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User Guide

Project: ACS Pricing Simulator
Status: Operational document

Contents

1. Introduction

The ACS Pricing Decision Platform is an interactive analysis and simulation tool for sulfuric acid (ACS) pricing, designed for contract negotiations with OCP.

The tool comprises **three modules**:

Module	Description
Monte Carlo Simulation	Future price projections with confidence intervals and spike scenarios.
Formula Lab & Decision	Backtest a formula against the real market, then test the formula on Monte Carlo scenarios.
Contract Impact Analysis	Revenue analysis by volumes, OCP scenarios (70–100 %), inflation.

Data Source

Historical prices and projections come from **S&P Global annual data**. Market reference: **ACS CFR North Africa**. Variable index: **ACS FOB NW Europe**.

2. Monte Carlo Simulation

This module generates price projections through **Monte Carlo simulation**: from an S&P trend and historical volatility, hundreds of possible trajectories are simulated, with the option to add price spikes.

2.1 Parameters

All parameters are located in the **left sidebar**.

Parameter	Description
Product	Variable to simulate (ACS CFR North Africa, ACS NW EU, S ME, DAP, etc.)
Horizon	Start year and end year of the projection
Override S&P	Modify S&P outlook values per year (check "Override S&P values")
Petcoke & Clinker	Optional override of petcoke and clinker outlooks (for F6)
Volatility	"Use Historical" computes volatility from data. Multiply to adjust.
Spikes (Frequency)	Number of spikes per year (price shocks)
Spikes (Intensity)	Spike amplitude in %
Spikes (Persistence)	Spike duration in months
Decay Type	Exponential or linear spike decay
MC Paths	Number of simulated trajectories (100 to 2 000)
Smoothing	Brownian motion smoothing (0.3 to 0.9)
Random Seed	Seed for result reproducibility

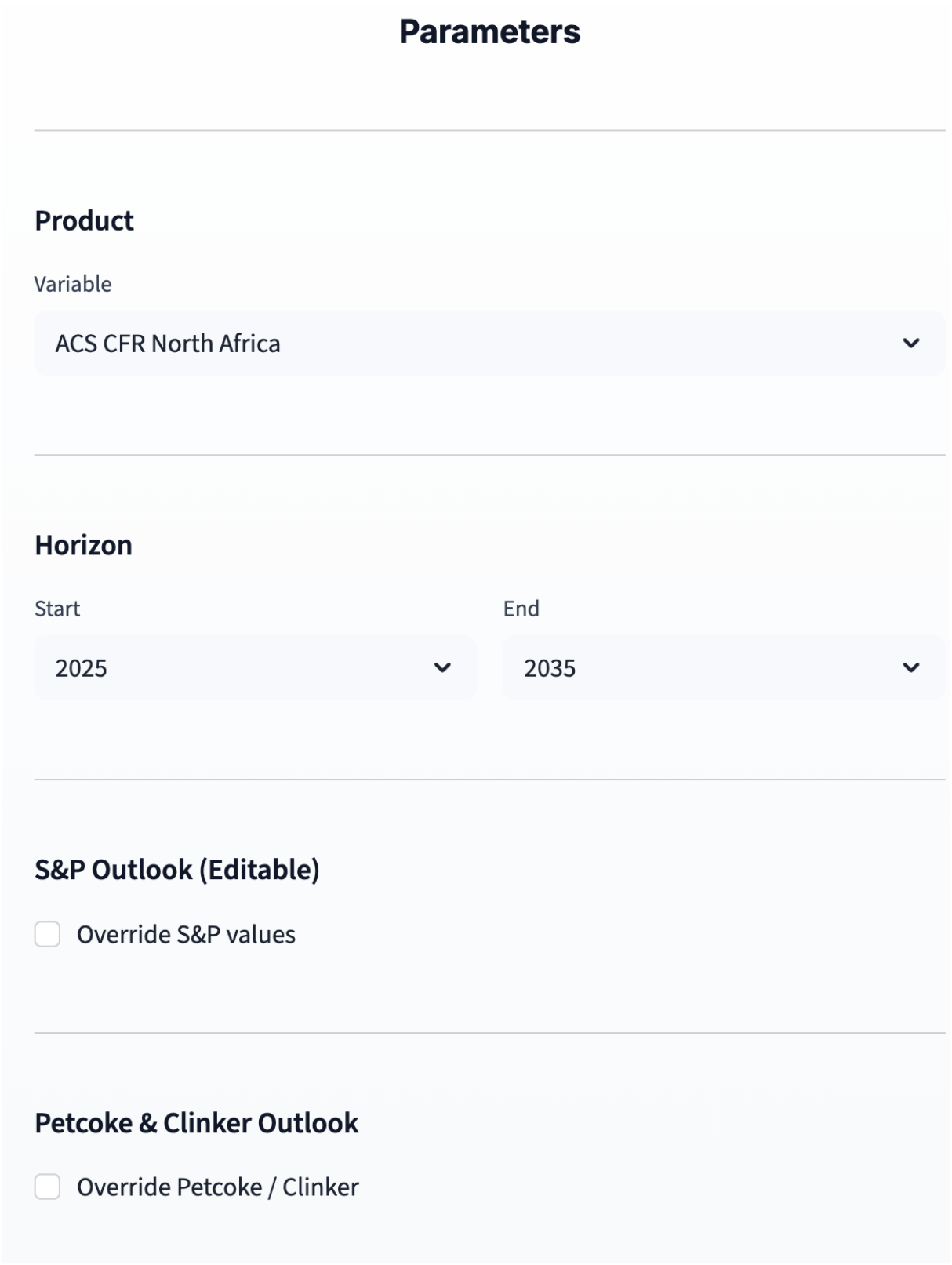

Figure 1: Monte Carlo simulation metrics and parameters.

2.2 Results

After clicking **Run Simulation**:

- **5 metrics** at the top — Average S&P Outlook, Simulated Mean, 95th pctl max, 5th pctl min, Volatility used.
- **Projection chart** — Blue band (95 % interval), red dashed line (S&P trend), blue line (individual scenario selected via slider).
- **3 histograms** — Price distribution for 3 years (end − 2, end − 1, end).

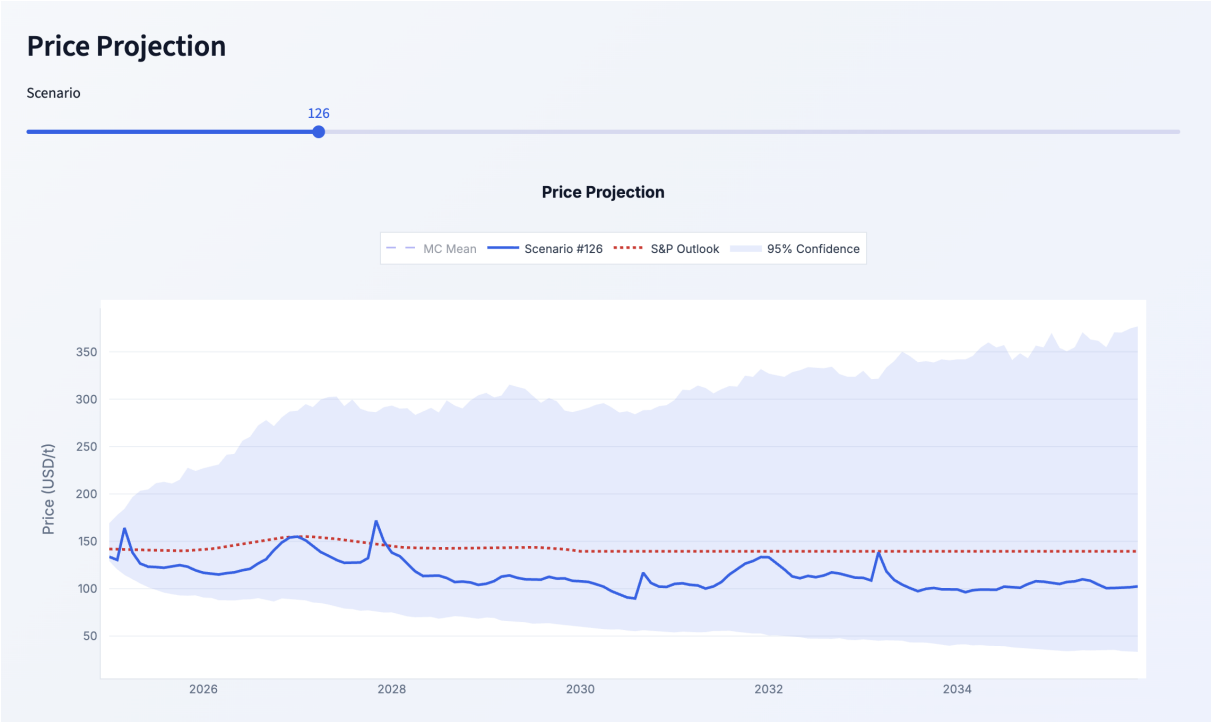

Figure 2: Monte Carlo projection: 95 % confidence band, S&P trend, individual scenario.

Figure 3: Simulated price distribution for 3 years.

Interpretation

Wide band = high uncertainty. The yellow line (MC average, hidden by default) shows the average trend of simulations. Enable it via the legend to compare with the S&P trend.

3. Formula Lab & Decision

This module has **two functions**: (1) test a formula against the market history (*backtest*), and (2) apply this formula to Monte Carlo scenarios to assess future risk.

3.1 The Six Formulas

The user selects **one formula at a time** from the dropdown menu. Each formula has its own adjustable parameters.

ID	Name	Principle
F1	Sulfur Indexing	Direct sulfur indexation (ME/NA) + production cost
F2	Smooth Sulfur	Like F1, but with smoothed sulfur average
F3	Last Month ACS	Previous month ACS price (regional weighting)
F4	S & DAP Variation	Sulfur + DAP variation relative to references
F5	Smooth S & DAP	Like F4, with smoothed inputs
F6	Full Cost Stack	Sulfur + DAP + petcoke + clinker (4 components)

3.2 Formula Parameters

Each formula exposes its coefficients (a, b, c…), regional weights, and reference prices. A **Floor** and a **Cap** can be enabled or disabled via a toggle.

Figure 4: Formula selection, equation, adjustable parameters, and Floor/Cap toggle.

3.3 Backtest — Historical

The backtest compares the selected formula to the real market over history (2018–2025 by default, adjustable via slider).

- **Formula vs Market chart** — Two curves: market price (red) and formula price (blue). Floor/Cap lines if enabled.
- **P&L chart** — Green bars (formula below market = buyer advantage) or red bars (formula above = disadvantage). Quarterly or annual view.

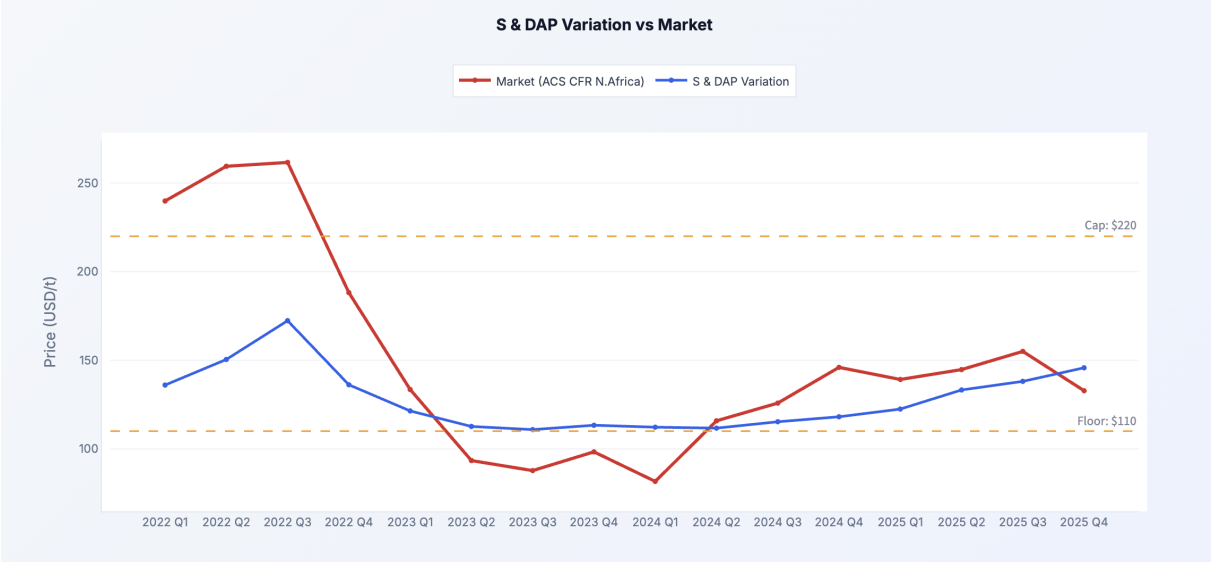

Figure 5: Backtest: market price (red) vs formula price (blue) over history.

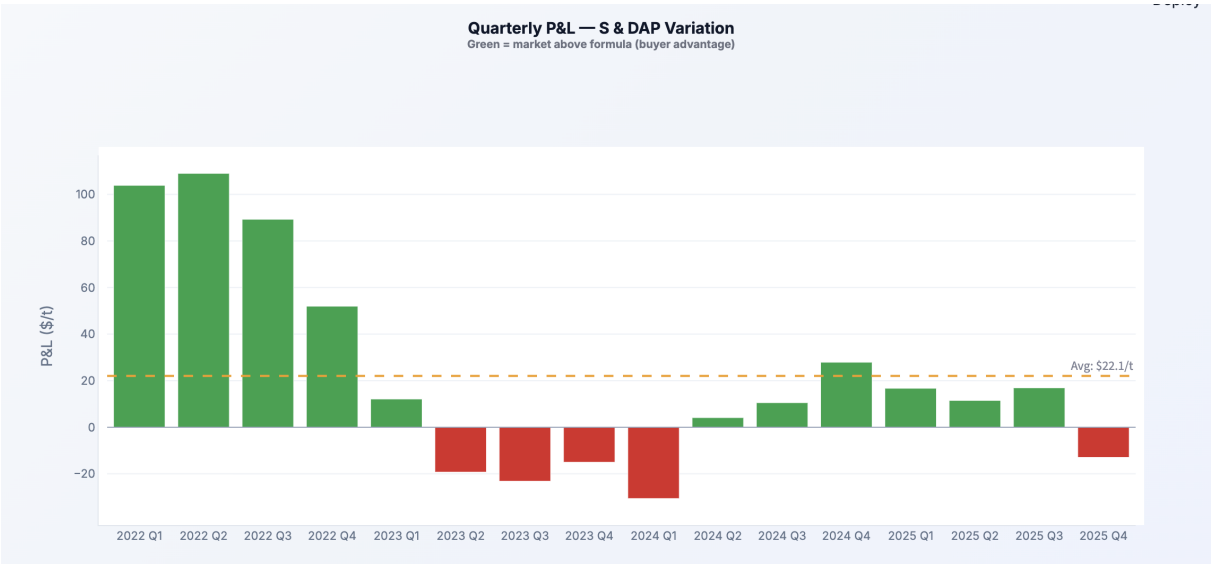

Figure 6: Historical P&L: green/red bars per quarter with average.

3.4 Performance Summary

Five cards summarize the backtest:

Card	Description
Avg P&L	Average formula vs market spread ($/t)
Win Rate	% of periods where the formula is below the market
Best Period	Best spread in favor of the buyer
Worst Period	Worst spread (formula above market)
Annual Impact	Annualized financial impact in $M (750 KT)

3.5 Decision — Test on Monte Carlo Scenarios

> **Prerequisite**
>
> You must first run a Monte Carlo simulation in **Tab 1** to generate future scenarios. Then return here to apply the selected formula.

This section applies the selected formula to a Monte Carlo scenario to evaluate its future behavior.

- **Annual Volume** — Annual volume (default 750 KT) for the financial calculation.
- **MC Scenario** — Slider to choose a scenario from those generated.
- **Formula vs MC chart** — Formula applied to the future scenario (simulated market price vs formula price).
- **Future P&L** — Green/red bars over the simulated period.
- **3 cards** — Market Cost, Formula Cost, Savings ($M/yr).

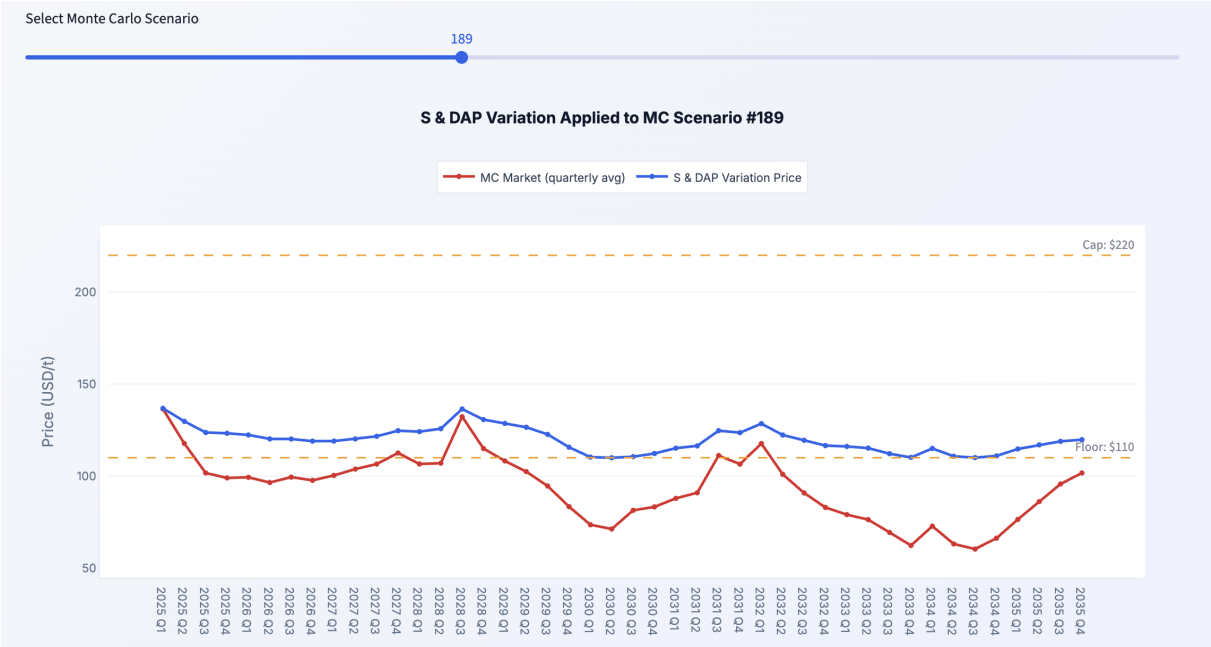

Figure 7: Formula applied to a future Monte Carlo scenario.

3.6 Risk Analysis — All MC Scenarios

The tool automatically computes formula savings across **all MC scenarios** (up to 200) and displays:

- **Expected Savings** — Average savings across all scenarios.
- **Best Case (P95)** — Savings in the most favorable scenario.
- **Worst Case (P5)** — Savings in the least favorable scenario.
- **Prob. of Savings** — % of scenarios showing savings.
- **Histogram** — Savings distribution across all scenarios.

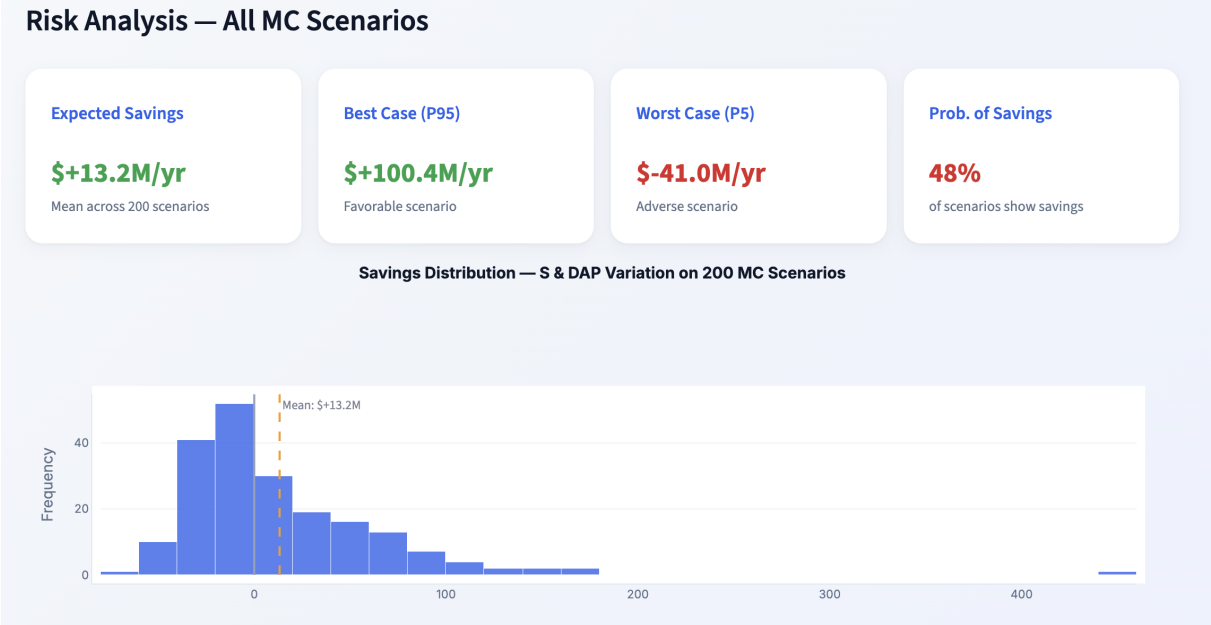

Figure 8: Risk Analysis: Expected/Best/Worst/Probability cards + savings histogram.

> **Decision Support**
>
> If "Prob. of Savings" is $> 50\,\%$ and the "Worst Case" remains acceptable, the formula offers good protection. Compare multiple formulas by changing the selection in the dropdown menu.

4. Contract Impact Analysis

This is the main module for contract analysis. It models project revenues and evaluates the OCP impact over the contract duration.

4.1 Parameters

Parameters are displayed **at the top of the tab** (not in the sidebar), in three columns.

Parameter	Default	Description
Total Production Volume	750 KT	Annual production capacity
Fixed Price	110 \$/t	Contractual fixed price (base year)
OCP Purchase Volume	70–100 %	Share purchased by OCP. 70 % = all at fixed
Inflation Rate	2 %	Annual inflation rate on the fixed price
Coefficient A	1.0	FOB NW Europe multiplier
Premium B	0 \$/t	Premium/discount added to the variable price

Below the parameters, three **formula boxes** display in real time the fixed price, variable price, and volume allocation.

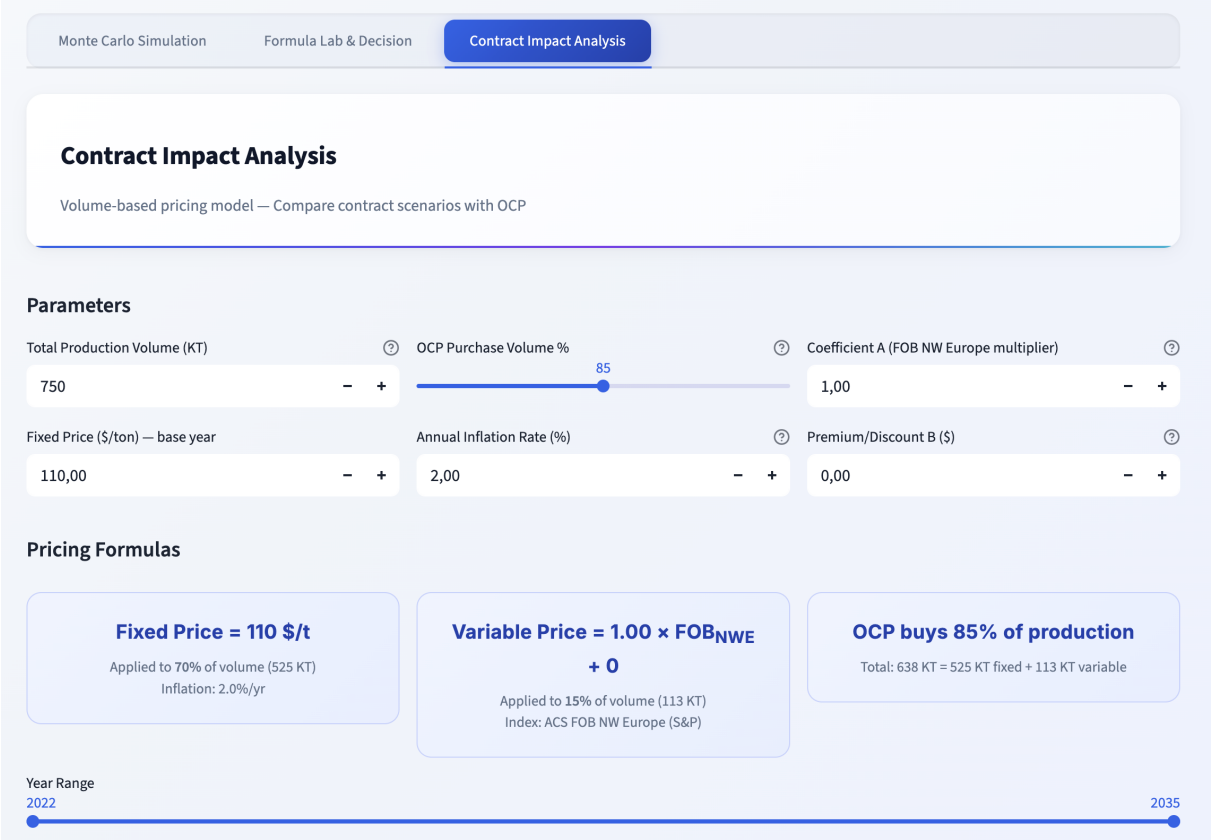

Figure 9: Contract Impact parameters: 3 columns + formula boxes.

Volume Logic

OCP is required to buy at least **70 % of production** at the **fixed price**. The slider ranges from 70 % to 100 %. Any volume above 70 % is purchased at the **variable price** (formula $A \times \text{FOB}_{\text{NWE}} + B$).

- At 70 %: OCP buys 525 KT, all at the fixed price.
- At 85 %: OCP buys 637 KT = 525 KT fixed + 112 KT variable.
- At 100 %: OCP buys 750 KT = 525 KT fixed + 225 KT variable.

4.2 Formulas

Fixed Price (with inflation):

$$P_{\text{fixed}}(t) = P_{\text{base}} \times (1+i)^{t-t_0}$$

where i = annual inflation rate, t_0 = first year of the filter.
Variable Price:

$$P_{\text{var}} = A \times \text{FOB}_{\text{NW Europe}} + B$$

4.3 Year Range & Market Override

- **Year Range** — Slider to restrict the analysis period (e.g., 2022–2035).
- **Override market price projections** — Check to enter custom market prices per year. All charts recalculate automatically.

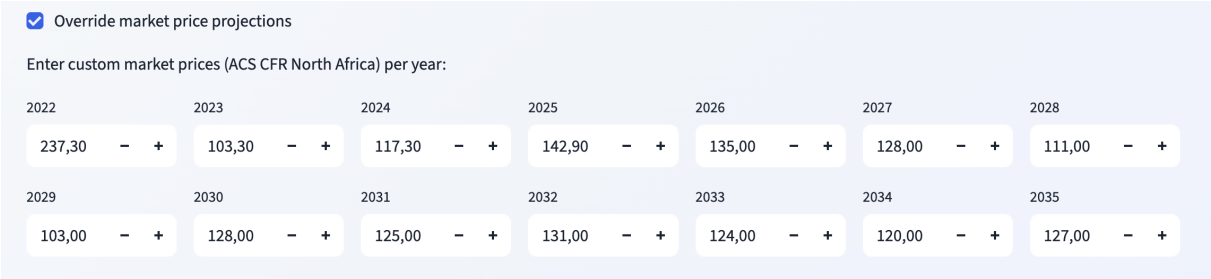

Figure 10: Market price override: fields per year to modify ACS CFR North Africa prices.

4.4 Perspective Selector

A radio button toggles between two views: **Project Perspective** (seller) and **OCP Perspective** (buyer).

4.5 Project Perspective

Seller's point of view: how much revenue the project generates.

- **5 metrics** — Avg Revenue, Weighted Avg Price, Market Ref Price, Negotiated Price, vs Market (%).
- **Business Plan Revenue** — Stacked bars: fixed revenue (blue) + variable revenue (yellow) per year.
- **Volume Split** — Stacked bar showing the fixed/variable allocation in KT.
- **Price Comparison** — 5 curves: Market Ref (black), Weighted Avg (yellow), Fixed Price with inflation (dashed blue), Negotiated Price (dashed red), FOB NW Europe (purple).
- **Sensitivity** — Table comparing different volume splits (50/50, 60/40, ..., 100/0) and their impact on average revenue.

Figure 11: Business Plan Revenue: stacked bars for fixed (blue) and variable (yellow) revenue per year.

4.6 OCP Perspective

Buyer's point of view: how much OCP saves compared to the market.

- **4 metrics** — OCP Avg Cost, Market Cost, Avg Value Gain, Avg Price Paid.
- **OCP Value Gain** — Bars per year. Blue = fixed portion gain, yellow = variable portion gain. Negative bars extend below zero (barmode "relative").
- **OCP Price Paid vs Market** — 3 predefined scenarios (70 % fixed, 85 %, 100 %) + market.
- **Cumulative Value Gain** — Cumulative gain over time for the 3 scenarios.
- **Breakeven Analysis** — Market (black) vs blended contract (yellow) vs fixed with inflation (dashed blue). Shaded area = savings zone.
- **Scenario Comparison Summary** — Summary table: volume, cost, gain for each scenario.

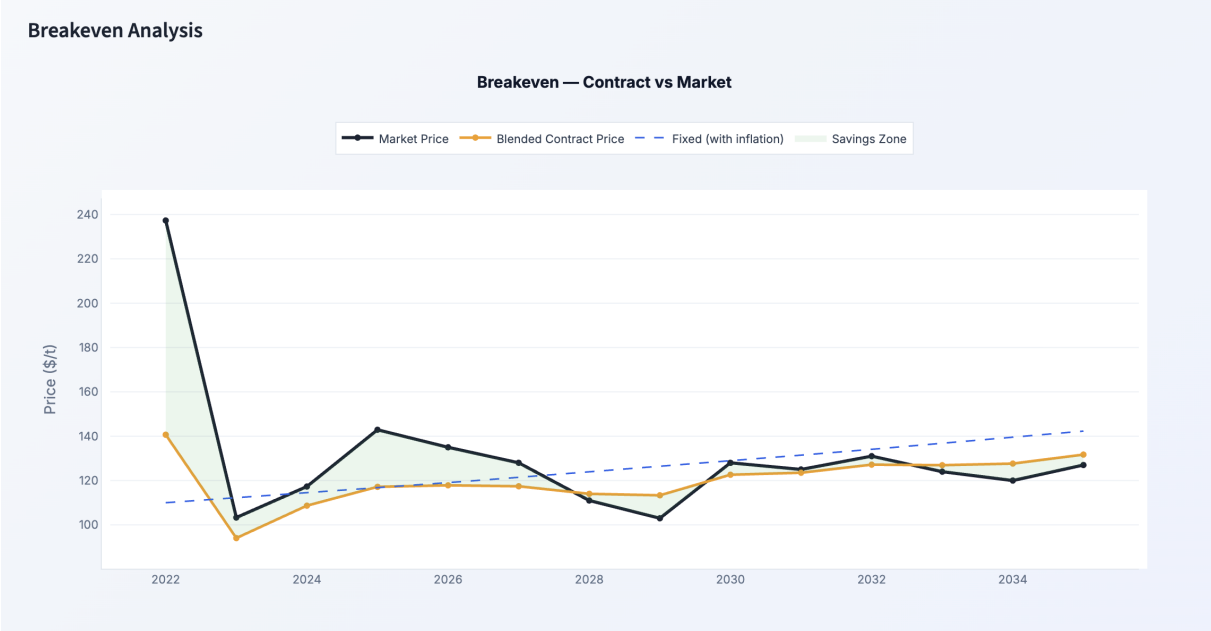

Figure 12: Breakeven Analysis: market vs contract with savings zone.

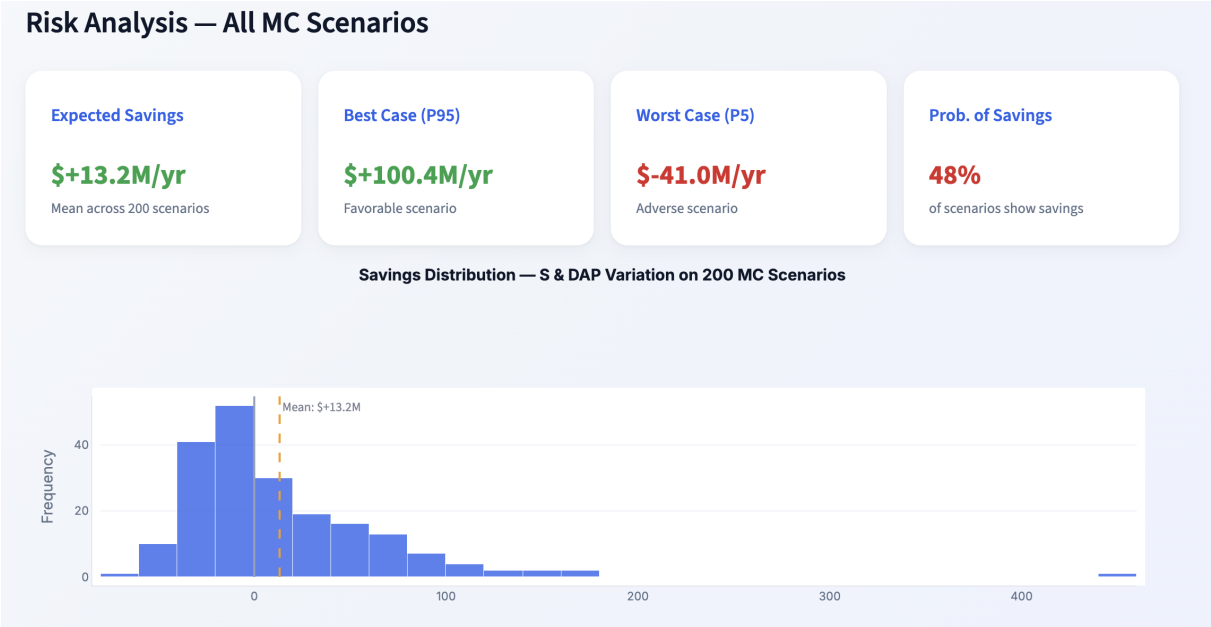

Figure 13: Scenario Comparison Summary: summary table of the 3 OCP scenarios.

Key Point

When the market is high, the fixed-price contract benefits OCP (positive gain). When the market drops below the fixed price, the gain becomes negative. Inflation increases the fixed price each year, gradually reducing the advantage.

5. General Features

- **Automatic recalculation** — All charts update as soon as a parameter changes.
- **Time filtering** — "Year Range" or "History from" sliders to restrict the period.
- **Chart export** — Hover over a chart and click the camera icon to save as PNG.
- **Data export** — Open the "Detailed Data" expanders to copy-paste into Excel.
- **Interactive legends** — Click a series in the legend to hide/show it.

6. Glossary

Term	Definition
ACS	Sulfuric acid
CFR North Africa	ACS market price delivered to North Africa (reference)
FOB NW Europe	ACS price North-West Europe (variable index)
OCP	Office Chérifien des Phosphates
KT	Kilo-ton (1 000 tonnes)
Value Gain	OCP savings = (Market price − Price paid) × Volume
Breakeven	Point where the contract price equals the market price
P&L	Profit and Loss = Market − Formula ($/t)
Monte Carlo	Multi-scenario statistical simulation
S&P	S&P Global Commodity Insights (data source)
DAP	Di-ammonium phosphate
Floor / Cap	Floor and ceiling imposed on the formula price