The Payne Institute for Public Policy
AT COLORADO SCHOOL OF MINES

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Ras Laffan LNG Thermal Profiles Suggest an Operational Shift at Multiple Trains

Commentary by Mikhail Zhizhin and Morgan Bazilian

New VIIRS Nightfire analysis indicates that several sources in the Ras Laffan LNG cluster may contain both compressor and flare emissions within a single satellite pixel, with March 2026 observations pointing to a possible change in operating regime.

Recent VIIRS Nightfire analysis [1] of the Ras Laffan LNG complex (Figure 1) comes against the backdrop of the March 2026 Iranian attack on Ras Laffan Industrial City, which Reuters reported [2] caused extensive damage to LNG infrastructure and knocked out about 17% of Qatar's LNG export capacity; in that setting, the thermal changes observed at several Ras Laffan sources may reflect a broader disruption in train-level operations rather than a purely local anomaly, with the satellite signal appearing consistent with two distinct subpixel heat emitters—a lower-temperature source, likely a compressor at about 900 K, and a higher-temperature source, likely a gas flare at about 1700 K.

This pattern becomes particularly clear in the most recent temporal profiles of these flares (Figure 2). In the Trains 4 and 5 complex (25.908412N, 51.557708E**)** the lower-temperature component disappears in March 2026, while the higher-temperature flare signal remains strong and may even intensify. One plausible interpretation is that the compressors were shut down while flaring continued, possibly at elevated levels during a force majeure or related operational disruption.

The same behavior is visible at multiple locations across the Ras Laffan LNG complex. At least five out of fifteen flare sites at the LNG cluster show a shift in their thermal and persistence signatures, suggesting that this is not an isolated anomaly but may reflect a broader operational change affecting multiple trains.

The observations also highlight an important limitation of VIIRS Nightfire v3.0. The current version cannot reliably separate two hot subpixel sources when both are present within the same satellite pixel. In practice, the stronger radiant heat source dominates the retrieval. That means when flaring intensifies, the lower-temperature compressor signature may no longer appear in the product even if it had been visible previously. Improved separation of mixed subpixel thermal sources is experimental in VNF v4.0, with further advances planned for v5.0.

This example demonstrates how temporal thermal profiling can provide insight into changing industrial operations at major LNG facilities, even when the underlying heat sources are smaller than the satellite footprint. As higher-resolution retrieval methods become available, they may offer a more detailed view of how flaring and associated equipment respond during abnormal operating conditions.

Figure 1. Map of flare locations in the Ras Laffan LNG cluster showing sites with an apparent regime change. The highlighted (cyan) sources exhibit a shift from a mixed thermal signature to one dominated by a stronger high-temperature flare component.

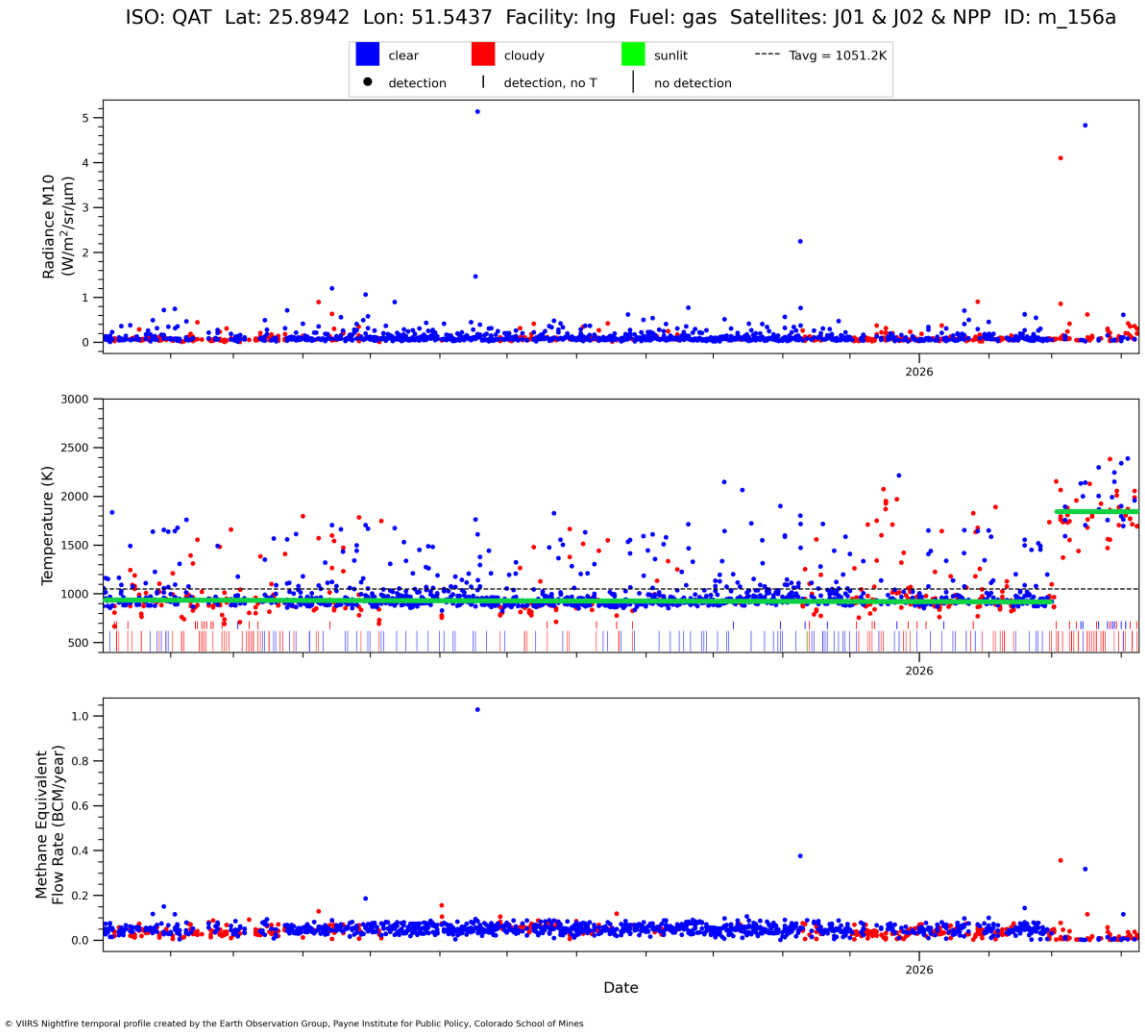

Figure 2. Temporal thermal profiles for selected Ras Laffan LNG sources. Earlier periods show evidence of both lower- and higher-temperature components, while March 2026 profiles indicate disappearance of the lower-temperature signature and persistence of strong flaring.

References:

1. Zhizhin, M.; Elvidge, C.D.; Ghosh, T.; Gleason, G.; Bazilian, M. VIIRS Nightfire Super-Resolution Method for Multiyear Cataloging of Natural Gas Flaring Sites: 2012-2025. *Remote Sens.* **2026**, *18*, 314. https://doi.org/10.3390/rs18020314
2. Reuters, "Iran targets energy facilities across Gulf after Israel struck Iran's South Pars gas field," March 19, 2026; Reuters, "Iran attacks wipe out 17% of Qatar's LNG capacity for up to five years, QatarEnergy CEO says," **March 19, 2026**.

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Mikhail Zhizhin, M.Science in mathematics from the Moscow State University in 1984, Ph.D. in computational seismology and pattern recognition from the Russian Acad. Sci. in 1992. Research positions from 1987 to 2012 in geophysics, space research and nuclear physics at Russian Acad. Sci., later at NOAA and CU Boulder. Currently he is a researcher at the Earth Observation Group at Colorado School of Mines. His applied research fields evolved from high performance computing in seismology, geodynamics, terrestrial and space weather to deep learning in remote sensing. He is developing new machine learning algorithms to better understand the Nature with Big Data.

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