# Rochelle Municipal Utilities
# Rochelle, IL

# Generation Planning Study

September 2024

# Agenda

- Existing Generation
- Generation Heat Rate
- Generation Operation
- Generation Operation Costs
- Generation Saving and Profit
- Power Market
- Analysis Results and Recommendations

# Existing Generation

- There are three generation plants in RMU
  1. Ninth Street Plant
  2. Peaker Plant
  3. Caterpillar/ Caron Road Plant

Generation Summary

| Plant | Generator Set Number | Total Capacity (KW) |
|---|---|---|
| Ninth St. | 9 | 20,500 |
| Peaker | 2 | 5,000 |
| Caterpillar | 6 | 11,100 |

Total = 36,600

# Existing Generation

## Ninth St. Plant

| Unit # | Capacity (KW) | Engine (HP) | Fuel Type | Mfr. Date |
|---|---|---|---|---|
| 1 | 868 | - | Diesel | 1940 |
| 2 | 2,500 | 3,500 | Diesel/Neutral Gas | 1956 |
| 3 | 1,050 | 1,500 | Diesel/Neutral Gas | 1949 |
| 4 | 1,050 | 1,500 | Diesel | |
| 5 | 3,750 | 3,440, | Diesel/Neutral Gas | 1958 |
| 6 | 4,500 | 5,250 | Diesel/Neutral Gas | 1961 |
| 7 | 800 | 720 | | 1944 |
| 8 | 3,500 | 4,930 | Diesel/Neutral Gas | 1964 |
| 9 | 2,500 | 3,300 | Diesel/Neutral Gas | 1957 |

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# Existing Generation

## Peaker Plant

| Unit # | Capacity (KW) | Engine (HP) | Fuel Type | Mfr. Date |
|---|---|---|---|---|
| P1 | 2,500 | - | Diesel/Neutral Gas | 1966 |
| P2 | 2,500 | - | Diesel/Neutral Gas | 1966 |

## Caterpillar Plant

| Unit # | Capacity (KW) | Engine (HP) | Fuel Type | Mfr. Date |
|---|---|---|---|---|
| 13 | 1,850 | - | Diesel | 2000 |
| 14 | 1,850 | - | Diesel | 2000 |
| 15 | 1,850 | - | Diesel | 2000 |
| 16 | 1,850 | - | Diesel | 2000 |
| 17 | 1,850 | - | Diesel | 2000 |
| 18 | 1,850 | - | Diesel | 2000 |

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# Generator Heat Rate

- Heat rate is one measure of the efficiency of electrical generators/power plants that convert a fuel into heat and into electricity. The heat rate is the amount of energy used by an electrical generator set to generate one kilowatthour (kWh) of electricity

- To express the efficiency of a generator set as a percentage, divide the equivalent Btu content of a kWh of electricity (3,412 Btu) by the heat rate. For example, if the heat rate is 10,500 Btu, the efficiency is 33%.

- Higher heat rate of a power generator set indicates lower efficiency

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# Generator Heat Rate

| Generator Unit Heat Rate | | | |
|---|---|---|---|
| Unit # | Mode of Operation | Gross Heat Rate (BTU/KWh) | Net Heat Rate (BTU/KWh) |
| **Ninth Street Plant** | | | |
| **1** | Diesel | 12,714 | 12,952 |
| **3** | Diesel | 10,338.5 | 11,462.8 |
| **3** | Gas/ Diesel Dual | 10,978.4 | 12,247.5 |
| **4** | Diesel | 11,828 | 12,060 |
| **6** | Diesel | 10,168.7 | 11,339.5 |
| **6** | Gas/ Diesel Dual | 10,606.3 | 11,696.0 |
| **7** | Diesel | 9,911.6 | 10,369.2 |
| **7** | Gas/ Diesel Dual | 10,365.6 | 10,935.2 |
| **9** | Diesel | 10,567.0 | 10,742.0 |
| **9** | Gas/ Diesel Dual | 10,632.0 | 10,815.0 |
| **10** | Diesel | 9,977.0 | 10,143.0 |
| **10** | Gas/ Diesel Dual | 11,409.0 | 11,611.0 |
| **Peaker Plant** | | | |
| **P1** | Diesel | 18,003.7 | 18,003.7 |
| **P1** | Gas/ Diesel Dual | 13,387.7 | 13,387.7 |
| **P2** | Diesel | 14,320.1 | 14,320.1 |
| **P2** | Gas/ Diesel Dual | 11,791.7 | 11,791.7 |
| | | | |
| **CAT generators Plant** | | | |
| **13** | Diesel | 9327.72 | 9,327.7 |
| **14** | Diesel | 10,248.2 | 10,248.2 |
| **15** | Diesel | 9,571.8 | 9,571.8 |
| **16** | Diesel | 10,162.6 | 10,162.6 |
| **17** | Diesel | 10,265.4 | 10,265.4 |
| **18** | Diesel | 9,564.3 | 9,564.3 |

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# Generation Operation

RMU's generation run for;

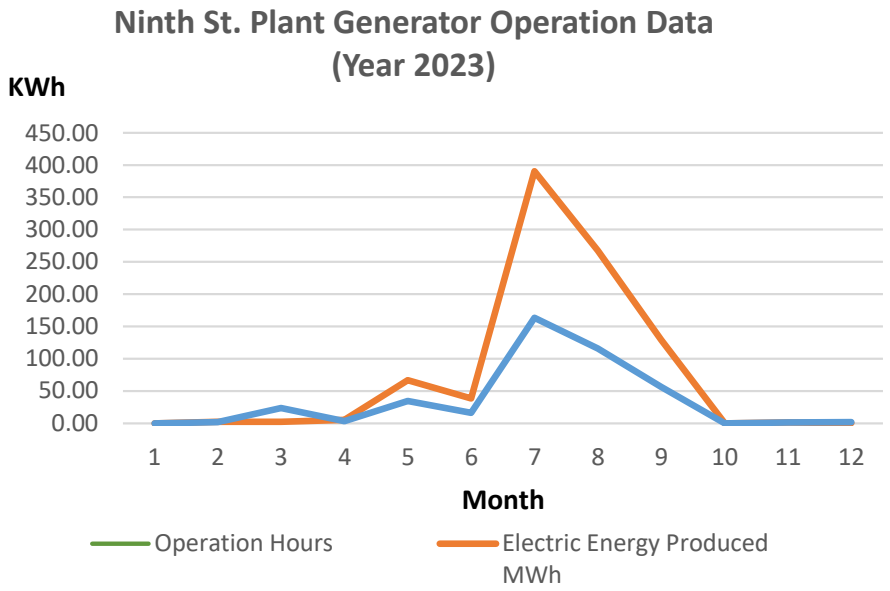
- Generating power energy
- Emergency system power backup
- System peak shaving

- Currently all generators are run mainly for peak shaving or Emergency system power backup only.
- Running peak shaving dispatched daily based on recommendations of IMPA (Indiana Municipal Power Agency)

# Generation Operation

## Ninth Str. Plant

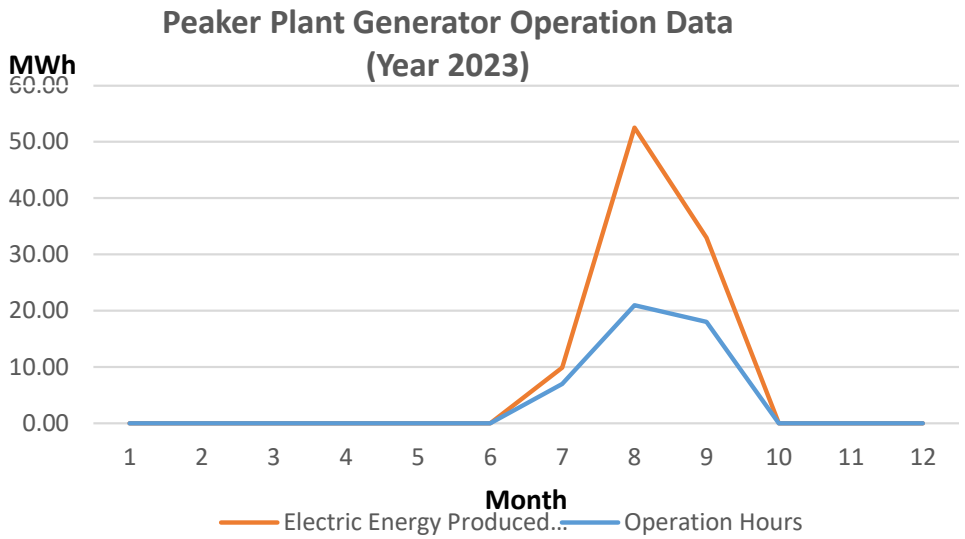
| Ninth St. Plant Generator Operation Data (Year 2023) | | | | |
|---|---|---|---|---|
| Month | Electric Energy Produced MWh | Operation Hours | Cost $/KWh (Net) | Notes |
| 1 | 0.00 | 0.00 | - | |
| 2 | 2.44 | 1.70 | $0.392 | |
| 3 | 2.44 | 23.66 | $0.275 | |
| 4 | 5.19 | 3.00 | $0.154 | |
| 5 | 66.66 | 34.59 | $0.139 | |
| 6 | 38.24 | 16.13 | $0.159 | |
| 7 | 390.41 | 163.43 | $0.060 | Peak |
| 8 | 267.58 | 115.94 | $0.069 | Peak |
| 9 | 129.05 | 56.28 | $0.069 | Peak |
| 10 | 0.00 | 0.00 | - | |
| 11 | 1.36 | 1.19 | $0.588 | |
| 12 | 0.35 | 1.60 | $1.794 | |
| TOTAL= | 903.72 | 417.52 | | |



# Generation Operation

## Peaker Plant

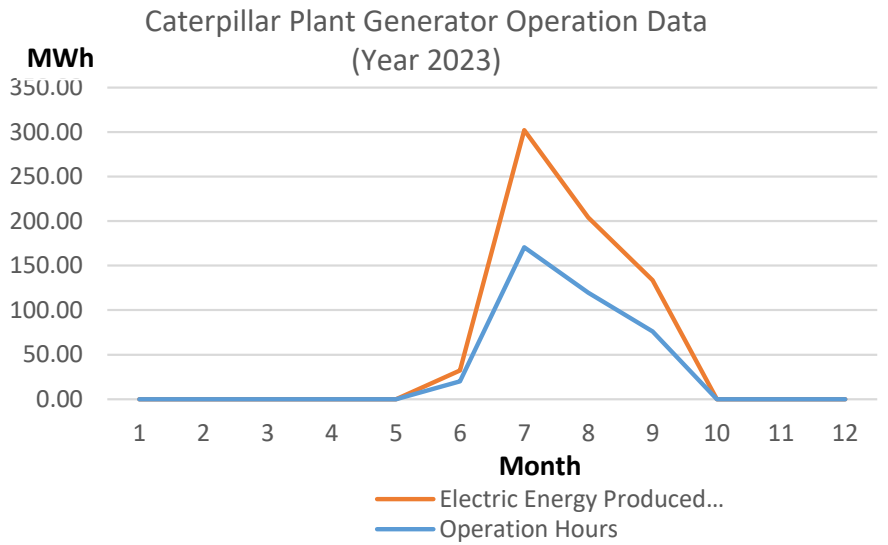
| Peaker Plant Generator Operation Data (Year 2023) | | | | |
|---|---|---|---|---|
| Month | Electric Energy Produced MWh | Operation Hours | Cost $/KWh (Net) | Notes |
| 1 | 0.00 | 0.00 | - | |
| 2 | 0.00 | 0.00 | - | |
| 3 | 0.00 | 0.00 | - | |
| 4 | 0.00 | 0.00 | - | |
| 5 | 0.00 | 0.00 | - | |
| 6 | 0.00 | 0.00 | - | |
| 7 | 9.88 | 7.00 | $0.2448 | Peak month |
| 8 | 52.52 | 21.00 | $0.1266 | Peak month |
| 9 | 32.95 | 18.00 | $0.108 | Peak month |
| 10 | 0.00 | 0.00 | - | |
| 11 | 0.00 | 0.00 | - | |
| 12 | 0.00 | 0.00 | - | |
| Total= | 95.35 | 46.00 | | |



# Generation Operation

## Caterpillar Plant

| Caterpillar. Plant Generator Operation Data (Year 2023) | | | | |
|---|---|---|---|---|
| Month | Electric Energy Produced MWh | Operation Hours | Cost $/KWh (Net) | Notes |
| 1 | 0.00 | 0.00 | - | |
| 2 | 0.00 | 0.00 | - | |
| 3 | 0.00 | 0.00 | - | |
| 4 | 0.00 | 0.00 | - | |
| 5 | 0.00 | 0.00 | - | |
| 6 | 32.37 | 20.00 | $0.944 | |
| 7 | 302.26 | 170.80 | $0.206 | Peak month |
| 8 | 204.13 | 119.50 | $0.248 | Peak month |
| 9 | 133.64 | 76.00 | $0.167 | Peak month |
| 10 | 0.00 | 0.00 | - | |
| 11 | 0.00 | 0.00 | - | |
| 12 | 0.00 | 0.00 | - | |
| Total= | 672.40 | 386.30 | | |



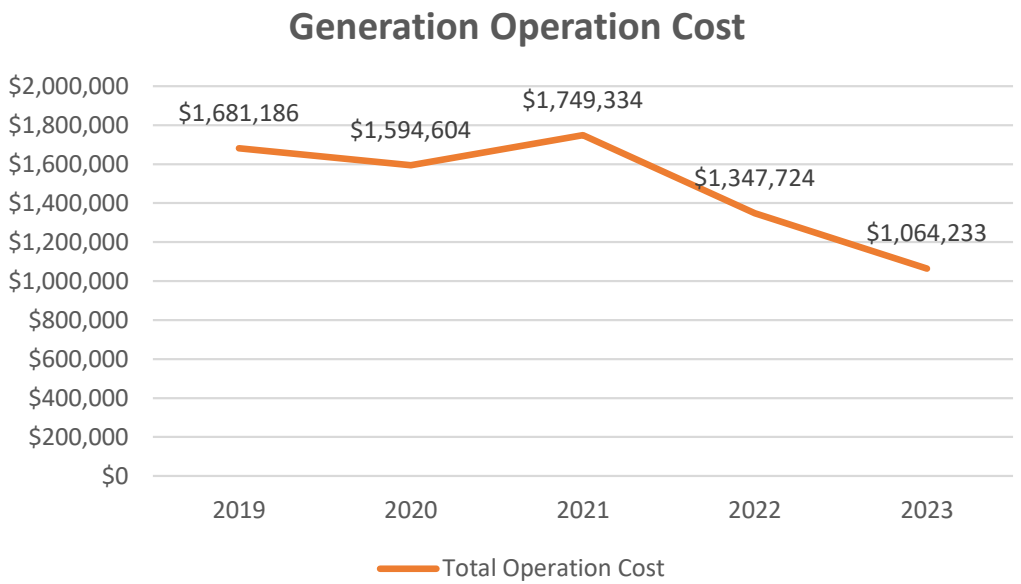
# Generation Operation Cost

- Operation Cost Categories
    1. Fuel costs; natural gas and diesel
    2. Personnel
    3. Contractual service
    4. Maintenance/commodities

# Generation Operation Cost

| Generation Operation Cost History Summary | | | | | |
|---|---|---|---|---|---|
| **Cost Category** | **2019** | **2020** | **2021** | **2022** | **2023** |
| Fuel Cost | $295,769 | $343,573 | $474,305 | $557,390 | $223,585 |
| Personnel | $453,542 | $586,249 | $537,399 | $497,919 | $464,722 |
| Contractual service | $19,660 | $279,985 | $185,253 | $103,375 | $168,611 |
| Commodities/Maintenance | $912,215 | $384,797 | $552,377 | $189,040 | $207,315 |
| **Total Operation Cost =** | $1,681,186 | $1,594,604 | $1,749,334 | $1,347,724 | $1,064,233 |

Note: only Jan to Oct 2023 cost data available. Estimation was made for 2023 cost



# Generation Saving and Profit

- Energy generation

When running generation, it produces energy to power system that reduces RMU's energy purchase.

The cost of RMU's energy generation typically is higher than energy purchase.

- Peak Shaving

Peak shaving operation results two parts of system operation saving;

1. NITS Transmission Saving

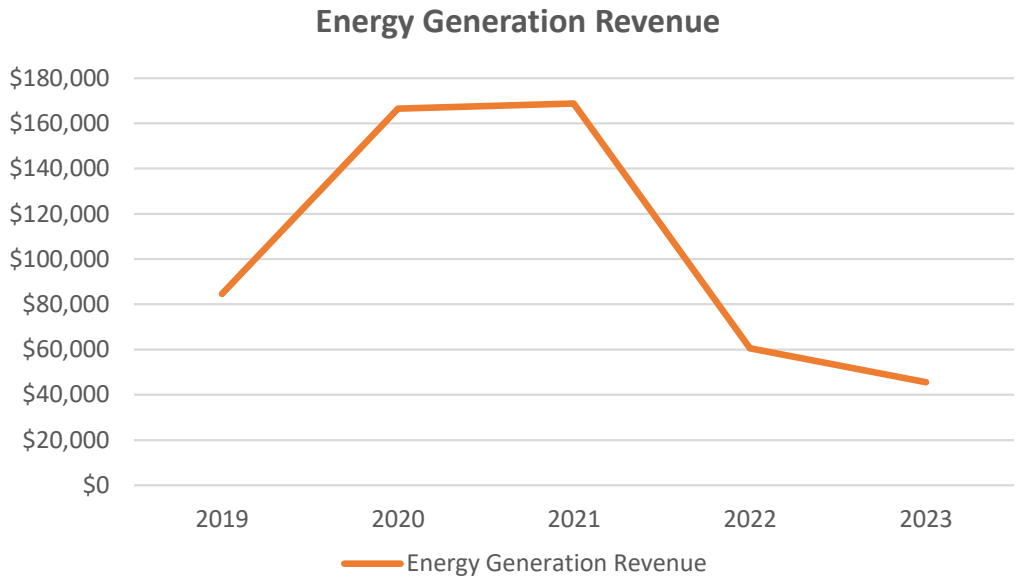
PJM Network Integration Transmission Service (NITS) NITS fees are based on electricity providers' usage of the transmission network, so the more electricity an area consumes, especially during peak times, the higher the fees could be. Running generation at a system high peak demand period time reduces higher transmission fee.

2. Capacity Saving

PJM capacity costs are the price of ensuring the reliability of the electric grid during periods of high demand. . Running generation at a system high peak demand period time reduces higher capacity cost.

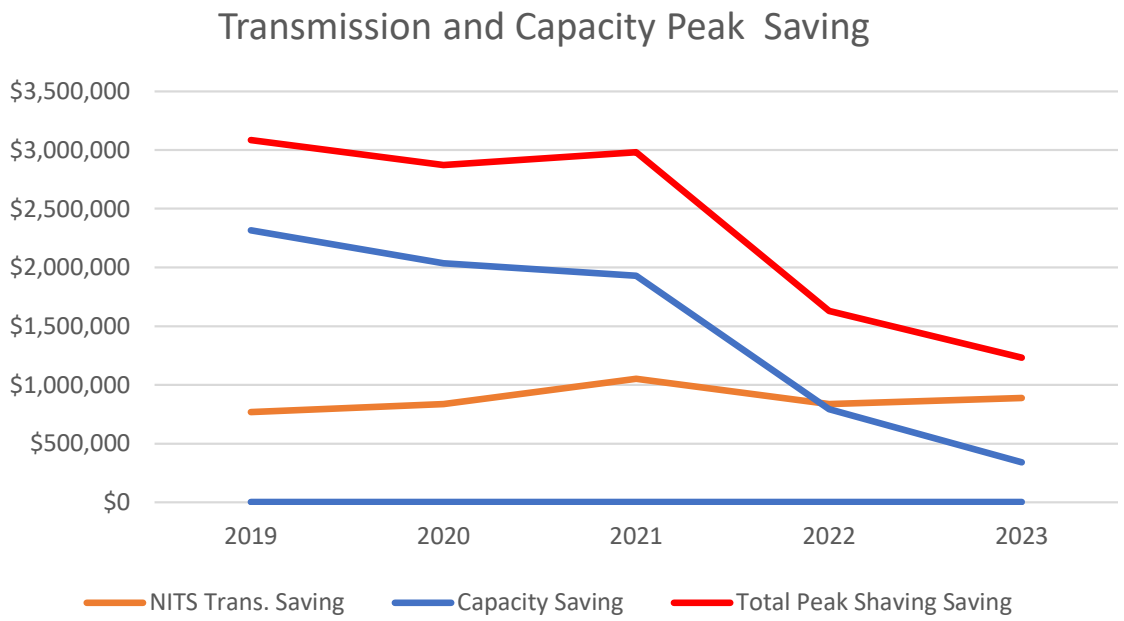
# Generation Saving and Profit

| Energy Generation | | |
|---|---|---|
| **Year** | **Net Energy Generation KWh** | **Energy Generation Revenue** |
| 2019 | 1,692,381 | $84,619 |
| 2020 | 3,329,006 | $166,450 |
| 2021 | 3,374,973 | $168,749 |
| 2022 | 1,209,315 | $60,466 |
| 2023 | 909,934 | $45,497 |
| Total = | 10,515,609 | $525,780 |



# Generation Saving and Profit

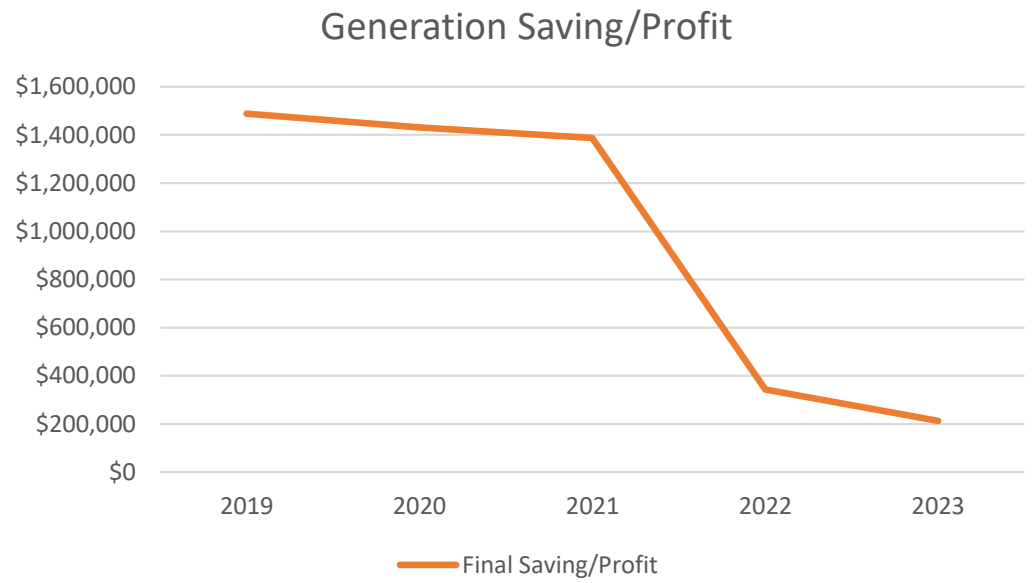
| Peak Shaving Savings | | | |
|---|---|---|---|
| **Year** | **NITS Trans. Saving** | **Capacity Saving** | **Total Peak Shaving Saving** |
| 2019 | $768,299 | $2,317,357 | $3,085,656 |
| 2020 | $837,586 | $2,034,665 | $2,872,251 |
| 2021 | $1,053,197 | $1,928,460 | $2,981,657 |
| 2022 | $836,801 | $793,628 | $1,630,429 |
| 2023 | $889,441 | $341,827 | $1,231,268 |
| Total = | 4,385,324 | $7,415,937 | $11,801,260 |



# Generation Saving and Profit

| Generation Saving and Profit | | | | |
|---|---|---|---|---|
| **Year** | **Energy Generation Revenue** | **Peak Shaving Saving** | **Operation Cost** | **Final Saving/Profit** |
| 2019 | $84,619 | $3,085,656 | $1,681,186 | $1,489,089 |
| 2020 | $166,450 | $2,872,251 | $1,606,954 | $1,431,748 |
| 2021 | $168,749 | $2,981,657 | $1,762,438 | $1,387,967 |
| 2022 | $60,466 | $1,630,429 | $1,348,053 | $342,841 |
| 2023 | $45,497 | $1,231,268 | $1,064,233 | $212,532 |
| Total = | $525,780 | $11,801,260 | $7,462,864 | $4,864,177 |

Generation Profit = Energy Generation Revenue + Peak Shaving Saving – Operation Cost



# Power Market

PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.

RMU is a member of PJM.

**2025/2026 Base Residual Auction Report, July 30, 2024**

**Table 2.** RPM Base Residual Auction Resource Clearing Price Results in the RTO

| | Auction Results | | | | |
|---|---|---|---|---|---|
| Delivery Year | Resource Clearing Price | Cleared UCAP (MW) | RPM Reserve Margin | Total Reserve Margin[1] | Total Cost to Load ($ billion) |
| 2015/16[2] | $136.00 | 164,561.2 | 19.7% | 19.3% | $9.7 |
| 2016/17[3] | $59.37 | 169,159.7 | 20.7% | 20.3% | $5.5 |
| 2017/18 | $120.00 | 167,003.7 | 20.1% | 19.7% | $7.5 |
| 2018/19 | $164.77 | 166,836.9 | 20.2% | 19.8% | $10.9 |
| 2019/20 | $100.00 | 167,305.9 | 22.9% | 22.4% | $7.0 |
| 2020/21[4] | $76.53 | 165,109.2 | 23.9% | 23.3% | $7.0 |
| 2021/22 | $140.00 | 163,627.3 | 22.0% | 21.5% | $9.3 |
| 2022/23 | $50.00 | 144,477.3 | 21.1% | 19.9% | $3.9 |
| 2023/24 | $34.13 | 144,870.6 | 21.6% | 20.3% | $2.2 |
| 2024/25 | $28.92 | 147,478.9 | 21.7% | 20.4% | $2.2 |
| 2025/26[5] | $269.92 | 135,684.0 | 18.6% | 18.5% | $14.7 |

*[1] Reserve Margin includes FRR+RPM (Total ICAP/Total Peak-1; [2] 2015/2016 BRA includes a significant portion of AEP and DEOK zone load previously under the FRR Alternative; [3] 2016/2017 BRA includes EKPC zone;*

*[4] Beginning 2020/2021 Cleared UCAP (MW) includes Annual and matched Seasonal Capacity Performance sell offers; [5] DOM zone included in RPM*

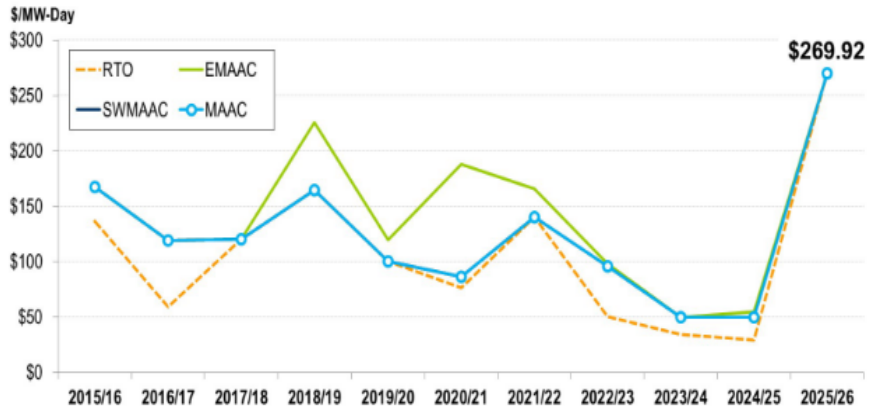
# Power Market

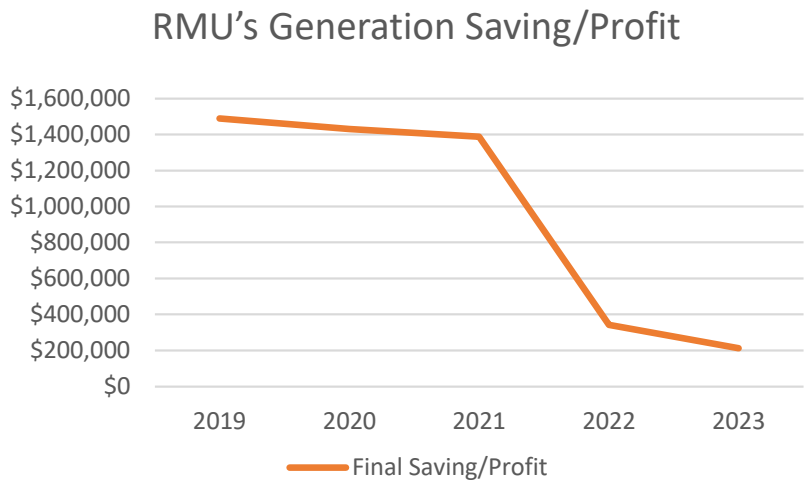
PJM's capacity market is set up to ensure that there is enough electricity to meet demand on high demand days of the year. Capacity auctions, which happen annually, occur when power plants are paid to commit to be available, or customers are paid to conserve during emergencies. RMU sell its generation capacity to power network during system peak demand time to generate revenue.

RMU's generation saving/profit matches PJM history capacity market trend

**Figure 1** represents the trend in BRA capacity price by delivery year for RTO, EMAAC, SWMAAC and MAAC. For 2025/2026, all four LDAs cleared at $269.97. This clearing price was an increase from $28.92 in RTO, $49.49 in MAAC and SWMAAC and $54.95 in EMAAC in the 2024/2025 BRA. The number of constrained LDAs decreased from five LDAs (MAAC, BGE, DPL-S, EMAAC and DEOK) to two LDAs (BGE and DOM).

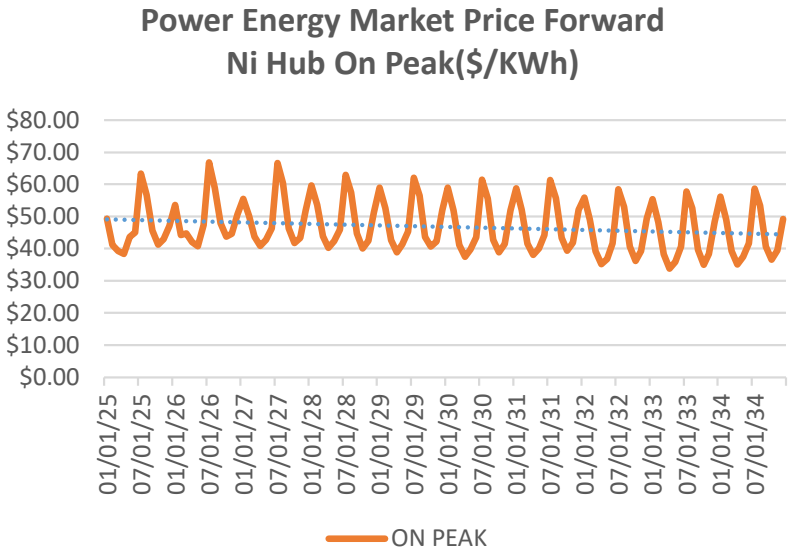
**Figure 1.** BRA Clearing Prices by Delivery Year for Major LDAs

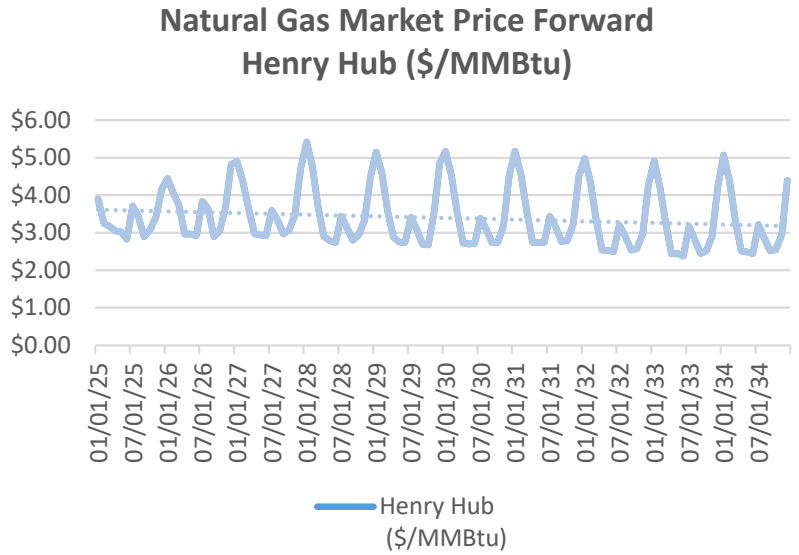


# Power Market

- 2025/2026 market Auction reached a record high. Based on new data point for PJM capacity, It is forecasted that peak capacity price will be $125-$175/MW-day range as a long term forecast.
- NITS Transmission rate will be about $110 /MW-day as forecasted
- Power energy market price forward is projected by IMPA, the trend of peak season price is relative stable in near future.
- Natural gas market trend is expected moderate price due to lower economic growth, which will reduce demand in the short term while easing geopolitical pressures in the longer term will lead to further price declines.



# Analysis Results and Recommendations

- In past five years, generation produced total $4,864,000 net profit, from $1.48 millions in 2019 decreased to 0.22 millions in 2023 due to system weak capacity demand.
- Last year, PJM took the first step in remedying this problem by changing the way all resources are evaluated for reliability, resulting in finding the result that was that roughly 26 gigawatts (GW) of gas and coal resources were shown to be unreliable, and thus could no longer claim to benefit PJM at their assumed full output during all weather conditions.
- Around 6 GW of fossil plants retired since the last auction. Most of the retiring resources are decades-old coal plants, built in the 1960s, and some are facing bankruptcy
- Projected load growth of 3.2 GW further strained the system, which is a 2.2% increase over the last planning year. Planning for load growth and retirements is important, but the principal driver of the capacity market price increase was PJM derating the gas plants to reflect their lower reliability value. The gas and coal derating (26 GW) was nearly three times as much as the combination of retirements and load growth.
- Based on recent PJM capacity auction and market performance data, it is projected that the peak generation capacity price will be a $125 – 175/MW-day range, and NITS transmission rate price will be about $110 /MW-day as a long term forecast.
- Per generation capacity and transmission prices forecast,  and last five years RMU's generation operation analysis. It is projected that RMU's generation will produce a saving/profit between 0.95 to1.35 millions per year in the long term.

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# Analysis Results and Recommendations

**Recommendations:**

1. Keep existing generation operation, it is expected to have saving/profit between 0.95 to1.35 millions per year in a long term.

2. Recommend to add a new natural gas generation sets or a battery energy saving unit to saving more of RMU's power bill.

A. Add an 8MW natural gas generation set.

It is estimated that new generator will produce about $0.7 millions peak saving/profit, and 15 years return of investment.

Provide more emergency power backup capability.

Retire aged and high maintenance cost generators, replace their capacities with the new generator.

B. Option to install a 10 MW/4 Hours battery energy storage unit for peak saving.

Note: a detail evaluation/case study should be conducted.

# Analysis Results and Recommendations

## A. Add an 8MW natural gas generation set.

| Generation Addition Estimate | | |
|---|---|---|
| **Description** | **Value** | **Note** |
| **Generator Data** | | |
| New Gas generator unit rating (MW) | 8.0 | |
| Investment Estimate ($) | $11,000,000 | |
| Unit Heat rate (BUT/KWh) | 11,000 | |
| NITS transmission rate ($/MW) | $110.00 | |
| Capacity rate ($/MW) | $150.00 | |
| Energy generated market rate ($/KWh) | $0.053 | |
| Natural gas market rate ($/Therm) | $0.48 | Include all tax, delivery, …. |
| Annual generator running time (%) | 5% | Peake shaving running time |
| Bond/Cash of Investment | TBD | |
| **Financial Analysis** | | |
| Estimated annual energy generated (kWh) | 3,504,000 | |
| **Revenue Estimate** | | |
| Annual transmission saving | $321,200 | |
| Annual capacity saving | $438,000 | |
| Energy generated revenue | $185,712 | |
| Total gross revenue= | $944,912 | |
| **Operation Cost Estimate** | | |
| Natural Gas usage (therms) | 385,533 | |
| Gas fuel cost | $185,056 | |
| Other operation costs | $45,000 | |
| Total operation cost= | $230,056 | |
| | | |
| **Estimated saving/profit =** | $714,856 | |
| **Investment Estimate** | | |
| ROI Return od Investment (years) | 15 | |

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# Analysis Results and Recommendations

## B. Install a 10 MW/4 Hours battery energy storage unit for peak saving.

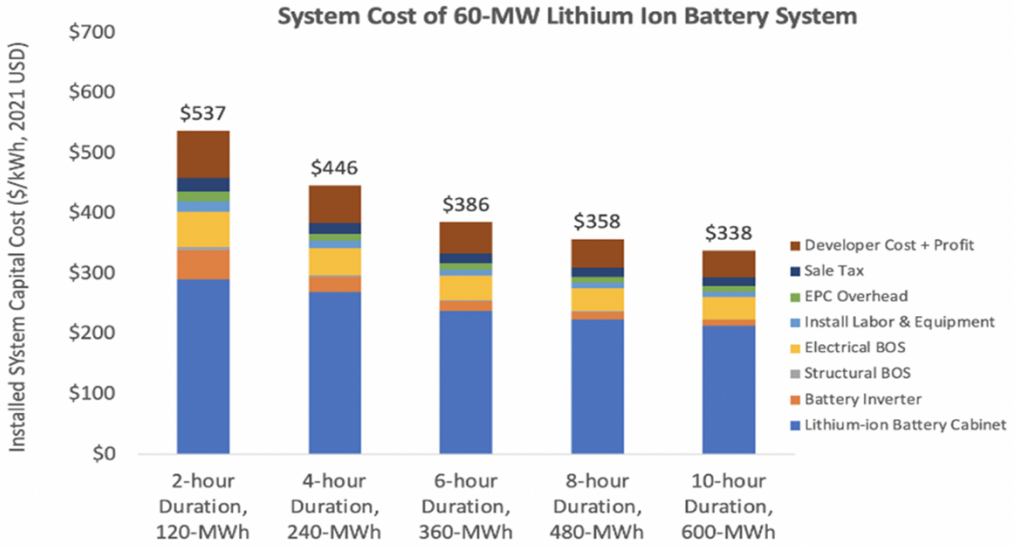


Figure 1. 2022 U.S. utility-scale LIB storage costs for durations of 2–10 hours (60 $MW_{DC}$) in $/kWh

**Table 2. Values from Figure 1 and Figure 2, which show the normalized and absolute storage costs over time. Storage costs are overnight capital costs for a complete 4-hour battery system.**

| | Normalized Cost Reduction | | | 4-hour Storage Costs (2022$/kWh) | | |
|---|---|---|---|---|---|---|
| Year | Low | Mid | High | Low | Mid | High |
| 2022 | 1.00 | 1.00 | 1.00 | 482 | 482 | 482 |
| 2023 | 0.72 | 0.96 | 1.04 | 347 | 463 | 500 |
| 2024 | 0.68 | 0.92 | 1.04 | 327 | 443 | 503 |
| 2025 | 0.64 | 0.81 | 1.03 | 310 | 388 | 496 |
| 2026 | 0.62 | 0.78 | 0.99 | 297 | 376 | 477 |
| 2027 | 0.59 | 0.75 | 0.95 | 284 | 363 | 459 |
| 2028 | 0.56 | 0.73 | 0.91 | 271 | 351 | 440 |

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## Analysis Results and Recommendations

Internal note: since there are different peak shaving ways between generators and battery storages, the battery storage unit peak shaving saving will be estimated by IMPA. BHMG hopes to have the IMPA estimate and then provide the economic analysis before September board meeting.

Questions?