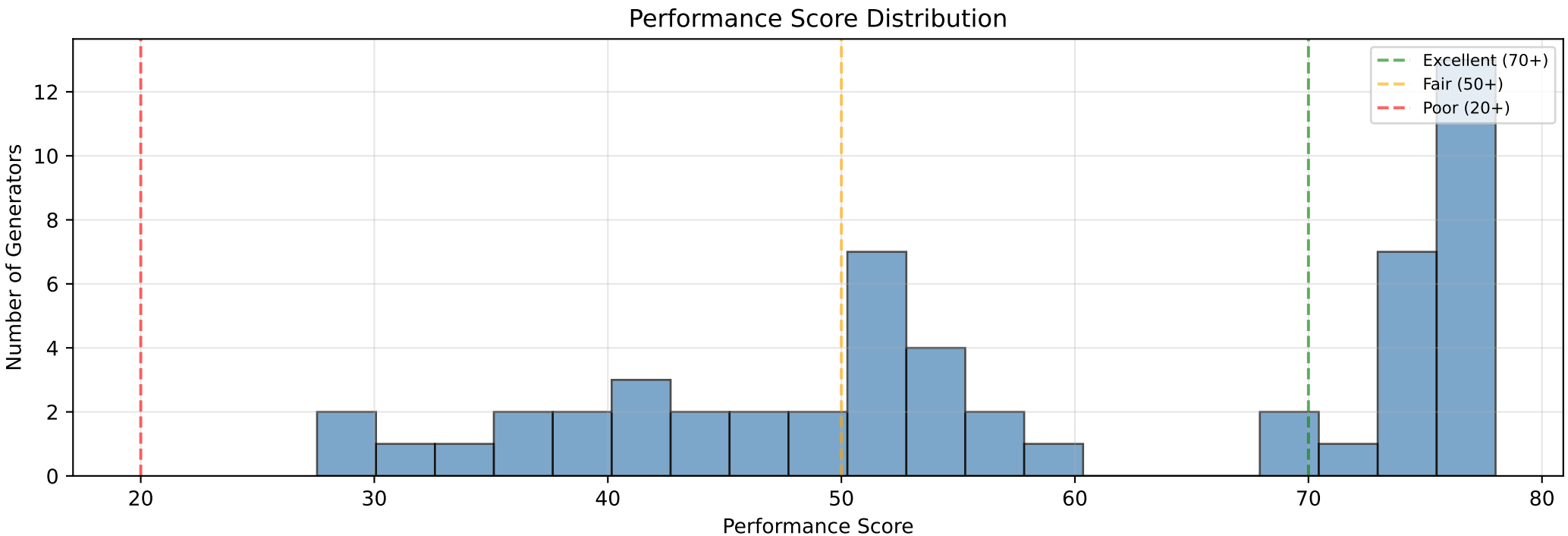
PERFORMANCE CLASSIFICATION SYSTEM

The system classifies each generator into one of 5 performance categories based on:
- RMSE as percentage of generator capacity (Pmax)
- R-squared correlation coefficient

Classification Criteria:
- EXCELLENT: RMSE ≤ 10.0% of Pmax, R^2 ≥ 0.7 (Highly accurate forecasts)
- GOOD: RMSE ≤ 20.0% of Pmax, R^2 ≥ 0.6 (Good forecast accuracy)
- FAIR: RMSE ≤ 30.0% of Pmax, R^2 ≥ 0.5 (Acceptable performance)
- POOR: RMSE ≤ 40.0% of Pmax, R^2 ≥ 0.2 (Needs attention)
- CRITICAL: RMSE > 40.0% of Pmax or R^2 < 0.0 (Immediate action required)

PERFORMANCE SCORE EXPLANATION:
The "Score" column represents a composite performance score (0-100) calculated as:
- 70% weight: Inverted RMSE percentage (lower RMSE = higher score)
- 20% weight: R-squared × 100 (higher correlation = higher score)
- 5% weight: Consistency score × 100 (more consistent = higher score)
- 5% weight: Inverted volatility score (lower volatility = higher score)

Higher scores (closer to 100) indicate better overall forecast performance.
Lower scores (closer to 0) indicate generators requiring immediate attention.



Generators Requiring Attention (Poor and Critical Only)

Generators requiring attention: 53 of 54 analyzed (54 total before filtering)

Generator Name	Plant ID	Unit ID	Pmax (MW)	Classification	Score	RMSE
ANDRUS	8054	1	740.0	critical	27.5	482.6
AMOS	3935	2	800.0	critical	27.8	525.5
MONROE4	1733	3	785.0	critical	31.8	458.2
POWERTO1	879	6	832.0	critical	34.4	463.6
ROCKPORT	6166	2	1300.0	critical	35.9	679.3
IATAN	6065	1	727.0	critical	36.2	372.9
KAMMER	3948	1	770.0	critical	37.8	380.1
MONROE4	1733	1	770.0	critical	40.1	347.2
IATAN	6065	2	936.0	critical	40.6	419.4
INDEP2	6641	2	900.0	critical	40.9	393.4
AMOS	3935	3	1330.0	critical	42.5	568.0
GREENWOO	6035	1	795.0	critical	42.7	328.4
TH_HILL	2759	1	750.0	critical	44.2	306.9
ROCKPORT	6166	1	1320.0	critical	45.8	497.0
LOUISA	6664	1	710.0	critical	47.7	248.8
AMOS	3935	1	800.0	critical	49.7	264.3
MOUNTAI2	6264	1	1500.0	critical	50.0	454.9
NINEMI	1403	6(4)	750.0	critical	51.3	224.7
GENTLMN	6077	2	705.0	critical	51.4	206.9
CAMPBEL4	1710	3	810.0	critical	51.8	237.3
WH_BLF	6009	1	828.0	critical	52.0	244.5
INDEP2	6641	1	900.0	critical	52.3	247.5
KAMMER	3948	2	790.0	critical	52.7	219.3
POWERTO1	879	5	832.0	critical	52.7	241.6
MONROE4	1733	4	810.0	critical	53.1	220.0
MONROE4	1733	2	800.0	critical	53.8	212.6
WH_BLF	6009	2	831.0	critical	54.7	215.2
GAVINAEP	8102	1	2001.0	critical	54.7	511.8
LACYGNE	1241	1	750.0	critical	56.8	157.6
GAVINAEP	8102	2	2000.0	critical	57.6	413.6
NINEMI	1403	5	750.0	poor	60.2	177.8
DOWMTR	55419	G500	900.0	critical	69.6	69.6
PERRY_FE	6020	1	1330.0	critical	72.1	56.0
WATERF	4270	3	1214.0	critical	73.8	73.6
20_BRAID	6022	2	1238.0	critical	73.9	62.4
1_LASALL	6026	1	1255.0	critical	74.7	22.8
COOK	6000	2	1220.0	critical	74.7	68.1
12_DRESD	869	2	982.0	critical	74.7	41.7
CLINTON0	204	1	1095.0	critical	74.8	26.8
20_BRAID	6022	1	1273.0	critical	74.9	68.7
QUADCITY	880	1	985.0	critical	75.7	11.9
BYRON000	6023	1	1265.0	critical	76.1	52.9
BYRON000	6023	2	1265.0	critical	76.1	53.6
12_DRESD	869	3	975.0	critical	76.1	41.6
QUADCITY	880	2	980.0	critical	76.3	6.0
RVB	6462	1	1080.0	critical	76.3	17.7
DAVISBES	6149	1	970.0	critical	76.4	41.1
COOPER	8036	1	1025.0	critical	76.4	22.8
COOK	6000	1	1220.0	critical	76.5	30.6
FERMI	1729	2	1195.0	critical	77.4	22.1
1_LASALL	6026	2	1354.0	critical	77.7	15.1
ARK_NU	8055	1	899.0	critical	78.0	15.9
ARK_NU	8055	2	1031.0	critical	78.0	9.1

Chronic Forecast Error Detection

CHRONIC FORECAST ERROR DETECTION

Identifies generators with persistent forecasting problems over extended periods:

- CHRONIC OVER-FORECASTING: Forecast consistently > 2x actual generation for 3+ days in any 5-day window
- CHRONIC UNDER-FORECASTING: Forecast consistently < 0.5x actual generation for 3+ days in any 5-day window

Detection Criteria:
- Minimum 3 problematic days in any 5-day sliding window
- Minimum 2 hours of data per day to qualify (adjusted for 3x daily sampling)
- Only considers periods with generation ≥ 5 MW to avoid noise
- High severity if 6+ problematic days occur in any 8-day window

Impact: Chronic errors indicate systematic model issues requiring immediate attention.
This approach detects sustained chronic patterns while reducing sensitivity to short-term market volatility.
Regular 5-day window monitoring provides balanced detection of forecast degradation.

METHODOLOGY:

The sliding window approach analyzes forecast accuracy over time:

1. Daily Statistics: Calculate daily average forecast-to-actual ratios for each generator
2. Sliding Windows: Apply 5-day and 8-day sliding windows across the analysis period
3. Pattern Detection: Identify periods where forecast ratios exceed thresholds:
   - Over-forecasting: Forecast/Actual ≥ 2.0 (forecast is at least 200% of actual)
   - Under-forecasting: Forecast/Actual ≤ 0.5 (forecast is 50% or less of actual)
4. Severity Classification:
   - Medium Severity: 3+ problematic days in any 5-day window
   - High Severity: 6+ problematic days in any 8-day window

This methodology ensures robust detection of persistent forecasting issues while minimizing
false positives from temporary market disruptions or operational anomalies.

Chronic Error Generators - Analysis Results

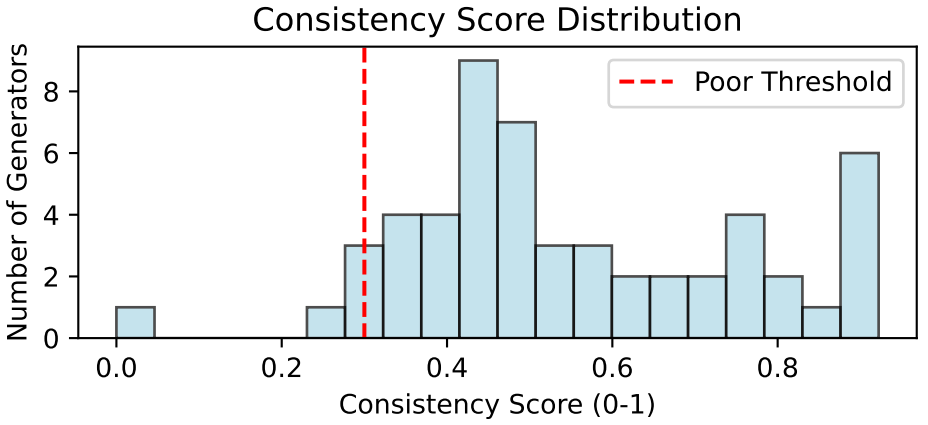
Chronic Error Generators (Unique)

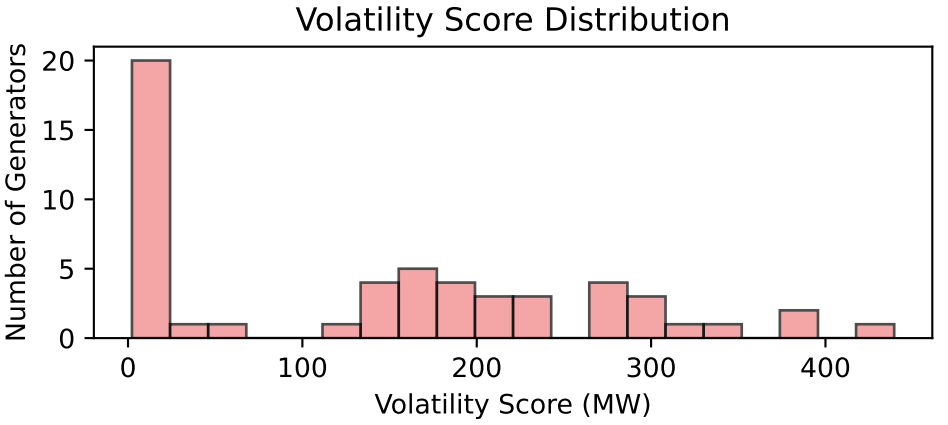
Generator	Plant ID	Unit ID	Error Type	Pattern	Pmax	Severity
GAVINAEP GV1	8102	1	OVERFO, UNDE	5 days	2001.0 MW	high
GAVINAEP GV2	8102	2	OVERFO, UNDE	5 days	2000.0 MW	high
MOUNTAI2 MT1	6264	1	OVERFO, UNDE	5 days	1500.0 MW	high
ROCKPORT RP1	6166	1	OVERFO, UNDE	5 days	1320.0 MW	high
ROCKPORT RP2	6166	2	OVERFO, UNDE	5 days	1300.0 MW	high
RVB G1	6462	1	OVERFO, UNDE	5 days	1080.0 MW	high
KAMMER ML1	3948	1	OVERFO, UNDE	5 days	770.0 MW	high
KAMMER ML2	3948	2	OVERFO, UNDE	5 days	790.0 MW	high
CAMPBEL4 CA3_CONS	1710	3	OVERFO, UNDE	5 days	810.0 MW	high
INDEP2 G1	6641	1	OVERFO, UNDE	5 days	900.0 MW	high
INDEP2 G2	6641	2	OVERFO, UNDE	5 days	900.0 MW	high
TH_HILL THOMAS_HILL...	2168	3	OVERFO, UNDE	5 days	750.0 MW	high
MONROE4 MON1	1733	1	OVERFO, UNDE	5 days	790.0 MW	high
MONROE4 MON2	1733	2	OVERFO, UNDE	5 days	800.0 MW	high
MONROE4 MON3	1733	3	OVERFO, UNDE	5 days	785.0 MW	high
MONROE4 MON4	1733	4	OVERFO, UNDE	5 days	810.0 MW	high
LOUISA LOUISA_1_UN...	6664	1	OVERFO, UNDE	5 days	710.0 MW	high
AMOS AM1	3935	1	OVERFO, UNDE	5 days	800.0 MW	high
AMOS AM2	3935	2	OVERFO, UNDE	5 days	800.0 MW	high
AMOS AM3	3935	3	OVERFO, UNDE	5 days	1330.0 MW	high
WH_BLF G1	6009	1	OVERFO, UNDE	5 days	828.0 MW	high
WH_BLF G2	6009	2	OVERFO, UNDE	5 days	831.0 MW	high
GREENWOO GW1	6035	1	OVERFO, UNDE	5 days	795.0 MW	high
IATAN IAT1	6065	1	OVERFO, UNDE	5 days	727.0 MW	high
IATAN IAT2	6065	2	OVERFO, UNDE	5 days	936.0 MW	high
WATERF G3	4270	3	OVERFO	5 days	1214.0 MW	high
LACYGNE LAC1	1241	1	OVERFO	5 days	750.0 MW	high
ANDRUS G1	8054	1	OVERFO, UNDE	5 days	740.0 MW	high
DOWMTR DOWCHEM	55419	G500	OVERFO, UNDE	5 days	900.0 MW	high
POWERTO1 PO-5	879	5	OVERFO	5 days	832.0 MW	high
POWERTO1 PO-6	879	6	OVERFO	5 days	832.0 MW	high
PERRY_FE PR10	6020	1	OVERFO	5 days	1330.0 MW	high
NINEMI G4	1403	6(4)	OVERFO	5 days	750.0 MW	high
NINEMI G5	1403	5	OVERFO	5 days	750.0 MW	high
QUADCITY 18UQC-1	880	1	OVERFO	5 days	985.0 MW	high
QUADCITY 18UQC-2	880	2	OVERFO	5 days	980.0 MW	high
FERMI FE2	1729	2	OVERFO	5 days	1195.0 MW	high
GENTLMN 2	6077	2	OVERFO	5 days	705.0 MW	high
CALLAWAY 1	6153	1	OVERFO	5 days	1270.0 MW	high
1_LASALL LA-1	6026	1	OVERFO	5 days	1255.0 MW	high
1_LASALL LA-2	6026	2	OVERFO	5 days	1354.0 MW	high
DAVISBES DB10	6149	1	OVERFO	5 days	970.0 MW	high
12_DRESD DR-2	869	2	OVERFO	5 days	982.0 MW	high
12_DRESD DR-3	869	3	OVERFO	5 days	975.0 MW	high
20_BRAID BR-1	6022	1	OVERFO	5 days	1273.0 MW	high
20_BRAID BR-2	6022	2	OVERFO	5 days	1238.0 MW	high
BYRON000 BY-1	6023	1	OVERFO	5 days	1265.0 MW	medium
BYRON000 BY-2	6023	2	OVERFO	5 days	1265.0 MW	medium
CLINTON0 CLNTN_U1	204	1	OVERFO	5 days	1095.0 MW	medium
ARK_NU G1	8055	1	OVERFO	5 days	899.0 MW	medium
ARK_NU G2	8055	2	OVERFO	5 days	1031.0 MW	medium
COOK CK1	6000	1	OVERFO	5 days	1220.0 MW	medium
COOK CK2	6000	2	OVERFO	5 days	1220.0 MW	medium

Advanced Forecast Metrics Analysis

Advanced Forecast Metrics

- CONSISTENCY SCORE (0-1): Measures how consistent forecast errors are over time (higher = better)
- VOLATILITY SCORE: Rolling standard deviation of forecast errors (lower = better)
- TREND ANALYSIS: Statistical trend in forecast performance (improving/stable/deteriorating)
- RMSE % OF CAPACITY: RMSE normalized by generator capacity for fair comparison





Bottom 10 Percentile: Lowest Consistency Score

Generator	Plant ID	Unit ID	Pmax (MW)	Consistency Score	RMSE	Class	Fuel
CALLAWAY	6153	1	N/A	0.000	273.2	fair	Nuc
MOUNTAI2	6264	1	N/A	0.255	454.9	crit	Unk
INDEP2	6641	2	N/A	0.307	393.4	crit	Coa
LACYGNE	1241	1	N/A	0.310	157.6	crit	Unk
INDEP2	6641	1	N/A	0.317	247.5	crit	Coa

Bottom 10 Percentile: Highest Volatility Score

Generator	Plant ID	Unit ID	Pmax (MW)	Volatility Score	RMSE	Class	Fuel
MOUNTAI2	6264	1	N/A	439.420	454.9	crit	Unk
GAVINAEP	8102	1	N/A	388.233	511.8	crit	Unk
ROCKPORT	6166	1	N/A	378.453	497.0	crit	Unk
GAVINAEP	8102	2	N/A	350.567	413.6	crit	Unk
MONROE4	1733	1	N/A	320.266	347.2	crit	Coa

Statistical Anomaly Detection

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Statistical Anomaly Detection

Uses population statistics to identify generators with anomalous performance:

- RMSE Z-SCORE: How many standard deviations above/below population mean (threshold: >2.0)
- MAE Z-SCORE: Mean Absolute Error compared to population (threshold: >2.0)
- POPULATION OUTLIERS: Generators performing significantly worse than peers

Generators with Z-scores > 2.0 are flagged for investigation.
Z-scores > 3.0 are considered critical and require immediate attention.
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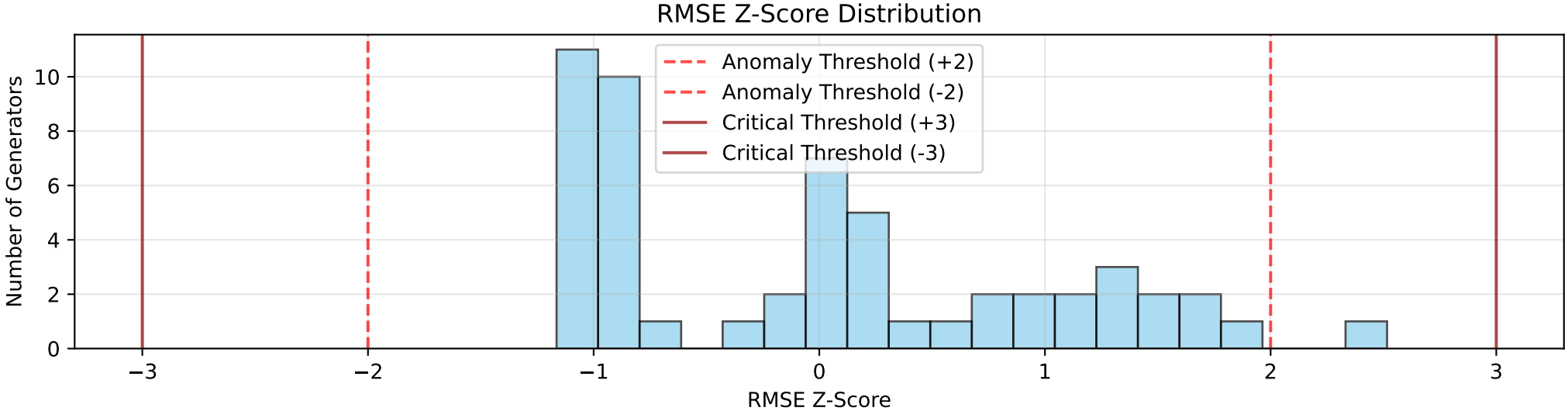


Statistical Anomalies (Z-Score > 2.0)

Generator Name	Plant ID	Unit ID	Pmax (MW)	RMSE Z-Score	Severity	Class
ROCKPORT	6166	2	1300.0	2.52	High	crit
AMOS	3935	3	1330.0	1.91	High	crit
AMOS	3935	2	800.0	1.68	High	crit

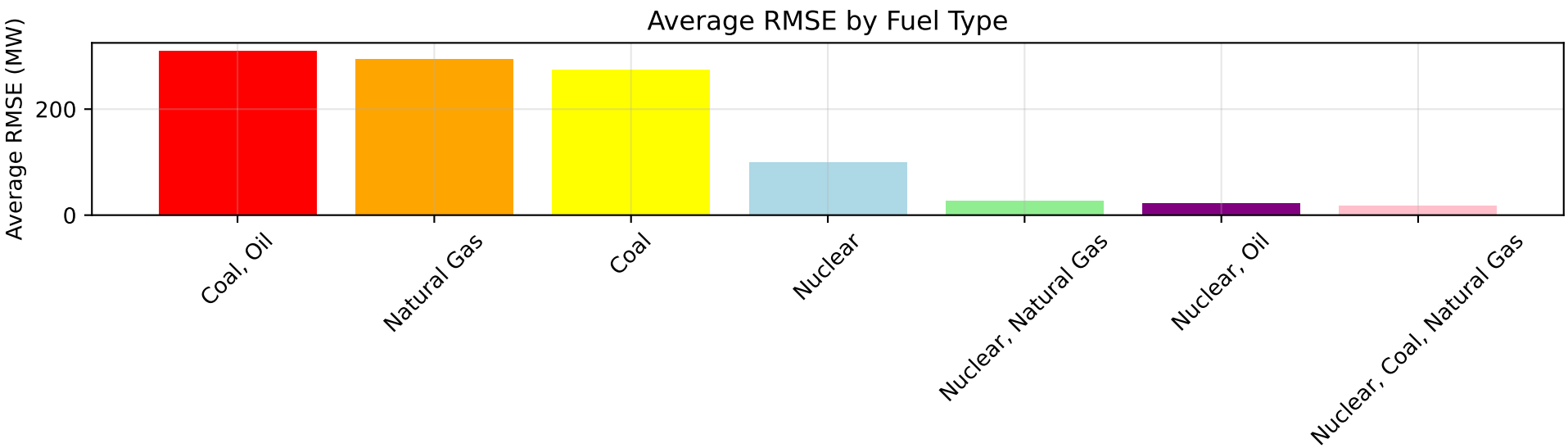
Operational Characteristics Analysis

OPERATIONAL CHARACTERISTICS

Analysis of generator operational patterns and their impact on forecast accuracy:

- CAPACITY UTILIZATION: Percentage of time generator is running
- MUST-RUN STATUS: Whether generator runs consistently (baseload characteristics)
- GENERATION PATTERNS: Zero vs non-zero generation frequencies
- CAPACITY FACTORS: Relationship between Pmax and actual generation patterns

These characteristics help identify if poor forecasts are due to operational complexity.



Low Utilization Generators with Poor Performance

Generator	Plant ID	Unit ID	% Running	RMSE	Class	Fuel	Pattern
ROCKPORT	6166	2	1.0%	679.3	critical	Unknow	Intermittent
AMOS	3935	3	1.0%	568.0	critical	Unknow	Intermittent
AMOS	3935	2	1.0%	525.5	critical	Unknow	Intermittent
GAVINAEP	8102	1	1.0%	511.8	critical	Unknow	Intermittent
ROCKPORT	6166	1	1.0%	497.0	critical	Unknow	Intermittent
ANDRUS	8054	1	1.0%	482.6	critical	Natura	Intermittent
POWERTO1	879	6	1.0%	463.6	critical	Unknow	Intermittent
MONROE4	1733	3	1.0%	458.2	critical	Coal,	Intermittent
MOUNTAI2	6264	1	1.0%	454.9	critical	Unknow	Intermittent
IATAN	6065	2	1.0%	419.4	critical	Unknow	Intermittent

Recommendations and Action Items

🚨 CRITICAL: 52 generators with critical performance require immediate model review

⚠️ HIGH: 1 generators with poor performance need attention within 1-2 weeks

🔄 CHRONIC ERRORS: 53 generators with chronic forecasting patterns

→ Review dispatch model parameters and operational constraints

→ Analyze market conditions during chronic error periods

📊 STATISTICAL: 1 generators are statistical outliers

→ Compare with similar generators in same zone/fuel type

→ Investigate if these generators have unique operational characteristics

⛽ FUEL TYPE: Coal, Oil generators show higher error rates (4 poor/critical)

→ Review Coal, Oil generator modeling parameters

✅ GENERAL RECOMMENDATIONS:

- Prioritize generators with multiple performance issues
- Review forecast models for generators with $R^2 < 0.5$
- Monitor generators with increasing error trends
- Update capacity constraints for generators with Pmax issues
- Consider market condition correlation analysis