53 MW on OML 30 associated gas: what the satellite record says

A technical review of a flare-to-compute project in Delta State, Nigeria

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Executive summary

Parameter	Value	Status
Announced project capacity	53 MW	public statement
VIIRS estimate, 3 sites, 2024	4.42 MMSCFD (0.0457 bcm/yr)	satellite estimate
Range 2020-2024	2.27-6.12 MMSCFD	satellite estimate
Net output equal to 40-50% of nameplate	21-27 MW	estimate
Years in which the VIIRS estimate covers 53 MW nameplate	2 of 5	calculation
Calculated methane number	86-98	estimate
H_2S	below 0.20 ppm (detection limit)	published data

Thesis of this document: open data are consistent with reading 53 MW as installed nameplate capacity. That does not prove the project's design basis. For a compute load, the relevant quantity is net electrical output, assumed in this screening case at 40-50% of nameplate. What follows tests that interpretation and identifies the remaining questions.

1. What is publicly known

In 2025, under the Nigerian Gas Flare Commercialisation Programme (NGFCP), a Gas Connection Agreement was announced between a permit holder and the joint venture developing OML 30 in Delta State [6].

Publicly stated parameters:

- **Three sites**: Afiesere, Eriemu and Kokori flow stations
- **Capacity**: 53 MW, off-grid generation
- **Purpose**: powering computing infrastructure (data centre)
- **Licence**: OML 30, 1,097 km², roughly 35 km east of Warri, eight fields, eight producing flow stations and five gas lift compression stations
- **Licence owners**: the national oil company (55%) and a private Nigerian operator (45%)

The NGFCP framework creates an economic incentive to utilise flare gas, but its size depends on the permitting regime and the contracts. The financial-bid floor price is USD 0.25/Mscf [7]. The 2023 regulations prescribe an administrative fine of USD 3.50/Mscf for unauthorised flaring or venting [8]. A producer may therefore have a strong interest in utilisation, but applicability of the fine and the commercial terms must be verified for the specific site.

2. Method

The task: verify whether the announced project is physically supported by available gas, using open sources only.

Volume data source. VIIRS Nightfire is derived from the VIIRS radiometer aboard Suomi NPP and developed by the Earth Observation Group. Annual summaries provide detected-flare coordinates, modelled burned-volume estimates, flame temperature, detection frequency and cloud-free observation counts. Files for 2020-2024 were used [1, 2].

Matching flares to flow stations. Delta State site coordinates were taken from a published GIS study. Matching used great-circle distance (the haversine formula) between each station coordinate and the nearest flare coordinate [3].

Match quality:

Station	Distance to nearest flare
Afiesere	0.31 km
Eriemu	0.37 km
Kokori	1.45 km
Olomoro	0.07 km
Uzere	0.25 km
Oroni	0.50 km
Evwreni	11.6 km (no flare present)

Distances of 0.07-0.50 km for Afiesere, Eriemu, Olomoro, Uzere and Oroni indicate close spatial matches. Kokori is 1.45 km from the matched flare, so its attribution carries greater uncertainty and is treated separately.

Method limitation. VIIRS volume calibration carries wide uncertainty intervals. The data provide a useful order-of-magnitude estimate and an indicative relative trend, not billing accuracy. Cloud cover, observation geometry, flare temperature, detection thresholds and model changes can affect results; operator measurements are needed for confirmation [1, 2].

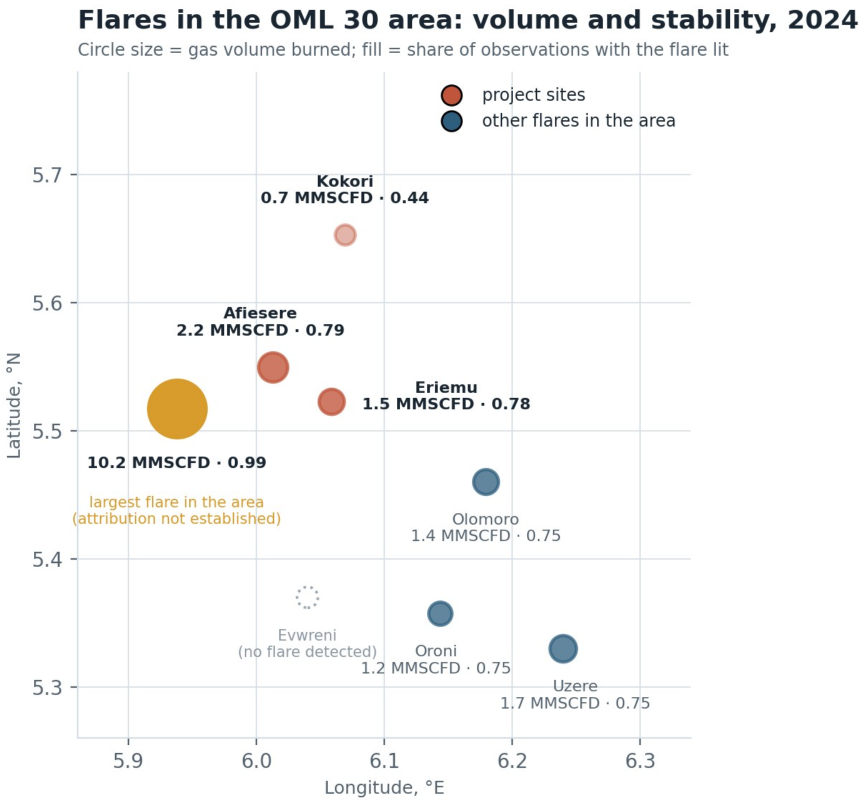

Figure 1. Flares in the OML 30 area in 2024. Circle size is proportional to gas volume burned; fill opacity to detection frequency. Project sites are highlighted.

3. VIIRS-estimated gas volume

Three project sites, bcm/year:

Station	2020	2021	2022	2023	2024
Afiesere	0.0009	0.0049	0.0237	0.0259	0.0227
Eriemu	0.0226	0.0204	0.0387	0.0322	0.0154
Kokori	0.0000	not detected	not detected	0.0052	0.0076
Total	**0.0235**	**0.0253**	**0.0625**	**0.0633**	**0.0457**

Conversion to power (at 1,000 Btu/scf and 38% electrical efficiency):

Year	MMSCFD	MW (electrical)
2020	2.27	10.6
2021	2.45	11.4
2022	6.05	28.1
2023	6.12	28.5
2024	4.42	20.6

Conversion basis: 1 MMSCFD at 1,000 Btu/scf = 12.21 MW thermal. The 38% efficiency is the author's screening assumption for a reciprocating gas engine on associated gas.

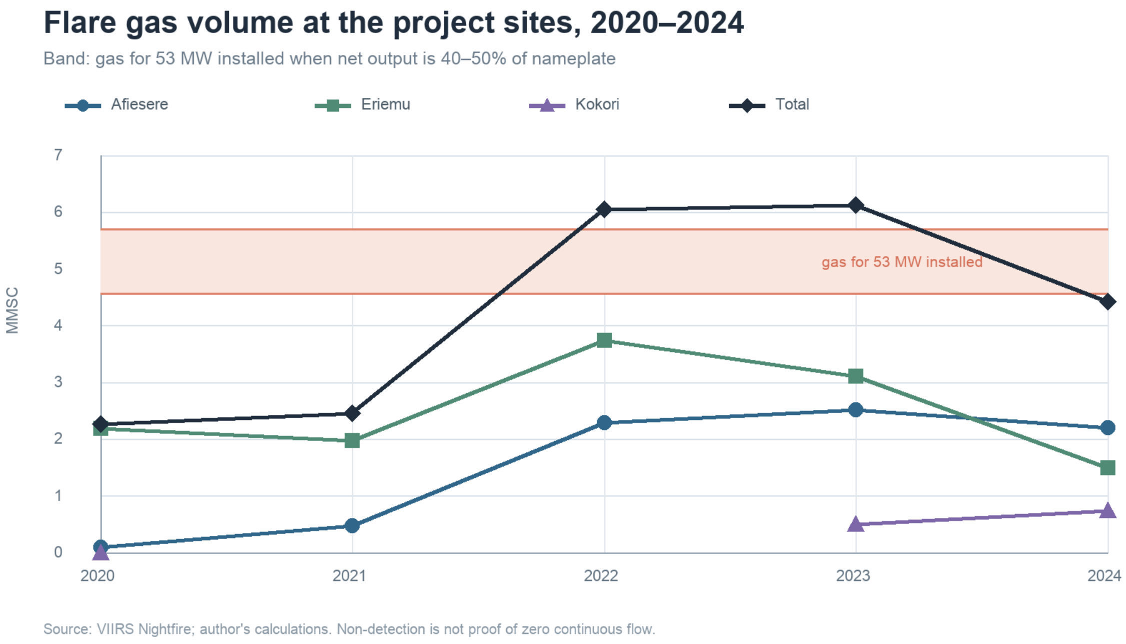

Figure 2. VIIRS-estimated flare gas volume at the three sites, 2020-2024. The shaded band is the gas required for 53 MW of installed nameplate when net output equals 40-50% of nameplate (a 50-60% reduction).

4. Two denominators

This is the central question of the document.

This review uses net output equal to 40-50% of nameplate as a screening case. It is a conservative author scenario based on operating experience, not a universal property of every engine. The project value must be confirmed against OEM curves for the selected model, actual fuel composition, ambient temperature, altitude, air-system and cooling-system limits [9].

Available power can be constrained by the air and cooling systems, ambient temperature, fuel methane number, filter restriction and operating margin against knock. These effects should not be multiplied without the manufacturer's model; the table below is a scenario range, not a guaranteed equipment characteristic.

What this means for the stated 53 MW:

Net output / nameplate	Delivered output	Gas required (38% efficiency)
40%	21.2 MW	4.56 MMSCFD
45%	23.9 MW	5.13 MMSCFD
50%	26.5 MW	5.70 MMSCFD

The 2024 VIIRS estimate is 4.42 MMSCFD. It lies near the lower edge of the scenario band, but this coincidence does not confirm the output factor used in the project's design.

Conclusion. Available gas is consistent with one possible interpretation of 53 MW as installed nameplate capacity. The match does not prove the project's design basis; confirmation requires an equipment schedule, OEM curves and an auxiliary-load balance. Open data provide no basis for alleging deliberate overstatement.

What remains open is the power actually available to the data-centre load rather than the sum of generator nameplates. In the screening case, 53 MW installed corresponds to about 21-27 MW net output. The same factor changes unit CAPEX: USD 900/kW of nameplate becomes roughly USD 1,800-2,250/kW of net output.

This is an observation, not an accusation: publishing nameplate ratings is an industry norm. The question is whether the reader understands what is being read.

Cross-check of the wider programme figure. A public estimate of roughly 3 GW from 250-300 MMSCFD cannot be explained by derating. At 1,000 Btu/scf and 38% efficiency, that flow supports about 1.16-1.39 GW electrical before auxiliaries; derating reduces rather than increases the result. The 3 GW figure is therefore excluded from the conclusions until its source and units are verified.

5. Volatility as the principal risk

The calculated interannual spread across the three matched flares is 2.7x (2.27 versus 6.12 MMSCFD). No matching Kokori flare was detected in the 2021-2022 annual summaries; this should not be read as proof of zero continuous flow.

Coverage check by year: if net output equals 40-50% of nameplate, 53 MW installed requires 4.56-5.70 MMSCFD. The VIIRS estimate covers this band in 2022 and 2023; 2024 is near the lower edge. Coverage in 2020-2021 would have been about 40-50%. This is a screening result and requires operator data.

For comparison, Nigeria's national flaring volume moved between 5.41 and 7.20 bcm over the same period, a 1.3x spread. The matched sites show a larger amplitude, but open data cannot fully separate local operating dynamics from satellite-estimation uncertainty.

Individual observations:

Afiesere. Growth from 0.0009 to 0.0237 bcm in two years — more than twentyfold. The cause cannot be established from open data. The hypotheses (a change in gas lift compressor regime, a rising gas-oil ratio, a change in the separation scheme) remain hypotheses; there is no data to choose between them.

Eriemu. Peak in 2022, a decline of more than half by 2024. The trend direction is downward.

Kokori. No matching flare was detected in the annual summaries before 2023. Frequencies of 0.27 in 2023 and 0.44 in 2024 mean that a burning flare was detected in those shares of cloud-free observations; they are not direct duty-cycle measurements. Combined with the 1.45 km match distance, this makes Kokori the most uncertain of the three sites.

Control case. Twelve kilometres from Afiesere sits a flare delivering a steady 0.065-0.105 bcm/year (up to 10.2 MMSCFD) at a detection frequency of 0.92-0.99 across all five years. That single source exceeds all three project sites combined. Its licence attribution cannot be established from open data and requires separate verification.

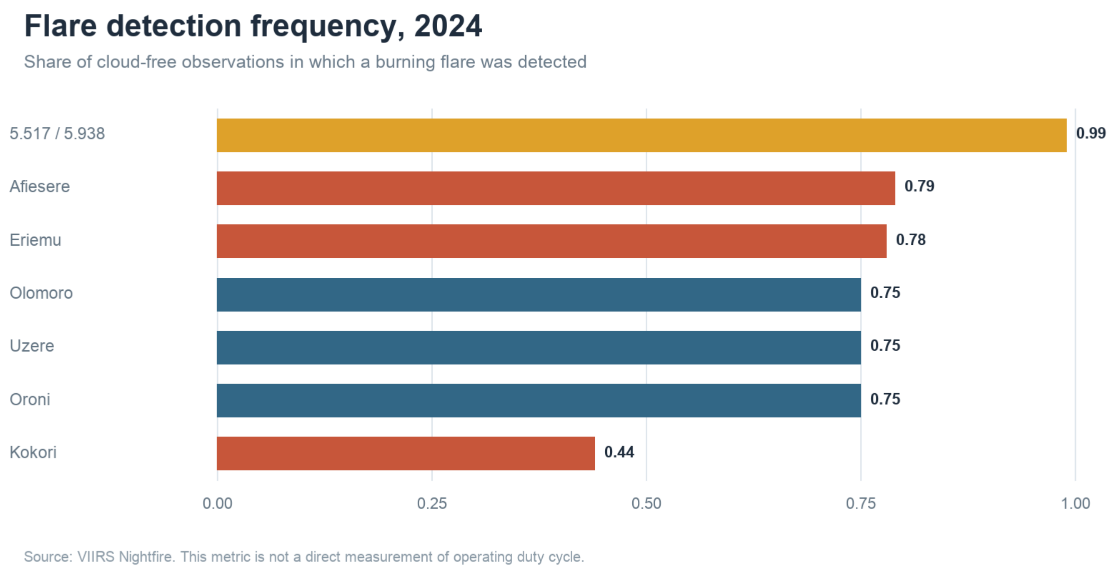

Figure 3. Detection frequency in 2024: the share of cloud-free satellite observations in which a burning flare was detected.

6. Gas composition: where the risk actually sits

A published study of 13 Niger Delta field samples reports methane at 89.93-98.08%, CO_2 at 0.47-4.83%, N_2 at 0.04-0.59%, and H_2S below the 0.20 ppm detection limit [4]. These values describe the sampled reservoir gases, not the specific OML 30 flare stream:

- Hydrogen sulphide content **below the 0.20 ppm detection limit**
- CO_2 around 1.5%, N_2 around 0.2%
- Methane 90-98%, C1-C5 sum from 95% to 99%
- General description of Nigerian associated gas: around 90% methane, ethane 3.9-5.3%, propane 1.2-3.4%, heavier fractions 1.4-2.4%

Converting these compositions gives a gas specific gravity in the range 0.60-0.64.

Three scenarios and calculated methane number:

	A. Light	B. Medium	C. Heavy
Specific gravity	0.58	0.60	0.63
CH_4	~97%	~94.5%	~91%
C_2	~0.7%	~2.0%	~3.9%
C_3	~0.3%	~1.0%	~1.9%
C_{4+}	~0.3%	~0.8%	~1.6%
Methane number	~98	~95	~86
Lower heating value, MJ/Nm^3	35.9	37.1	38.9

Methane number is calculated using the SwRI relationships between composition, motor octane number and methane number [5]. Reconstructing a full composition from specific gravity is the author's scenario estimate, not a laboratory analysis of the flare stream.

Where the problem begins. Extrapolating toward a heavier stream:

Specific gravity	CH_4	Methane number
0.63	91%	86
0.65	88%	79
0.70	82%	63
0.75	76%	47

Specific gravity around 0.65 is used here as a screening marker. Acceptable methane number and the need for C_{3+} removal depend on the selected engine, boost, ignition strategy and OEM fuel limits [5, 9].

The key uncertainty. Published data describe reservoir or station-average gas. A low-pressure separator stream sent to flare is often expected to be heavier, but that is not universal and the difference at these sites is unknown.

If flare-gas specific gravity is around 0.63-0.65, some standard lean-burn solutions may be suitable; closer to 0.70, C_{3+} removal or a different engine selection may be required. The stated 30-100% fuel-treatment uplift is only an author screening range. FID requires a chromatogram, process design and vendor quotations.

Heavy hydrocarbons and compositional variability are therefore among the main technical risks. Published reservoir samples indicate sweet gas, but they do not replace analysis of the actual OML 30 flare stream [4].

Specific gravity and full composition can be established by representative sampling with laboratory gas chromatography or by an online chromatograph. Until those data exist, engine and fuel-treatment selection remains conditional.

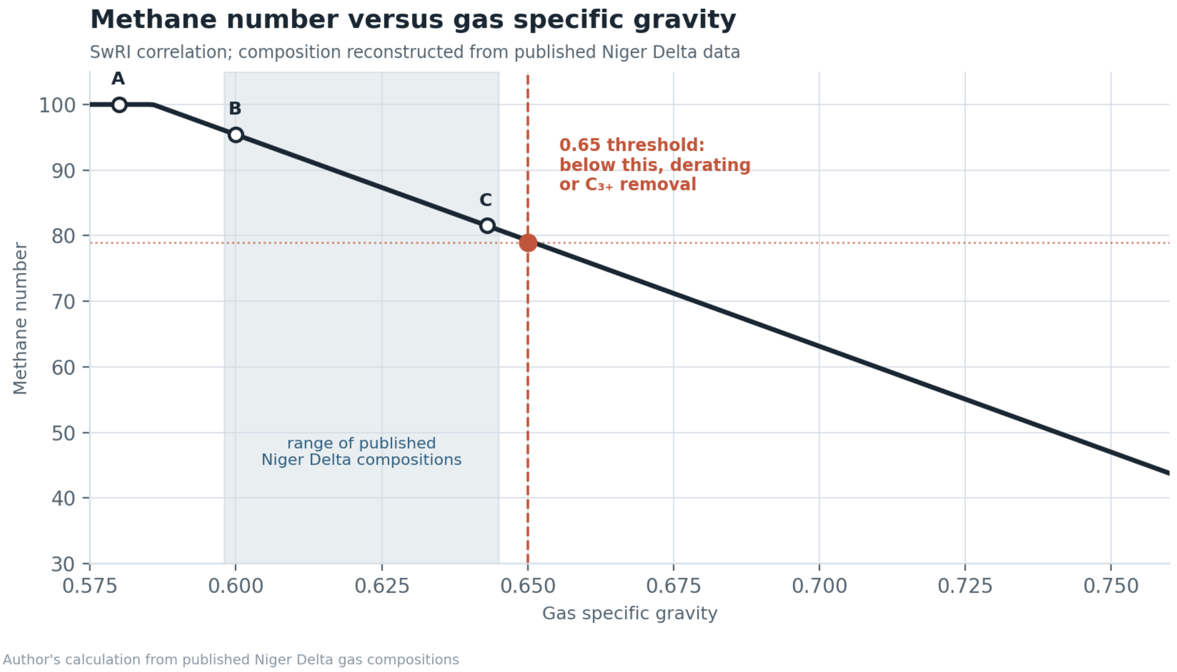

Figure 4. Calculated methane number as a function of gas specific gravity. Points A, B and C are the composition scenarios from Section 6.

7. Open questions

Questions a project of this kind must have answers to. None of them is a reproach: this is the standard list for the FID stage.

On gas

1. What is the specific gravity and full composition of the low-pressure stage stream reaching the flare — by chromatography, not by calculation?
2. How is produced gas allocated between gas lift, fuel gas and flare, and how does that allocation shift over the course of a day?
3. Which year of the five-year record was the installed capacity sized against?
4. What happens to the project on a return to 2020-2021 levels?
5. Why does the package include the Kokori site with a detection frequency of 0.44?

On equipment

6. Is the stated 53 MW a nameplate rating or a calculated delivered output under site conditions?
7. What derate is built into the calculation: for temperature, humidity, methane number?
8. Is fuel treatment with C_{3+} extraction provided for, and for which composition scenario is it sized?
9. What is the strategy when the methane number falls below 80 — load reduction, ignition timing change, stream blending?

On operations

10. How is spare parts supply organised at 35 km from Warri, and what is the planned interval between overhauls?
11. How does the data centre load profile (constant base load) fit an intermittent gas supply?
12. How is permitting structured? Off-grid generation may require a captive-generation permit or generation licence. Under the Electricity Act 2023, jurisdiction also depends on transfer to a State regulator and on whether the activity remains wholly within one State [10].

8. What this means for other programme participants

In the NGFCP round, 42 entities won 49 sites; by late 2025 NUPRC reported that permits to access flare gas had been issued to part of the awardee group. Engineering, financing, construction and stable operation are now the decisive stages [11].

A substantial share of permit holders are financial and trading structures rather than generation operators. The review above shows exactly where the risk concentrates for such participants:

- **Not in access to gas** — the regulatory frame provides it
- **Not in the oil producer's motivation** — the penalty mechanism creates it
- **Not in gas composition as such** — Niger Delta gas is sweet and light
- **But in two things**: the divergence between nameplate and delivered capacity, and the year-on-year volatility of the flare stream, which reaches 2.7x at individual sites

Both are identifiable before setting foot on site, from open data. Both change project economics by roughly a factor of two.

9. Reproducibility

Every calculation in this document is reproducible from open sources.

Volume data: VIIRS Nightfire annual summaries, Earth Observation Group, Payne Institute for Public Policy, Colorado School of Mines. Files for 2012-2024 are available on the EOG site under Annual Gas Flared Volume.

Site coordinates (latitude, longitude):

Station	Latitude	Longitude
Afiesere	5.55	6.01
Eriemu	5.52	6.06
Kokori	5.64	6.07
Olomoro	5.46	6.18
Oroni	5.36	6.14
Uzere	5.33	6.24
Evwreni	5.37	6.04

Procedure: filter rows with country code NGA, compute haversine distance to each coordinate, select the nearest flare within a 3 km radius, sum the volume column.

Conversion factor: 1 bcm/year = 96.75 MMSCFD; equivalently, bcm $\times 10^9 \times 35.3147 \div 365 \div 10^6$ = MMSCFD. 1 MMSCFD at 1,000 Btu/scf = 12.21 MW thermal.

Sources and reproducibility materials:

- [1] Elvidge C.D. et al. Methods for Global Survey of Natural Gas Flaring from VIIRS Data. Energies, 2016, 9, 14. https://doi.org/10.3390/en9010014
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- [5] Kubesh J., King S., Liss W. Effect of Gas Composition on Octane Number of Natural Gas Fuels. SAE 922359, 1992. https://doi.org/10.4271/922359
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- [10] NERC, Investor Regulatory FAQs under the Electricity Act 2023. https://nerc.gov.ng/need-help/services/investor-regulatory-faqs-nigerian-electricity-sector/

- [11] NUPRC, NGFCP successful bidders and implementation status. https://ngfcp.nuprc.gov.ng/wp-content/uploads/2023/10/NUPRC-ANNOUNCES-SUCCESSFUL-BIDDERS-FOR-THE-NGFCP.pdf and https://www.nuprc.gov.ng/wp-content/uploads/2026/04/Upstream-Gaze-Magazine-Vol.-12-26.pdf

10. Epistemic status: measurement, calculation, estimate

Statement	Status
Flaring volumes by year and site	satellite estimate with an uncertainty caveat
Attribution of flares to fields	**calculation** from published coordinates
Conversion of volume to thermal power	**calculation**, arithmetic
38-40% efficiency for reciprocating units on associated gas	author's **assumption**
Net output equal to 40-50% of nameplate	author's screening scenario; requires OEM confirmation
Composition reconstructed from specific gravity	author's **estimate**
Methane number	**calculation** using a published correlation
The claim that 53 MW is a nameplate figure	**hypothesis**, consistent with the data
Causes of the volume jump at Afiesere	**not established**, insufficient data
Specific gravity of the flare stream	**unknown**, no public data
Attribution of the large flare 12 km away	**not established**

About the author

Igor Shibanov is an independent engineer and distributed-generation analyst. Across his career with different companies, he has participated in delivering about 40 MW of gas-engine generation; about 25 MW of that was delivered by him through his own company. Experience includes Jenbacher, MTU, Caterpillar, MWM, Rolls-Royce, Jichai and Weichai, covering the full lifecycle from equipment selection to overhaul, including associated and sour gas.

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Corrections, clarifications and rebuttals are welcome. If you hold composition data for the flare stream at any of the sites mentioned, it would materially sharpen this review.