

## Production Decline and Maturity Assessment of the Rio Del Rey Basin, Cameroon: A Decade-Long Analysis (2012–2022)

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### Abstract

The Rio Del Rey Basin, historically Cameroon's primary hydrocarbon province, is undergoing irreversible structural decline that threatens the country's energy security and economic stability. This study presents a comprehensive quantitative assessment of the basin's maturity through analysis of production, drilling, and reserves data from the National Hydrocarbons Corporation (SNH) from 2012 to 2022. Our findings reveal a critical reserves renewal crisis, evidenced by a 0% oil Reserve Replacement Ratio (RRR) in 2021–2022 and continuous erosion of the oil Reserves to Production (R/P) ratio. Simultaneously, the gas R/P ratio experienced a dramatic plunge following the 2018 startup of the Hilli Episeyo FLNG facility, marking Cameroon's strategic transition toward gas exploitation. The root causes are identified as systematic abandonment of oil exploration coupled with accelerated reservoir degradation. This research demonstrates that current maintenance drilling strategies yield diminishing returns and concludes that only immediate implementation of enhanced oil recovery techniques and strategic infrastructure repurposing can mitigate decline and maximize residual value from this mature basin.

**Keywords:** Production Decline, Mature Basin, Reserve Replacement Ratio (RRR), Reserves-to-Production Ratio (R/P), Reservoir Depletion; Enhanced Oil Recovery (EOR)

### Nomenclature

bbl: barrel

Bopd: barrels of oil per day

Bcpd: barrels condensate per day

mD: millidarcy

M bbl : million barrels

Mmscf/d: million standard cubic feet per day

Mtpa: million tonnes per annum

Scf: standard cubic feet

TCF: trillion cubic feet

$\Phi$ : porosity

K: permeability

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## Abbreviations

**API:** American Petroleum Institute  
**AR:** Added Reserves  
**DKC:** Douala/Kribi-Campo Basin  
**EOR:** Enhanced Oil Recovery  
**FLNG:** Floating Liquefied Natural Gas  
**GOR:** Gas-Oil Ratio  
**KPI:** Key Performance Indicator  
**LB:** Logone Birni Basin  
**LPG:** Liquefied Petroleum Gas  
**P&A:** Plugged and Abandoned  
**RDR:** Rio Del Rey Basin  
**R/P:** Reserves-to-Production Ratio  
**RRR:** Reserve Replacement Ratio  
**SNH:** Société Nationale des Hydrocarbures (National Hydrocarbons Corporation)  
**SPE:** Society of Petroleum Engineers  
**USGS:** United States Geological Survey

## 1. Introduction

For decades, Cameroon's oil sector has been a cornerstone of its economy. However, since the late 2010s, this vital industry has entered a period of sustained structural decline. The numbers tell a clear story: average daily crude production has plummeted from a peak of around 100,000 barrels per day in the 2000s to an estimated 54,000–60,000 barrels in 2024–2025. This downturn is particularly acute in the Rio Del Rey (RDR) Basin, a region in the Gulf of Guinea that has historically supplied over 70% of the nation's oil. This challenge is not Cameroon's alone; it echoes across oil producing nations in Africa like Nigeria and Angola, all grappling with volatile global markets and the worldwide shift towards cleaner energy [1,2]. For Cameroon, the implications are severe. The decline threatens to undermine the country's energy security, reduce crucial state revenues (which still rely on oil for 16 – 20% of its budget), and destabilize macroeconomic growth, all while widening the current account deficit.

To this end, the investigation is guided by three primary objectives:

- To evaluate the maturity level of the Rio Del Rey Basin through a systematic analysis of its production history and reserves data.
- To quantify the observed production decline by employing key industry metrics, specifically the Reserve Replacement Ratio (RRR), the Reserves-to-Production (R/P) ratio, and well flow rates.
- To classify reservoir performance based on production data, thereby distinguishing areas with residual potential from those nearing exhaustion.

Through this structured approach, the study seeks to provide a critical diagnostic foundation for strategic planning aimed at

mitigating production decline and optimizing the basin's remaining value [3,4].

### 1.1. Context of Petroleum Activities in Cameroon

Cameroon's hydrocarbon resources are geographically and strategically defined by three principal sedimentary basins: the Rio Del Rey (RDR), the Douala/Kribi-Campo (DKC), and the Logone Birni (LB). Together, these formations constitute the core of the nation's oil and gas sector, yet they represent markedly different stages of the resource lifecycle. (Société Nationale des Hydrocarbures n.d.) The Rio Del Rey (RDR) Basin stands as the patriarch of Cameroonian production. Having entered development in 1977, its long history of extraction has led to a state of advanced maturity, which is now characterized by a natural and structural decline in reserves. In contrast, the Douala/Kribi-Campo (DKC) Basin represents a more contemporary chapter. Its development, beginning in 1997, has established it as a strategic hub, distinguished not by oil but by its substantial natural gas reserves, making it the primary focus for 90% of the country's gas resources. The third member of this trio, the onshore Logone Birni (LB) Basin in the Far North, remains an enigma. Its potential is overshadowed by persistent regional insecurity, which has effectively suspended exploration and left its resources untapped [5].

Confronted with the RDR's decline, a strategic national pivot is underway, shifting focus toward the gas-rich DKC basin. This reorientation is not merely theoretical; it is physically embodied by infrastructures like the Floating Liquefied Natural Gas (FLNG) unit at Kribi, which enables the export and monetization of this critical resource. This strategic shift is part of a coherent, multi-axial national strategy. To bolster domestic energy security, gas is being channeled to fuel new power plants, directly addressing chronic electricity deficits. Concurrently, the government seeks to revitalize exploration through new licensing rounds and is modernizing its legal framework under the revised 2019 Petroleum Code to improve governance and attract investment.

The tangible outcome of this gas pivot is most evident in the performance of the Kribi FLNG unit, officially named the Hilli Episeyo [6]. Operated in partnership with Perenco and the state-owned SNH, this facility began exporting in March 2018 with an initial capacity of 1.2 million tonnes per annum (Mtpa). Through an agreement with partners Perenco and SNH, utilization has been steadily increased toward 1.4 Mtpa in 2022 and up to 1.6 Mtpa from 2023 onward. This operation is critical: it not only provides a crucial revenue stream that offsets losses from the RDR's aging oil fields but also supplies condensates and LPG for domestic consumption, while securing Cameroon's place on the global LNG map [7].

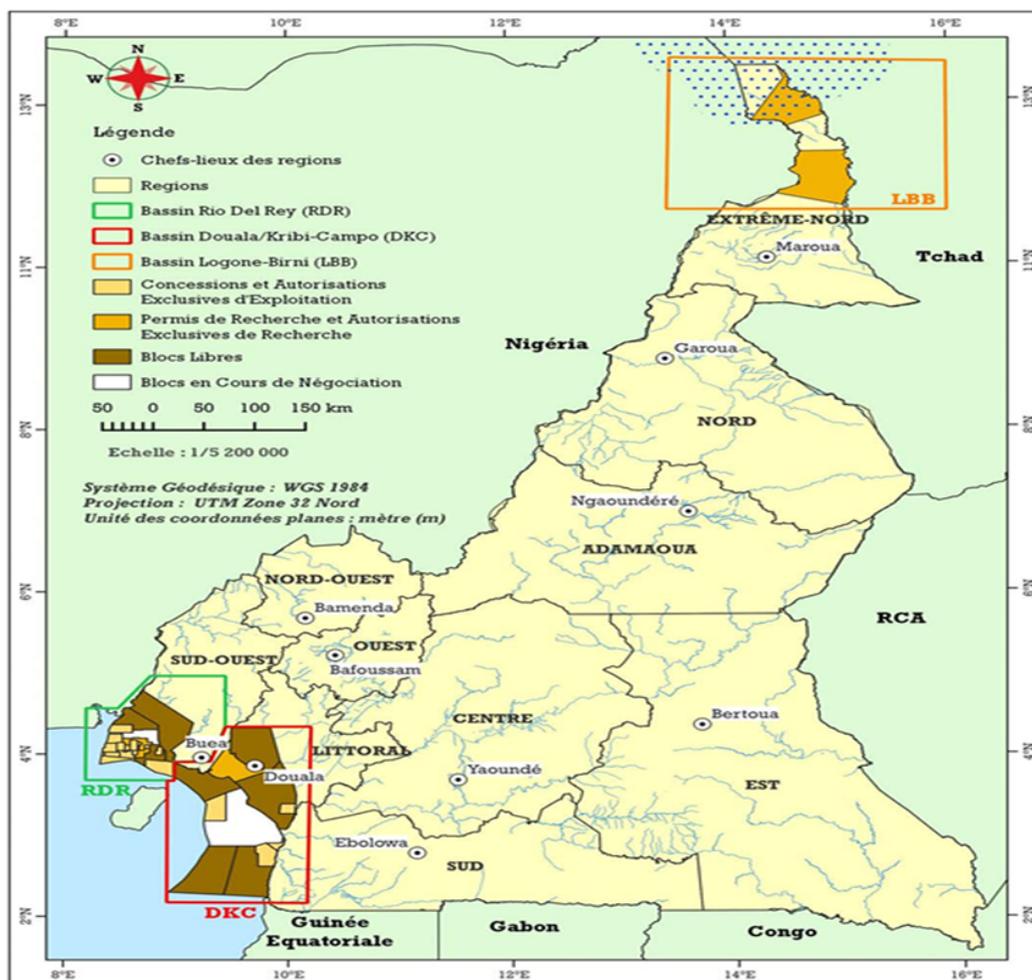


Figure 1: Overview Of The Oil And Gas Domain As Of 12/31/2022 (Source: Snh 2022 Report)

## 2. Methodology

### 2.1. Synthesis of SNH Reports from 2015–2022

The synthesis of SNH reports was conducted by aggregating and normalizing raw production, drilling, and reserves data to quantify depletion dynamics. This retrospective approach is justified by its ability to identify structural trends over a multi-year period, reducing biases related to annual fluctuations and optimizing extrapolation for future modeling. Data were extracted from official SNH reports and validated by cross-referencing with USGS databases for similar basins.

### 2.2. National Production Dynamics (2012–2022)

To analyze production, annual variations were calculated as follows:

$$\bullet \text{ Variation (\%)} = \frac{\text{Production}_n - \text{Production}_{n-1}}{\text{Production}_{n-1}} * 100$$

This simple yet robust formula, commonly used in petroleum economics, allows for measuring decline or growth rates, optimizing the detection of peaks (e.g., 2015 for oil) and inflection points (e.g., FLNG launch in 2018 for gas). The choice to include 2012–2014 ensures a pre-peak baseline, avoiding biases from truncated analyses [8-11].

Year	Oil Production (M bbl)	Crude Variation (%)	Commercial Gas Production (M scf)	Gas Variation (%)
2012	22.35	...	151.99	...
2013	24.28	+8.63%	5376.44	+3437.49%
2014	27.50	+13.26%	10859.55	+101.99%
2015	34.97 (Peak)	+27.18%	13048.20	+20.17%
2016	33.69	-3.67%	12612.52	-3.34%

2017	27.726	-17.69%	13886.97	+10.10%
2018	25.13	-9.36%	51678.62	+272.28% (FLNG Startup)
2019	25.995	+3.43%	70856.13	+37.11%
2020	26.556	+2.16%	75243.08	+6.19%
2021	25.610	-3.56%	78973.25	+4.96%
2022	24.951	-2.58%	88224.44	+11.71%

**Table 1: Evolution of National Hydrocarbon Production (2012–2022)**

This method was chosen for its alignment with SPE standards, allowing for international comparison of decline rates [12].

This indicator, recommended for assessing unit productivity, optimizes the identification of maturity by quantifying the decreasing efficiency of infill wells.

### 2.3. Drilling Activities (2015–2022)

Drilling data were classified by type (development vs. exploration), with the calculation of the average flow rate:

Exploration/Appraisal Share (%) = (Number of Explo/Appre Wells / Number of Wells Drilled) × 100

- Average Flow Rate (bopd) = Sum of Flow Rates / Number of Wells Drilled.

It measures the priority given to renewal, a key KPI (Key Performance Indicator) for mature basins [13].

Year	Total Wells Drilled	Main Activity	Key Highlight	Notable Wells
2015	6	RDR Development	Completion of major Padouk wells	PDK-4L (6000 bopd)
2016	12	RDR Development	Manatee-1 exploration failure; Start of Logbaba gas drilling	BJM-004 (3500 bopd)
2017	10	DKC Gas Development	Heavy investment in DKC for FLNG (Sanaga South), Decline of RDR	LA-107 (40–60 mmscf/d); SSA-9 (60 mmscf/d)
2018	17	RDR Infill Development	FLNG ramp-up; 13 infill wells in RDR (Kole Marine/Lima) with modest flow rates	KLM-16ST (1500 bopd); IE-4 (P&A)
2019	21 (Peak)	RDR Infill Development	Attempted oil rebound; Emergency drilling in RDR	OCM-001 (4500 bopd); OAK-S1A (4400 bopd)
2020	16 (8 completed)	RDR Infill Development	Covid-19 slowdown; Completion of 2019/early 2020 wells	EKM-061ST (1490 bopd)
2021	16	RDR Development	2 failures (P&A) in RDR; 2 Sanaga South gas wells	EKM-058ST2 (2053 bopd); KB-007/008 (50 mmscf/d)
2022	22 (Peak)	RDR Infill Development	Record activity to compensate for falling reserves/production	KL-004 (1194 Bcpd); RDR wells mostly modest

**Table 2: Summary of Drilling Activity and Operational Results by Year (2015–2022)**

### 2.4. Reserves Evaluation and Sustainability (2015–2022)

The formulas used are:

- Added Reserves (AR) = Reserves<sub>n</sub> - Reserves<sub>{n-1}</sub> + Production<sub>n</sub>
- RRR (%) = (AR / Production<sub>n</sub>) × 100
- R/P (years) = Proved Reserves / Production<sub>n</sub>

The RRR (Reserve Replacement Ratio) was chosen for its ability to quantify renewal, a critical indicator for mature basins like the RDR, while the R/P (Reserves/Production) ratio assesses temporal sustainability, optimizing depletion projections. The inclusion of 2014 as a baseline ensures calculation continuity [14,15].

Year	Proved Reserves (M bbl)	Production (M bbl)	Added Reserves AR (M bbl)	RRR (%)	R/P (Years)	Key Highlight
2014	276.97	27.50	N/A	N/A	10.07	Reserve baseline for 2015
2015	288.03	34.97	36.03	103.03%	8.24	Production peak. RRR>100% (positive reserve revision)

2016	240.96	33.69	-13.38	-39.71%	7.15	Start of RRR crisis (Declassification of 47 M bbl)
2017	210.62	27.726	-2.614	-9.43%	7.61	Continued reserve decline
2018	196.95	25.13	-11.40	-45.36%	7.84	Worst RRR of the period (Sharp fall in reserves)
2019	311.30	25.995	140.345	539.90%	11.97	Artificial rebound (Inclusion of condensates/major re-evaluation)
2020	309.97	26.556	25.226	95.00%	11.67	Stabilization (Added Reserves close to Production)
2021	284.36	25.610	0.00	0.00%	11.10	RRR at zero (No compensation)
2022	259.41	24.951	0.00	0.00%	10.40	RRR at zero (Second consecutive year)

**Table 3: Dynamics of Proved Oil Reserves, Replacement Rate (RRR) and Life Horizon (R/P) (2015–2022)**

Year	Resources (TCF)	Production (TCF)	Added Reserves (TCF)	RRR (%)	R/P (Years)	Key Highlight
2014	5.430	0.010860	N/A	N/A	499.98	Reserve baseline for 2015
2015	6.106	0.013048	0.689	5285.9%	467.91	Extremely high RRR (Major reserve re-evaluation)
2016	6.064	0.012613	-0.029	-2.30%	480.77	
2017	6.050	0.013887	-0.0007	-0.05%	435.66	
2018	6.000	0.051679	0.0017	3.25%	116.11	R/P Plunge (FLNG Production Surge)
2019	6.430	0.070856	0.5009	707.03%	90.75	RRR Rebound (Major Re-evaluation)
2020	6.350	0.075243	-0.005	-6.97%	84.40	
2021	6.275	0.078973	-0.004	-4.68%	79.45	
2022	6.187	0.088224	-0.0006	-0.72%	70.13	

**Table 4: Dynamics of Proved Gas Reserves, Replacement Rate (RRR) and Life Horizon (R/P) (2015–2022)**

## 2.5. Drilling Data Analysis

Drilling indicators were calculated as follows:

- Average Flow Rate (bopd) = Sum of Flow Rates / Number of Wells Drilled
- Exploration/Appraisal Share (%) = (Number of Explo/Appre Wells / Number of Wells Drilled) × 100

These metrics, standard in productivity analysis, were chosen for their ability to quantify efficiency and strategic priority, optimizing the assessment of RDR maturity [16].

## 3. Production Data Analysis

For production dynamics, decline/growth rates were calculated as indicated, with the average post-oil-peak rate being the mean of variations from 2016–2018 and 2021–2022 (excluding the rebound). This choice excludes anomalies for a robust estimate of structural decline. Parallel charts optimize the visualization of the oil/gas decoupling.

For the reserves renewal crisis:

- Negative average RRR (2016–2018) = Absolute mean

- R/P Erosion Rate =  $[(R/P_{2018} - R/P_{2015}) / R/P_{2015}] \times 100$
- Uncompensated Production = Sum 2021–2022

This three-step methodology assesses the asset decommissioning speed: first, the Reserve Replacement Ratio (RRR) measures the rate of non-compensation of reserves, particularly significant before the artificial adjustment in 2019. Second, the R/P Ratio Erosion Rate precisely quantifies the loss of the sustainability horizon that preceded the same rebound. Finally, calculating the total amount of oil extracted from reserves without being replaced during the critical years (2021–2022) certifies the structural depletion of the asset [17].

For gas dynamics:

- R/P plunge =  $[(R/P_{2022} - R/P_{2017}) / R/P_{2017}] \times 100$
- Contribution to RRR (2019) = Gas RRR / Oil RRR

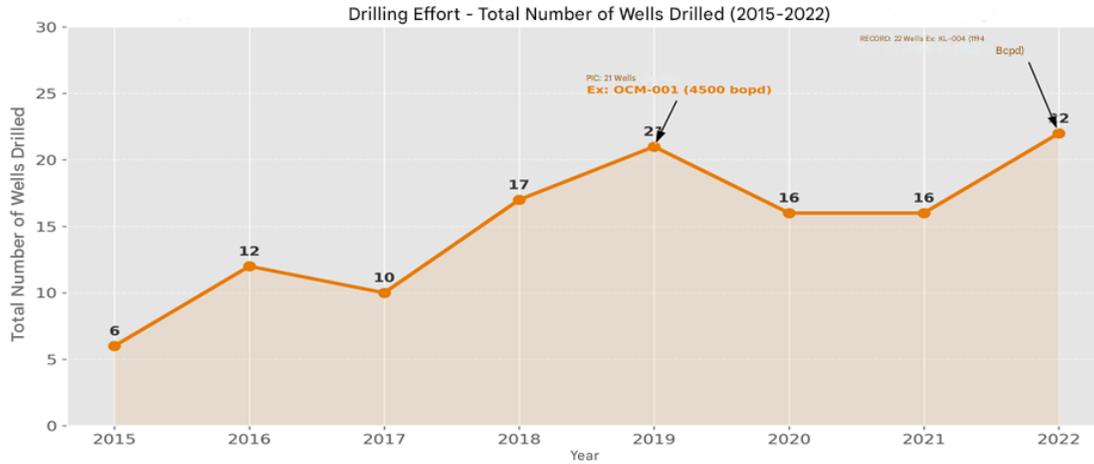
The analysis of gas dynamics is performed in two complementary steps to measure the strategic transition of the sector, a choice optimized for measuring the impact of a major project. First, the

Gas Production Curve (M scf) with FLNG Annotation serves to highlight the dependence of exponential gas growth on a single project (Hilli Episeyo) started in 2018. Second, the Gas R/P Curve (Years) allows visualization of the direct impact of this new

production on the resource's sustainability horizon [18].

## 4. Results and Discussion

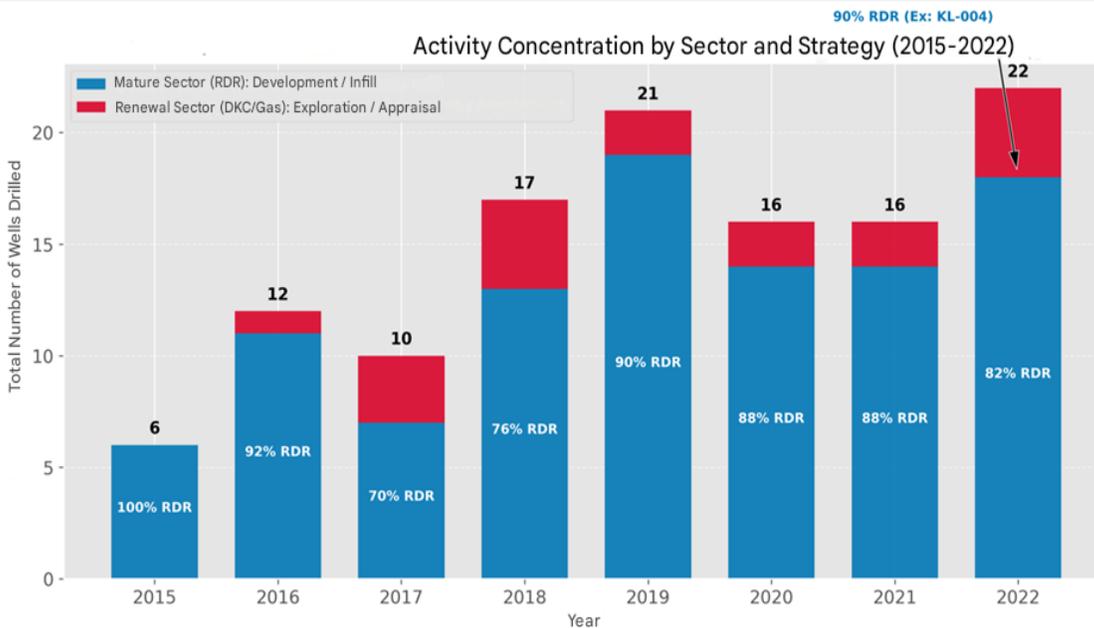
### 4.1. Analysis of Drilling Data



**Figure 2:** Curve of Total Wells Drilled Per Year (2015-2022)

This curve highlights the scale of investment required to sustain production levels. The intensive drilling campaigns conducted in 2019 (21 wells) and 2022 (22 wells) reveal a corrective strategy in

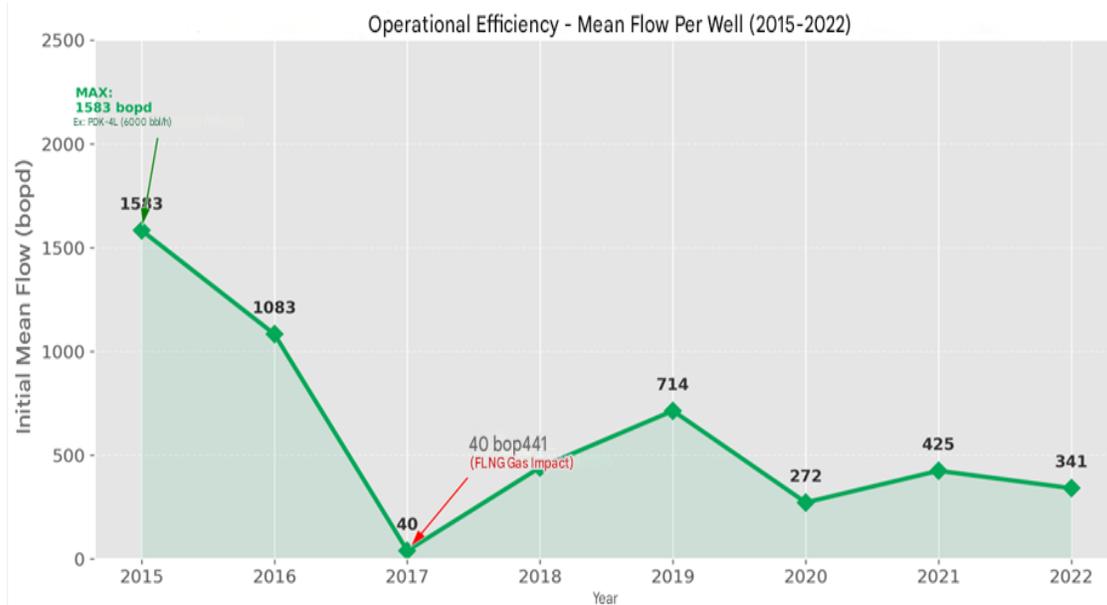
maturing fields, where increasing the number of wells struggles to compensate for the natural decline of the reservoirs.



**Figure 3:** Activity Concentration Diagram

This diagram demonstrates the strategic focus. The massive share of Development (or infill) wells confirms that activity is primarily

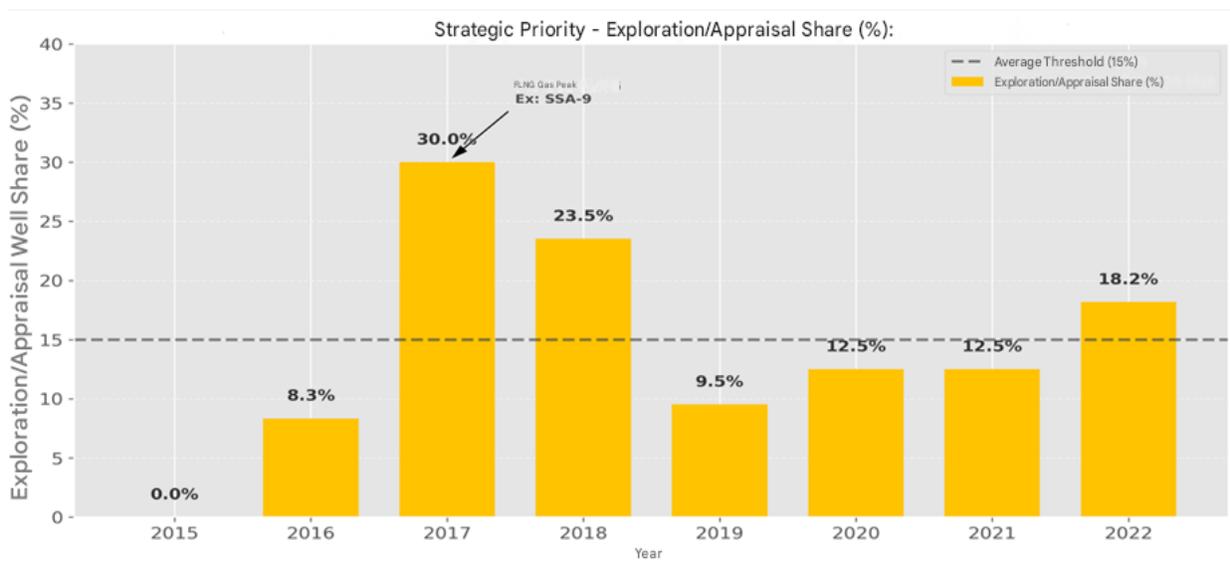
concentrated on maintaining existing reservoirs.



**Figure 4: Average Flow Rate per Well (bopd) Curve**

Its purpose is to measure the unit return on investment and demonstrate the declining quality of the targeted reservoirs. Despite increased effort, the average flow rate post-2018 remains

stagnant at a low level (300–700 bopd), proving that the new infill zones are structurally less productive.



**Figure 5: Exploration/Appraisal Share (%) Curve**

The low percentages (10–18% after 2018) signal a neglect of oil Exploration in favor of gas and short-term maintenance.

The location of drilling relative to the basins allows for their classification according to their lifecycle.

Analysis/Detailed Information	Role and Finding (Based on your data)	Supporting Example
Identification of Mature Basin (Rio Del Rey - RDR)	The majority of drilling is concentrated in one area (the RDR) and is primarily of the Development/Infill type. This maintenance drilling indicates advanced maturity and structural decline of existing fields	The drilling peaks in 2019 (21 wells) and 2022 (22 wells) are Infill efforts in the RDR to compensate for decline, not to discover new reserves
Identification of Emerging Basin (Douala Kribi Campo - DKC)	The low number of wells, but those focused on Exploration/Appraisal, indicates a basin in the de-risking or early development phase. The DKC is the home of gas	The SSA wells (2017) and activity associated with the FLNG illustrate a concentration of effort on gas resources in a basin less explored for oil
Missed Discoveries and Dead Zones	Exploration failures in certain concessions, despite drilling, signal dead zones or high geological risk, which will be avoided by future oil investors	The Manatee-1 (2016) exploration failure or P&A (Plug & Abandon) wells like IE-4 (2018) reveal geographical sectors where the exploration risk is too high

**Table 5: Characterization of Oil and Gas Basins by Drilling Activity (2015–2022)**

Reservoir Classification (Based on Initial Flow Rate)	In-Situ Characterization and Justification	Key Strategic Implication
Class I: Very High Flow Rate ( $\geq 2000$ bbl/d)	High-quality reservoir (Sweet Spots). Represents the best sands or less depleted compartments	Benchmark of quality/maximum potential. These zones are largely depleted post-2019, justifying the urgency of EOR intervention
Class II: Medium Flow Rate (300 to 1500 bbl/d)	Medium quality and mature reservoir. Typical rate for Infill drilling in the RDR. Production often depends on Stimulations (fracturing)	Decline in Drilling Efficiency. The Average Flow Rate dropped to 341 bopd in 2022, proving that maintenance efforts no longer compensate for permeability degradation
Class III: Very Low Flow Rate ( $\ll 100$ bbl/d)	Poor quality or highly depleted reservoir. Indicator of very low permeability or risk of Water Breakthrough	High Operational Risk. These wells are often abandoned, signaling the imminent depletion of certain peripheral areas of the field
Gas Characterization (M scf)	Gas/Oil Separation. Location of gas-dominated (DKC) versus oil-dominated (RDR) reservoirs	Strategic Shift. The flow rate in M scf (SSA-9, FLNG) confirms that the future of the DKC basin is centered on gas sustainability

**Table 6: Synthesis of Reservoir Characterization by Initial Flow Rate Classification (2015–2022)**

Classification	Flow Rate Trend	Estimated Porosity ( $\Phi$ )	Estimated Permeability (K)	Inferred Reservoir Characteristics	Supplementary (Production Factor)
I. High Performance	$\geq 2500$ bbl/d or $\geq 40$ mmscf/d	$\approx 25\%$ to $35\%$	Very High (Hundreds of mD to D)	Very clean Pleistocene or Miocene sands. Strong connectivity	Natural drainage = fewer wells
II. Good Performance	1000 to 2500 bbl/d	$\approx 20\%$ to $28\%$	High (Tens to Hundreds of mD)	Good quality Rio Del Rey sands. Primary reservoirs	Pressure monitoring = sustainable profitability
III. Moderate Performance	300 to 1000 bbl/d	$\approx 15\%$ to $22\%$	Moderate (Low Tens of mD)	Finer sands, or Heavily Exploited (Mature). Rates limited by reduced permeability or pressure	Artificial lift = high OPEX
IV. Low Performance / Depleted	$\ll 100$ bbl/d or Non-Productive	Low ( $< 15\%$ )	Very Low ( $\ll 1$ mD or $\ll 10$ mD)	Cemented, clayey, or Highly Depleted reservoirs. BKM-102 is a case of "reservoir degradation"	Infill drilling = profitability not guaranteed

**Table 7: Reservoir Classification by Performance and Estimated Petrophysical Properties**

The porosity ( $\Phi$ ) and permeability (K) values presented here result from calculated inferences based on production data, a recognized albeit indirect method for characterizing reservoir petrophysical properties. The unfavorable evolution of Cameroonian reservoirs

is clearly apparent through the progressive degradation of drilling outcomes: the transition from Class I wells to lower productivity categories reveals a concerning structural decline. This deterioration is accompanied by two interdependent phenomena:

- Increasing operational costs: Producing 1000 daily barrels now requires a greater number of wells and the systematic use of stimulation techniques
- Deterioration in drilling target quality: New targets are predominantly located in marginal areas or those affected by the depressurization of mature reservoirs

transformation of its economic and technical model.

#### 4.2. Production Data

The quantitative analysis of production trends underscores a fundamental shift in the basin's dynamics, characterized by a structural decline in oil and a transformative surge in gas production, as summarized in the table below:

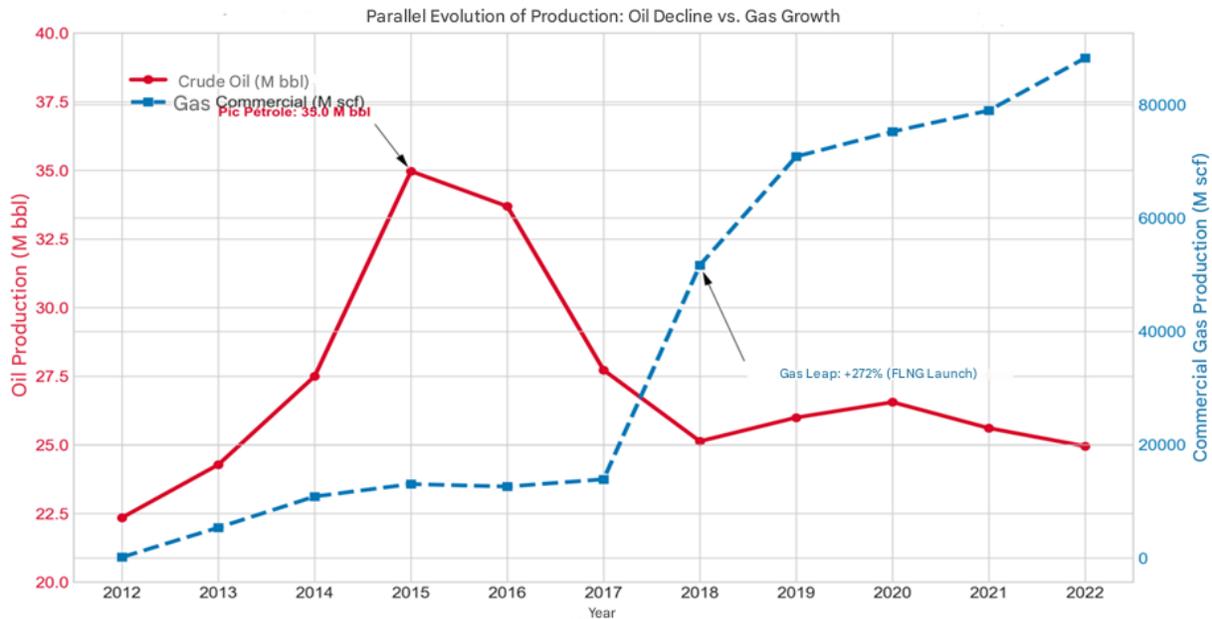
This dual observation validates the hypothesis that the basin has now entered an advanced maturity phase, initiating a profound

Indicator	Calculation	Result	Analytical Commentary
Average Post-Peak Oil Decline Rate (2016–2022)	Mean (-3.67; -17.69; -9.36; -3.56; -2.58) Excluding 2019–2020 as technical rebound	-7.37%	Structural decline = accelerated depletion of the RDR
Gas Growth Rate (2017–2018)	+272.28% (FLNG Startup)	+272.28%	The FLNG project (Hilli Episeyo) is the sole driver of the gas transition

**Table 8: Production Dynamics (Oil vs. Gas)**

This juxtaposition confirms the RDR basin's irreversible structural decline in oil production, while simultaneously highlighting the

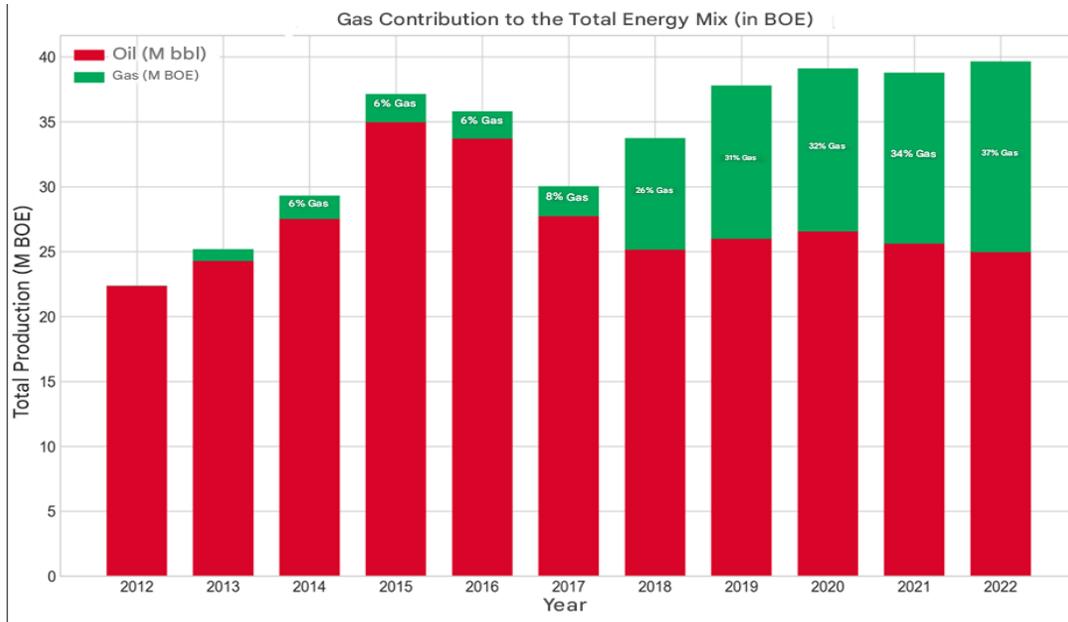
pivotal role of major gas infrastructure in redefining the national energy portfolio.



**Figure 6: Oil Decline and Gas Growth**

The graph clearly shows the Oil Peak in 2015 followed by a structural decline (negative average rate), contrasting with the

quantum leap in gas in 2018 (+272.28% variation).

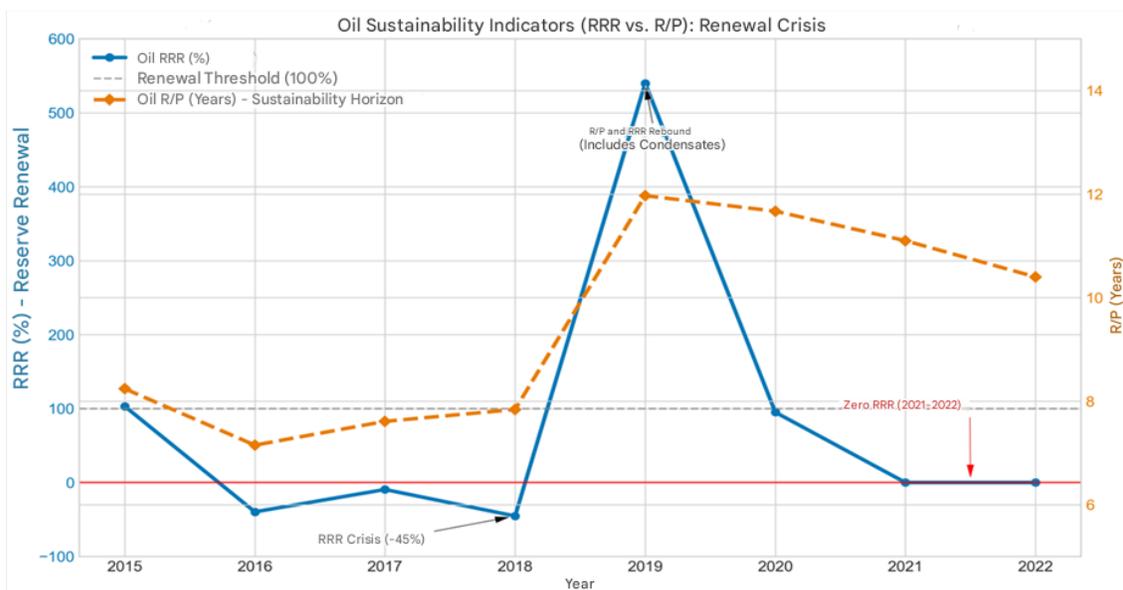


**Figure 7: Gas Contribution to Total Energy Mix**

The contribution of gas to total energy produced has skyrocketed since 2018, highlighting the country's de facto energy transition.

Indicator	Calculation	Result	Analytical Commentary
Average Negative RRR (2016–2018)	Absolute Mean of 2016–2018 (39.71; 9.43; 45.36)	-31.50%	Exploration crisis: 30% of production not compensated before 2019
Oil R/P Erosion Rate (2015–2018)	$(7.84 - 8.24) / 8.24 \times 100$	-4.85%	Sustainability decreased by 5% before the artificial addition of condensates in 2019, confirming the degradation of the oil asset
Uncompensated Production (2021–2022)	25.610 + 24.951 (M bbl) (Since AR=0 for 2021–2022)	50.561 M bbl	Two years of lost production (RRR = 0%), due to a lack of profitable discoveries

**Table 9: Oil Renewal Crisis**



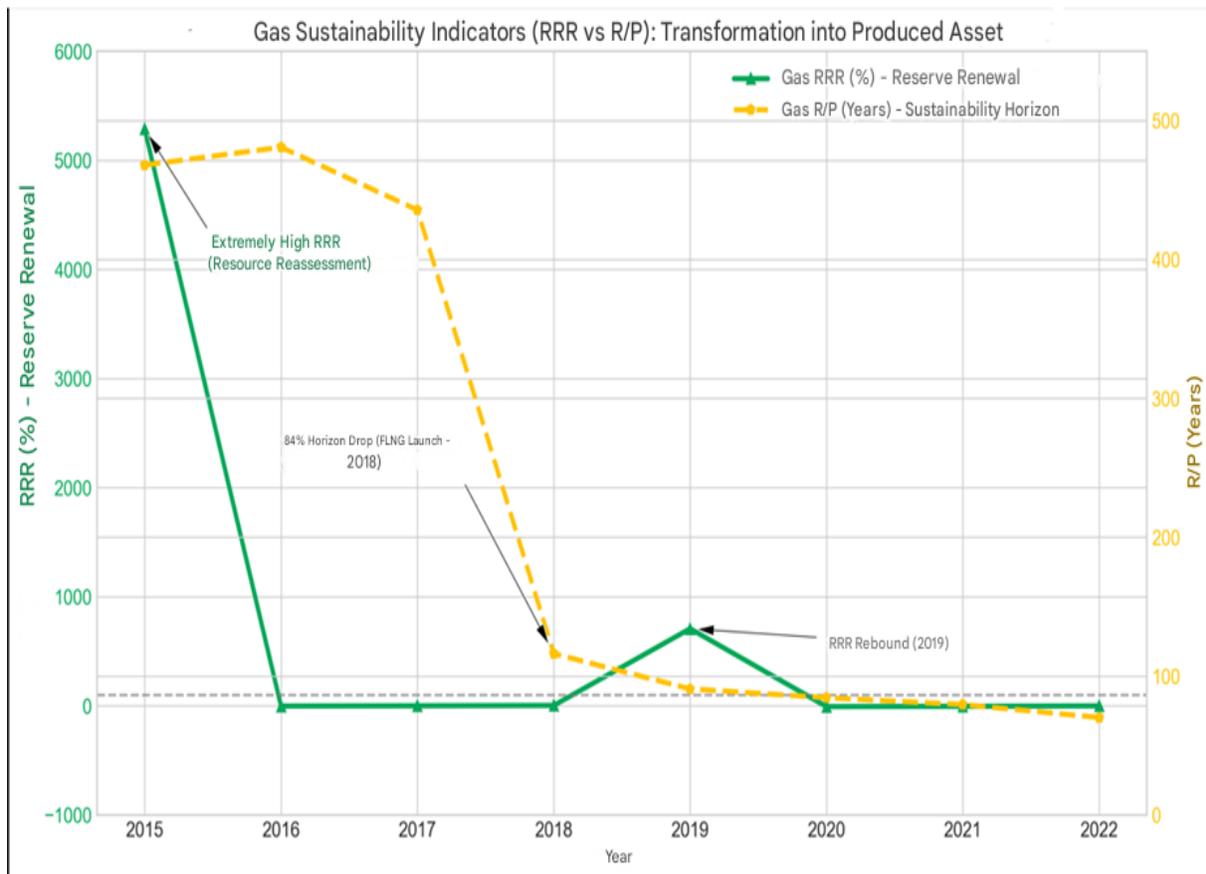
**Figure 8: Oil RRR and Oil R/P Curve**

This combined graph reveals that the Cameroonian oil industry has been in a structural renewal crisis since 2015, temporarily masked by accounting adjustments.

- Immediate Negative Correlation: Periods of negative RRR (2016–2018) correspond to the erosion of the R/P horizon (which drops from 8.24 to 7.84 years). The lack of exploration reduces sustainability.
- The 2019 (Artificial) Effect: The spectacular RRR of 539.90%

in 2019 causes an immediate jump in the R/P to nearly 12 years. This illustrates how major re-evaluations (inclusion of condensates) mask the real renewal crisis.

- Post-2019 Crisis: The R/P begins to decline again after 2019, despite the rebound, because the RRR falls back to 0% in 2021–2022. This confirms that the oil stock continues to be consumed without being renewed.



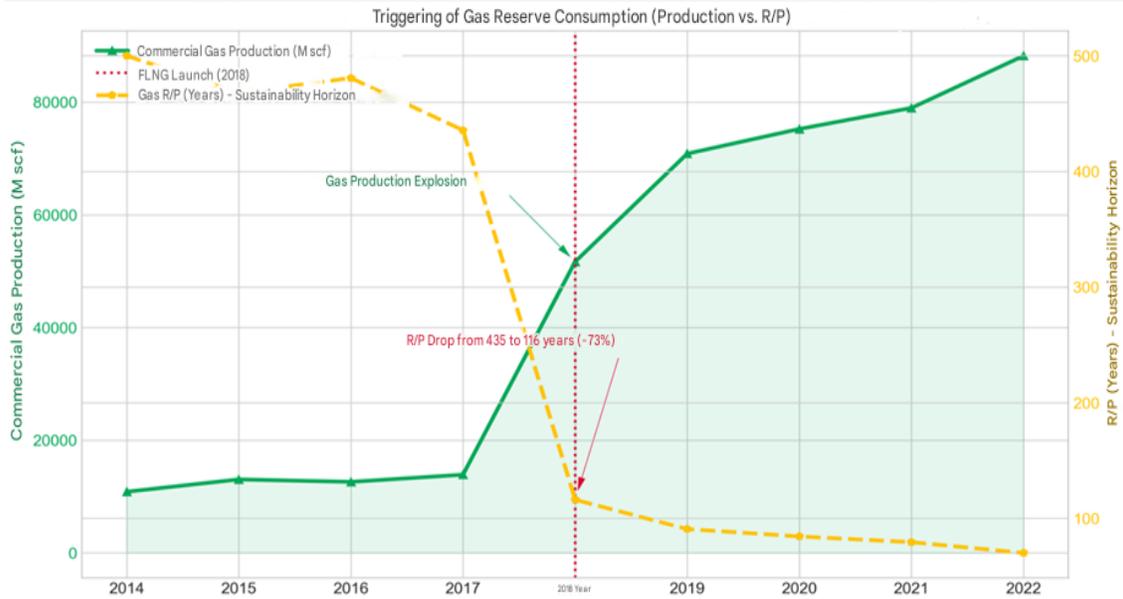
**Figure 9:** Combined Gas RRR and Gas R/P Diagram

Analysis of the Combined Gas RRR and Gas R/P Chart reveals the following key points:

- Trigger for Exploitation: The major event is the massive drop in Gas R/P in 2018 (from 435 to 116 years). This plunge is the direct consequence of the FLNG production surge and marks the transition from a dormant reserve to a consumed asset.
- Extreme RRR Volatility: The RRR is either very high (re-evaluation of existing resources) or close to 0% or negative

(production without adding new discoveries). The volatility of the RRR is less concerning than for oil, as the R/P horizon remains above 70 years, indicating a very comfortable long-term sustainability.

- Gas Strategy: After 2019, the low RRR suggests the operator is focusing on exploiting already proven reserves rather than drilling for new (costly) gas discoveries.



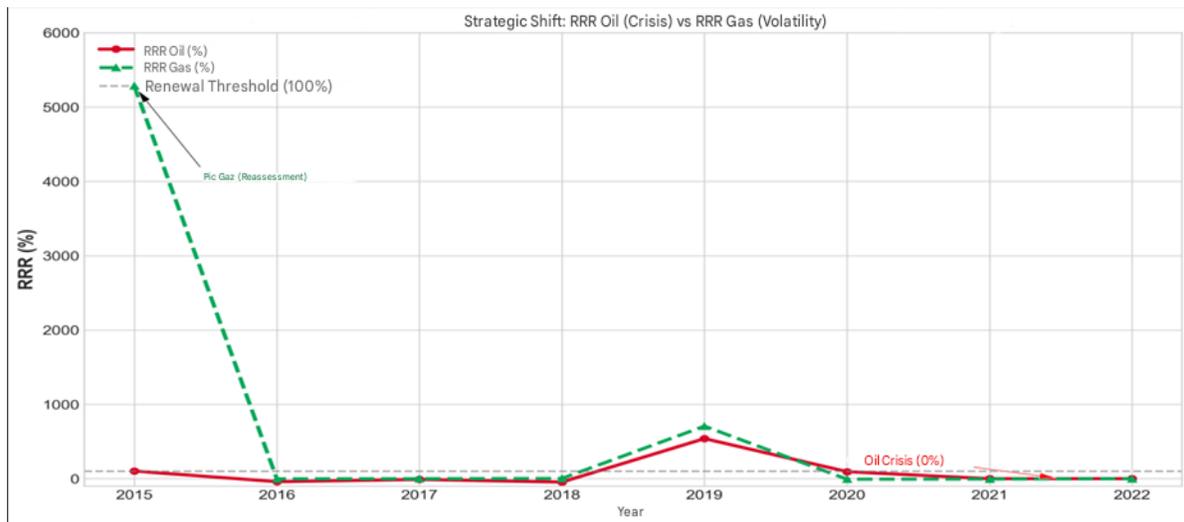
**Figure 10:** Combined Gas R/P and Gas Production Curve with FLNG Startup Impact

The commissioning of the Hilli Episeyo FLNG unit in 2018 redefined the dynamics of Cameroon's gas sector along two fundamental axes:

- The transformation of the reserve profile materialized through a significant adjustment of the gas R/P ratio. Although maintained at a comfortable horizon exceeding seventy years, this post-2018 recalibration attests to a strategic transition: gas has shifted from being a strategic reserve to a fully integrated

asset within the production portfolio.

- Concurrently, the production architecture underwent a major reconfiguration. The exponential growth recorded since 2018 reveals a near-exclusive dependence on the Hilli Episeyo project. This project has progressively established the DKC basin as the main driver of national hydrocarbon growth, concentrating the majority of investments and sectoral development prospects.



**Figure 11:** Combined Oil RRR and Gas RRR Curve

### 4.3. Synthesis of Drilling and Production Data

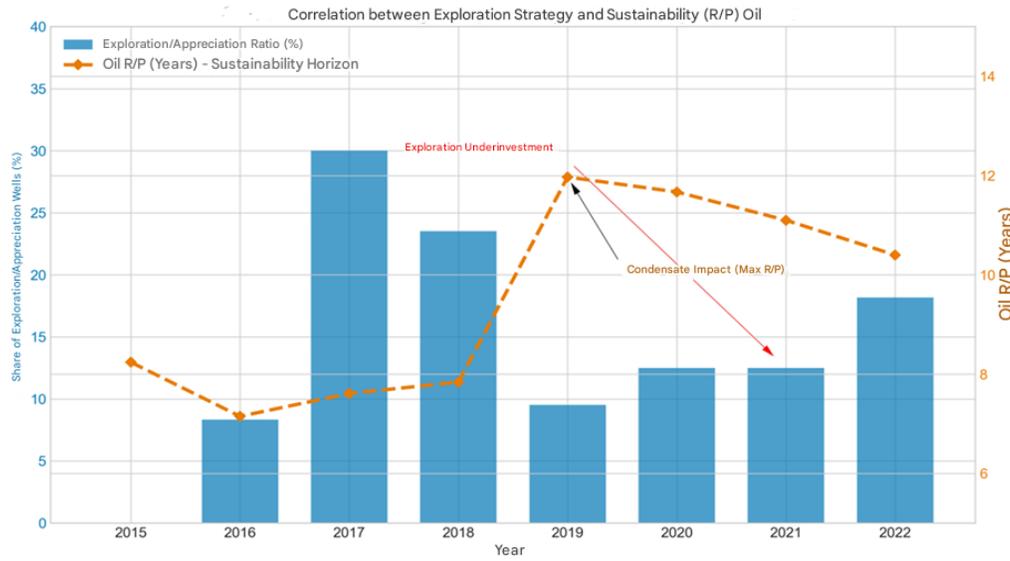
The Rio Del Rey basin now exhibits the characteristic signs of advanced maturity, where reservoir degradation is reflected in a significant drop in flow rates. These rates fell from 4,500 barrels

per day in 2019 in the last areas of optimal productivity to just 341 barrels per day in 2022. This erosion of unit productivity forces operators to multiply drilling campaigns (22 wells in 2022) and resort heavily to artificial stimulation techniques, mechanically

increasing operational costs and reducing the marginal profitability of projects. Faced with this structural decline in oil production and the simultaneous emergence of exponential gas growth, the basin is undergoing a fundamental energy transition. The very nature of the remaining resources - predominantly gas in the Douala/Kribi-Campo basin or in the form of heavy oils - mandates a strategic reorientation towards liquefied natural gas and enhanced recovery methods. This evolution proves essential to preserving the long-

term economic viability of the national hydrocarbon industry.

The current reliance on infill drilling for maintenance is unsustainable, serving only to delay (not prevent) the basin's structural decline. Recent initiatives, however, signal a shift towards revitalization. Cameroon's 2025 licensing round for nine blocks and Tower Resources' planned NJOM-3 appraisal well in 2025 represent critical steps to reinvigorate exploration.



**Figure 12:** Strategic Correlation between Exploration and Oil Sustainability

## 5. Conclusions

The Rio Del Rey Basin is undergoing a structural decline, marked by a zero oil Reserve Replacement Ratio (RRR) and consistently deteriorating well productivity. In response to this well-documented crisis, authorities and operators have initiated measures such as a new nine-block licensing round, the extension of Perenco's operating contract, and targeted drilling campaigns like the NJOM-3 well. While these actions demonstrate a commitment to revitalizing exploration, the current strategy remains overly reliant on conventional methods and marginal field development, failing to implement Enhanced Oil Recovery (EOR) at the necessary scale. A decisive strategic reorientation is therefore imperative, one that integrates an ambitious EOR program, builds on ongoing exploration projects, and ultimately considers repurposing existing infrastructure for CO<sub>2</sub> storage. This integrated pathway represents the most viable approach to maximizing the basin's residual value and ensuring a sustainable energy transition for Cameroon.

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## Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Conflicts of Interest

The corresponding author, on behalf of all authors, declares no conflicts of interest.

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