GAUSSIAN WELLWORKS
RESERVOIR INTELLIGENCE

HEADQUARTERS
3730 Kirby Drive, Suite 1200
Houston, TX 77098
+1 949 244 1918
Info@GaussianWellworks.com

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ECONOMIC APPRAISAL

As unconventional assets mature and capital discipline intensifies, development planning increasingly requires quantitative, physics-consistent workflows capable of resolving uncertainty in both production forecasting and asset valuation.

Gaussian Wellworks applies integrated reservoir and economic modeling to support field development decisions under geological, operational, and commercial constraints, with a focus on consistency, traceability, and uncertainty quantification.

The result is a decision-grade view of value, risk, and execution timing: which wells to drill, how fast to develop, which infrastructure constraints matter, which assumptions control downside exposure, and which development plan creates durable risk-adjusted value.

CORE CAPABILITIES

Full-Field Development Scenarios
Drilling cadence, well spacing, completions, parent-child effects, ramp-up, and plateau alternatives.

Production and Reserves
Probabilistic production forecasts, EUR ranges, and developed or undeveloped location support.

Integrated Infrastructure View
Gathering, processing, transport, liquefaction, storage cycles, and offtake and downstream demand.

Economic and Fiscal Evaluation
After-tax cash flow, NPV, IRR, payout, profitability index, government take, and fiscal benchmarking.

Risk and Sensitivity Analytics
Monte Carlo simulation, P10/P50/P90 outcomes, tornado and spider charts, and risk-weighted valuation.

Portfolio and Transaction Support
Acquisition screening, acreage value, farm-in/farm-out, bid-round support, and capital allocation.

WHY AN INTEGRATED VIEW MATTERS

Unconventional and large-scale developments can be technically attractive and still fail commercially when production profiles, infrastructure, market timing, and capital sequencing are treated separately. Value depends not only on EUR, but also on price decks, drilling and completion cost, fiscal take, market timing, working capital exposure, infrastructure availability, and the ability to continually update assumptions as new data are acquired.

Without integration, operators risk suboptimal capital deployment, bottlenecks, and misaligned production profiles. **Gaussian Wellworks** helps clients understand those interactions before committing to a development path. The objective is not simply to forecast revenue; it is to identify the development strategy that creates the most resilient risk-adjusted value under real-world constraints.

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HOW GAUSSIAN WELLWORKS DIFFERS FROM TRADITIONAL APPRAISAL METHODS

DECISION ELEMENT	TRADITIONAL APPROACH	GAUSSIAN WELLWORKS APPROACH
Production forecast	One deterministic type curve or narrow low/mid/high case.	Physics-grounded forecasts with P10/P50/P90 ranges and updates as well data improve.
Development timing	Drilling schedule is often treated independently of surface constraints.	Tests drilling cadence against processing, transport, storage, offtake, and capital availability.
Economic value	Reports NPV and IRR for a single base case.	Reports risk-weighted NPV/IRR, payout, maximum negative cash flow, probability bands, and sensitivities.
Fiscal and market setting	Uses generic or static assumptions.	Models contract terms, tax/royalty structure, commodity price ranges, and government/contractor take.
Decision support	Produces a valuation number.	Produces a ranked development plan, documented assumptions, sensitivities, and actionable recommendations.

A SIX-STEP ECONOMIC APPRAISAL WORKFLOW

Gaussian Wellworks converts technical and commercial assumptions into a transparent, updatable decision model. The methodology links production uncertainty, development timing, infrastructure capacity, fiscal terms, and discounted cash flow to evaluate value, funding needs, and downside exposure consistently.

1. Frame Define the asset, ownership, decision question, evaluation period, economic limits, success criteria, and outputs.	**2. Integrate** Compile and quality-check reservoir, production, facility, schedule, cost, fiscal and market data; document assumptions and uncertainty ranges.	**3. Model** Build probabilistic production and development schedules, then convert volumes, prices, CAPEX, OPEX, royalties, and tax into after-tax cash flow.
4. Simulate Run base cases, alternatives, Monte Carlo distributions, and sensitivities; calculate P10/P50/P90 NPV, IRR, payout, and capital exposure.	**5. Optimize** Compare drilling cadence, facilities, market timing, capital phasing, and transaction options by risk-adjusted value and funding needs.	**6. Decide** Deliver the auditable model, assumptions, sensitivities, and ranked recommendations; update as technical, cost, or market data change.

The result is a traceable decision package showing:

EXPECTED VALUE	DOWNSIDE	CAPITAL	RECOMMENDATIONS
Risk-Weighted	Defined	Timed	Ranked
NPV, IRR and profitability	Key assumptions and probability ranges	Peak funding and self-funding	Development and transaction alternatives

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CLIENT VALUE

- A development plan that is technically plausible and commercially ranked.
- Clearer downside and upside visibility for production, capital, timing, and cash exposure.
- A transparent bridge between engineering assumptions and investment decisions.
- A repeatable model that can be refreshed as production, cost, market, or infrastructure data change.

KEY APPLICATIONS

Most relevant in situations requiring high-confidence, uncertainty-aware decisions, including:

New-Play Screening
Shale gas, shale oil, and condensate evaluation before major field development.

Large Ramp-Up Programs
Sequence tens to thousands of wells over multiple years while testing infrastructure and capital constraints.

Brownfield Re-Appraisal
Infill, refrac, spacing, parent-child, and redevelopment options.

Transactions and Portfolio
Acquisitions, divestments, farm-ins, farm-outs, bid rounds, and portfolio ranking.

Reserves and Resources
Support developed and undeveloped locations with production and economic limits.

Fiscal Benchmarking and Reuse
Compare jurisdictions and contract types, including geothermal reuse of depleted wells.

Our economic appraisals underpin high-confidence strategic decisions.

CLIENT DELIVERABLES

OPERATORS

- Ranked development strategy for drilling cadence, spacing, completions, and infrastructure.
- P90/P50/P10 production and EUR ranges with reserves and resources support for developed and undeveloped locations.
- After-tax cash flow, NPV, IRR, payout, breakeven, and sensitivities.

INVESTORS AND LENDERS

- P90/P50/P10 NPV, IRR, payout, and profitability ranges.
- Capital phasing, peak funding, and time to self-funding.
- Risk-ranked asset and transaction screening.

AUDITORS AND REGULATORS

- Auditable model with documented data, equations, assumptions, and uncertainty.
- Traceable link from forecast and schedule to cash flow and valuation.
- Fiscal and commerciality support covering royalties, tax, cost recovery, and economic limits.

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CASE STUDY—PROBABILISTIC ECONOMIC APPRAISAL OF THE JAFURAH BASIN DEVELOPMENT

Summary

The development of the largest unconventional gas field in the Jafurah Basin, Saudi Arabia (**Figure 1**), was assessed using public pilot data, Eagle Ford wet-gas analogs, and engineering assumptions. The development required wells, gathering pipelines, liquids processing, and underground gas storage before production start-up. This made it a strong example of why economic appraisal must connect reservoir uncertainty, development timing, infrastructure, and product-market assumptions.

The appraisal used pilot data, Eagle Ford wet-gas analogs, and probabilistic inputs to quantify NPV10, IRR, payout, maximum negative cash flow, profitability index, and economic limit year. The value of the workflow is that it does not ask management to trust a single deterministic result; it shows the probability range and highlights the assumptions that govern the investment case.

The analysis demonstrated why single deterministic appraisals are insufficient for large unconventional programs where well performance, gas-oil ratio, price, CAPEX, and OPEX remain uncertain.

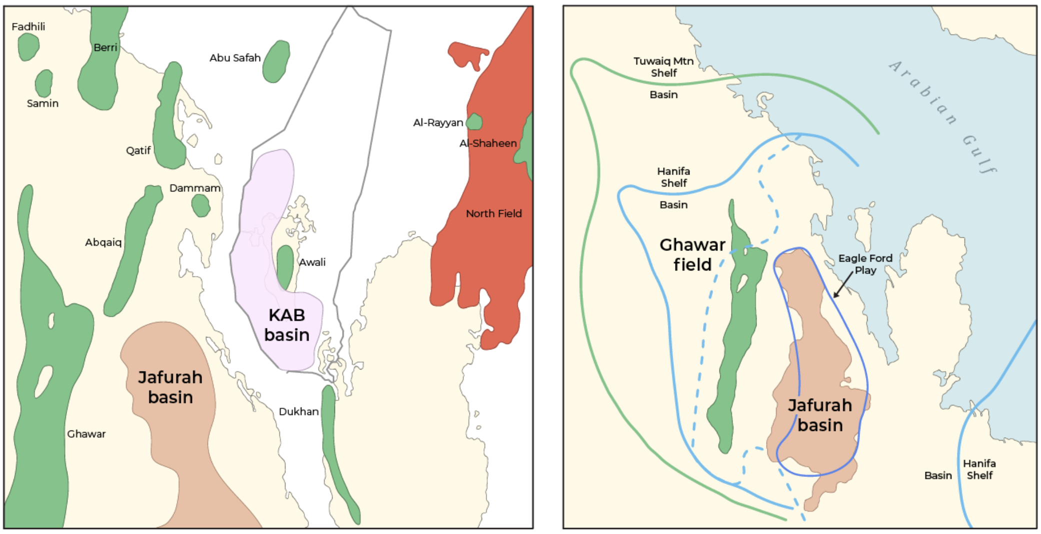

Figure 1 – Jafurah Basin location and scale compared with the Eagle Ford analog.

Objective

The objective was to translate uncertain pilot and analog data into decision-grade economic ranges before committing major development capital. The study compared probabilistic appraisal results with a prior deterministic benchmark and identified which operational or commercial variables most affected value, payout, and cash exposure. From the client's perspective, the goal was to move from a single forecast to a management-ready decision range: downside, base case, upside, and the drivers that can be acted on.

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Provided solution

The model combined decline-curve production forecasting with a discounted cash-flow model over a 40-year evaluation window. Raw well output was allocated into product streams including natural gas, ethane, natural gas liquids, and condensate/natural gasoline. This is important for clients because full-field value is not determined by raw gas volume alone; the liquids yield, gas-oil ratio, ethane/NGL split, product price, and CAPEX and OPEX assumptions all influence revenue, infrastructure needs, and economic ranking.

The probabilistic case assumed a fast-paced full-field development program of 10,000 wells drilled over 10 years and used 10,000 Monte Carlo simulations. The model assigned probability distributions to the main uncertain inputs, including production rate, gas-oil ratio, natural gas price, drilling and completion cost, and fixed operating expenditure, allowing the economics to be reported as P90, P50, and P10 outcomes rather than as a single-point estimate.

For a client, this workflow is directly transferable. The same structure can be applied to a new shale or condensate play, a brownfield re-appraisal, a corporate reserves review, a development financing decision or an acquisition screen. The model shows whether value is robust, where the downside cash exposure sits, and which technical or commercial assumptions should be tested first.

Results and Findings

The probabilistic analysis produced a wide but commercially useful range of outcomes. The P90 case remained profitable with an NPV10 of $7.45 billion and an IRR of 13.8%, while the P50 case generated an NPV10 of $47.21 billion and an IRR of 46.8%. Payout was 10 years in the P90 case and 4 years in the P50 case. These values were compared to a prior deterministic benchmark of $15.97 billion NPV10, 26.34% IRR, and 12.4-year payout. The P50 maximum negative cash-flow exposure was $7.50 billion, a planning metric that matters for liquidity, debt capacity, and capital phasing. These results show why a full-field appraisal must report not only value, but also the amount of capital that must be carried before the project becomes self-funding.

The key finding was not simply that the P50 project value was attractive. The stronger message is that the probabilistic method made uncertainty visible and actionable, because deterministic methods cannot account for uncertainty in either operational or financial input parameters, whereas the probabilistic workflow quantified the downside case, upside case, payout period, and capital exposure. For client decisions, that comparison demonstrates why the appraisal method can materially influence how a development is ranked, financed, and phased.

Figure 2 explains which assumptions matter most. Gas price was the dominant driver of NPV10 and IRR. Initial production rate and gas-oil ratio also influenced value because they control early production and liquids revenue. Drilling and completion capital expenditure had a strong effect on payout and capital exposure. Fixed operating expenditure had a smaller influence in the plotted ranges. This is the type of insight a client needs before committing capital: management can focus data acquisition, commercial negotiation and engineering optimization on the variables that have the greatest impact on value.

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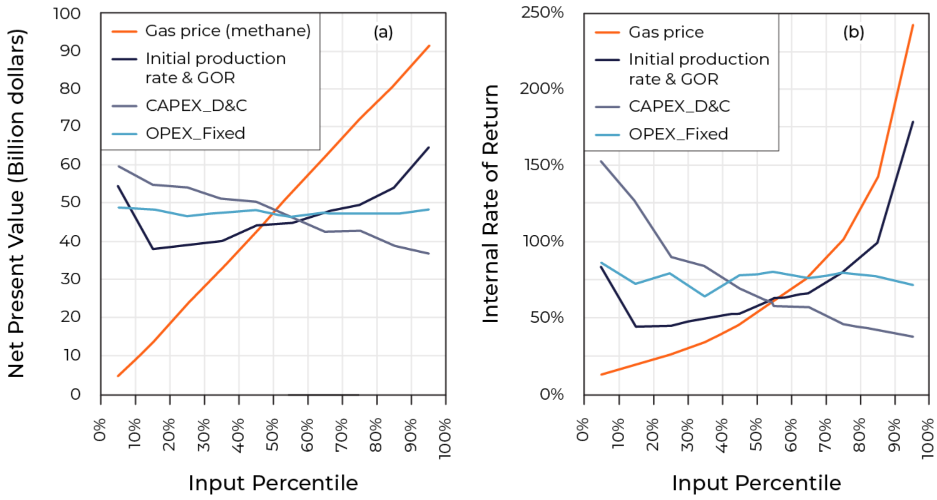

Figure 2 – Spider sensitivity analysis showing the impact of input parameter uncertainty on project economics.

In short, a large, full-field development cannot be appraised solely on reservoir forecasts. The investment depends on how well performance, product yields, development speed, infrastructure availability, price uncertainty and capital exposure interact. A repeatable appraisal model allows the client to re-run the decision as new wells come online, costs change, market conditions shift, or infrastructure capacity is revised. That update loop supports better field development, completion design, production optimization, and capital allocation. Overall, a probabilistic workflow provides management with a wider range of useful decisions than a single deterministic base case.

READ THE FULL CASE STUDY

ADDITIONAL EVIDENCE

The following studies demonstrate how our approach extends beyond shale and condensate appraisal to support fiscal benchmarking, deepwater development, energy-transition reuse, and portfolio value management.

[1]. Weijermars, R., Budiman, O., Al-Raeeini, K., Astsauri, T., 2026. A probabilistic appraisal of Project Greensand: Economic viability of offshore geological CO_2 storage under uncertainty. Energy Reports 109311. DOI

[2]. Rodriguez, P., Ferro, S., and Weijermars, R., 2019. Probabilistic Techno-Economic Appraisal of Prospective Hydrocarbon Resources in Five Turbidites, Offshore Uruguay. OTC-29929-MS. DOI

[3]. Westphal, D. and Weijermars, R. 2018. Economic Appraisal and Scoping of Geothermal Extraction Projects using Depleted Hydrocarbon Wells. Energy Strategy Reviews, vol. 22, p. 348-364. DOI

[4]. Weijermars, R., Alves, I., Rowan, M., and Blasco Flores, D., 2017. Economic Benchmark of Deepwater field development projects in the Perdido fold belt at either side of the U.S.-Mexico Transboundary

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Zone: Which fiscal regime offers the most competitive return on investment? Energy Policy, V. 109, p. 898-915. DOI

[5]. Weijermars, R., Paradis, K., Belostrino, E., Feng, F., Lal, T., Xie, A., and Villareal, C., 2017. Re-appraisal of the Bakken Shale Play: Accounting for Historic and Future Oil Prices and applying Fiscal Rates in North Dakota, Montana and Saskatchewan. Energy Strategy Reviews, vol. 16, p.68-95. DOI

[6]. Weijermars, R., Sorek, N., Seng, D., and Ayers, W., 2017. Eagle Ford Shale Play Economics: U.S. versus Mexico. Journal of Natural Gas Science and Engineering, vol. 38, p. 345-372. DOI

[7]. Weijermars, R. and Zhai, J., 2016. Competitiveness of shallow water hydrocarbon development projects in Mexico after 2015 actualization of fiscal reforms: Economic benchmark of new production sharing agreement versus typical U.S. federal lease terms. Energy Policy, Vol. 96, p. 542-563. DOI

[8]. Weijermars, R., 2013. Economic appraisal of shale plays in Continental Europe. Applied Energy, Vol. 106, p. 100-115. DOI

[9]. Weijermars, R. and Van der Linden, J., 2012. Assessing the economic margins of sweet spots in shale gas plays. First Break, Vol. 30, no. 12 (Dec Issue), p. 99-106. DOI

[10]. Weijermars, R., and Watson, S., 2011. Unconventional Natural Gas Business: TSR Benchmark and Recommendations for Prudent Management of Shareholder Value. SPE-154056-MS. SPE Economics & Management, vol. 3, no. 4 (Oct.), p. 247-261, SPE-154056. DOI

