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Screening monthly gas use in Trinidad and Tobago with nearest neighbours

An unsupervised test across four gas-consuming sectors

Adrian Dunkley | info@caribbeanaiassociation.com

Abstract

We compared monthly gas use in 2024 with twelve reference months from 2023. A nearest-neighbour screen flagged April, June and July. June exceeded the reference threshold even when we omitted each sector in turn. A screen using national gas use alone also flagged August and October but missed April. The results identify records for review. The bulletins contain no incident labels against which to measure detection accuracy [1, 2].

Research question

Does a four-sector screen select the same months for review as a screen based on total national gas use?

Data and methods

From Table 3B of the amended 2023 and 2024 energy bulletins, we extracted gas use for power generation, ammonia, methanol and liquefied natural gas (LNG), plus the national total. Each observation is a monthly average daily rate in millions of standard cubic feet per day [1, 2].

For each pair of months we divided the sector differences by their respective 2023 sample standard deviations, squared them, summed them and took the square root. Each 2024 month received its smallest distance to any 2023 month. This is a one-nearest-neighbour novelty score [3]. The threshold was the largest distance from a 2023 month to its closest other 2023 month. Only scores strictly above it triggered review.

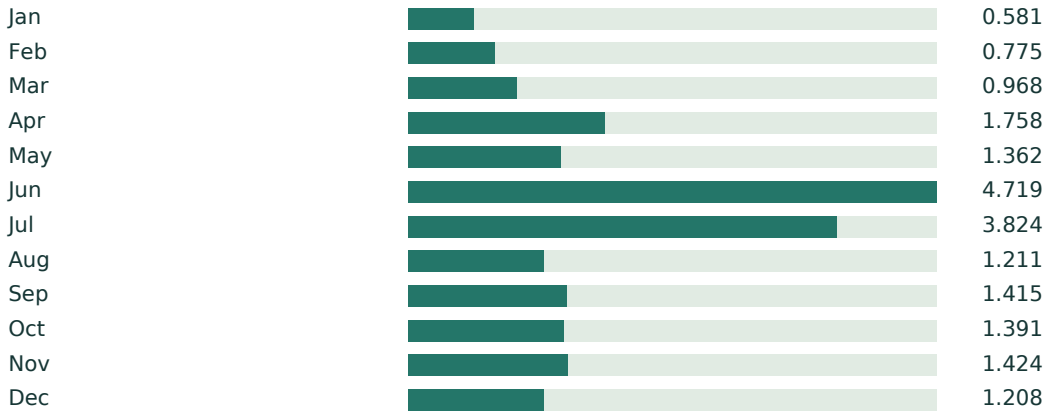
Results

The four-sector threshold was 1.703. April scored 1.758, June 4.719 and July 3.824. June's closest match was August 2023. In June 2024 gas use for ammonia was 294 and methanol 409 million standard cubic feet per day. Both fell below their 2023 monthly minima of 359 and 483 [1, 2].

Repeating the full calculation on the national total alone flagged June, July, August and October. When we removed LNG and recalculated the four-sector test using the three remaining sectors, only June triggered review. June remained above the recalculated threshold in all four single-sector omissions.

Distance from each 2024 month to its closest 2023 match

Standardised distance



Higher scores indicate less familiar sector combinations. The four-sector reference threshold was 1.703. Scores are unitless. Calculated from [1, 2].

Discussion

A reviewer investigating April would see an unusual combination across sectors even though the national total of 2,364 lay within the 2023 range of 2,331–2,665 [1, 2]. The score identifies which records merit comparison. Plant logs and reporting notes would be needed to explain a difference.

Limitations

One reference year cannot represent the full range of seasonal and industrial conditions. The amended bulletins are retrospective. The method has no information about planned shutdowns, reporting errors or confirmed disruptions. A flag estimates neither the probability of an outage nor the cost of a missed event.

Reproduce the analysis

Read the 24 rows in date order. All five volume columns are monthly average daily rates in millions of standard cubic feet per day.

Use the four sector columns to compute 2023 sample standard deviations with denominator 11. Keep these scales fixed when measuring both reference and test distances.

For each reference month, exclude itself before finding its closest match. Use the largest of those twelve distances as the threshold. Compare each 2024 month with all twelve reference months.

Repeat with the national total as the sole feature. For the sensitivity test, omit one sector at a time and recalculate both the threshold and the 2024 scores.

Data table

Month	Power	Ammonia	Methanol	LNG	National total
2023-01	247	462	569	1264	2665
2023-02	239	454	569	1265	2638
2023-03	251	427	488	1273	2537
2023-04	253	409	483	1190	2419
2023-05	264	419	517	1230	2529
2023-06	271	464	534	1118	2501
2023-07	293	418	548	1094	2461
2023-08	270	377	523	1058	2331
2023-09	290	438	559	1178	2527
2023-10	261	374	576	1082	2342
2023-11	260	359	592	1180	2488
2023-12	249	408	590	1074	2415
2024-01	256	414	496	1158	2431
2024-02	254	480	558	1284	2686
2024-03	265	450	536	1182	2540
2024-04	266	448	557	994	2364
2024-05	290	443	506	1087	2430
2024-06	265	294	409	848	1905
2024-07	284	445	530	800	2161
2024-08	274	478	572	1155	2586
2024-09	275	480	544	1015	2388
2024-10	272	449	484	1261	2566
2024-11	275	452	487	1220	2536
2024-12	247	438	512	1184	2474

References

[1] Ministry of Energy and Energy Industries, Consolidated Monthly Bulletins, January–December 2023, Table 3B, amended 28 November 2025

[2] Ministry of Energy and Energy Industries, Consolidated Monthly Bulletins, January–December 2024, Table 3B, amended 28 November 2025

[3] S. Ramaswamy, R. Rastogi and K. Shim (2000), Efficient algorithms for mining outliers from large data sets

Data credits

Ministry of Energy and Energy Industries, Table 3B, 2023 and 2024 bulletins, amended 28 November 2025. CAIA calculations.