

A governed agentic architecture for PPA, GoO and route-to-market operations

Blackdown built and implemented a governed agentic workflow for a European power trading firm.

The system managed complex renewable energy transactions from start to finish, but it could not move money, transfer certificates, submit registry actions, or take market positions without approval from an authorised person.

ROLE

Architecture, build & delivery

DOMAIN

Renewables origination · Guarantees of Origin · route-to-market operations

PATTERN

Agent orchestration with deterministic tools and human-in-the-loop approval

CLIENT

A European power trading firm

SCOPE

Trading, certificate management, nominations, settlement and governance

DELIVERED

2025, to production

The brief

A single commercial request hides many regulated workflows underneath

A typical request was kept intentionally simple:

“Place this 50 GWh corporate PPA and source matching Guarantees of Origin.”

In reality, that simple instruction starts a series of regulated and financially sensitive steps: contract interpretation, certificate sourcing, GoO matching, registry redemption, commercial pricing, nominations, balancing, settlement, and audit checks.

The main design question was not if a language model could help. Instead, it was:

How can a trading desk use an intelligent assistant for complex renewable transactions without letting the system carry out any binding commercial, financial, or market actions on its own?

The problem

Each transaction was fragmented, manual, and sensitive to risk

A single PPA-and-GoO transaction covers several business areas, each with its own data, systems, and possible failure points.

The risks go beyond just inefficiency. If workflows are not managed well, they can lead to financial losses, misallocated certificates, inaccurate green claims, settlement errors, non-compliance, or unauthorised trading.

Discipline	Operational challenge
Contract intelligence	Extracting volume, delivery profile, GoO matching rules, optionality, penalties and settlement terms from long-form agreements.
GoO portfolio management	Matching demand to certificate supply across technology, geography, vintage, delivery period and registry constraints.
Deal and pricing	Structuring offers against forward curves, shape risk, imbalance assumptions, certificate availability and GoO market pricing.
Route-to-market operations	Preparing nominations, bidding assumptions, metering inputs, imbalance exposure and settlement workflows.
Audit and governance	Maintaining a reconstructable record of who approved what, when, using which source data, and on what basis.

Before orchestration, the process depended mostly on email. Commercial, legal, operations, settlement, and registry specialists each had their own piece of the information.

The system changed that fragmented process into a governed workflow, but it did not give business-critical calculations or external submissions to the LLM.

Blackdown’s contribution

Designing and delivering the whole operating model, not just how agents interact

Blackdown designed, built and delivered the production agentic workflow — the orchestration model, tool boundaries, approval controls and audit processes used in live operations.

The goal was to support complex renewable energy operations while keeping the control standards needed in a trading environment.

Area	Contribution
Workflow decomposition	Broke the high-level PPA-and-GoO request into auditable business capabilities and operational steps.
Agent architecture	Defined specialist agents for contract intelligence, GoO portfolio matching, deal/pricing support and route-to-market operations.
Orchestration model	Designed the planner/router pattern that decomposes requests, routes tasks and manages workflow state.
Control design	Introduced the human approval gate for any action involving money movement, certificate transfer, market exposure or external submission.
Tool boundaries	Separated LLM reasoning from deterministic execution so calculations, registry actions, position updates and settlement logic stayed testable.
Audit model	Designed the traceability pattern across source data, agent outputs, tool calls, approvals and final actions.
Integration thinking	Mapped integration boundaries to market data, registry APIs, metering, operational stores, document systems and settlement processes.

The main principle was simple: agents give reasoning and recommendations, deterministic tools carry out the actions, and humans approve all binding steps.

The architecture

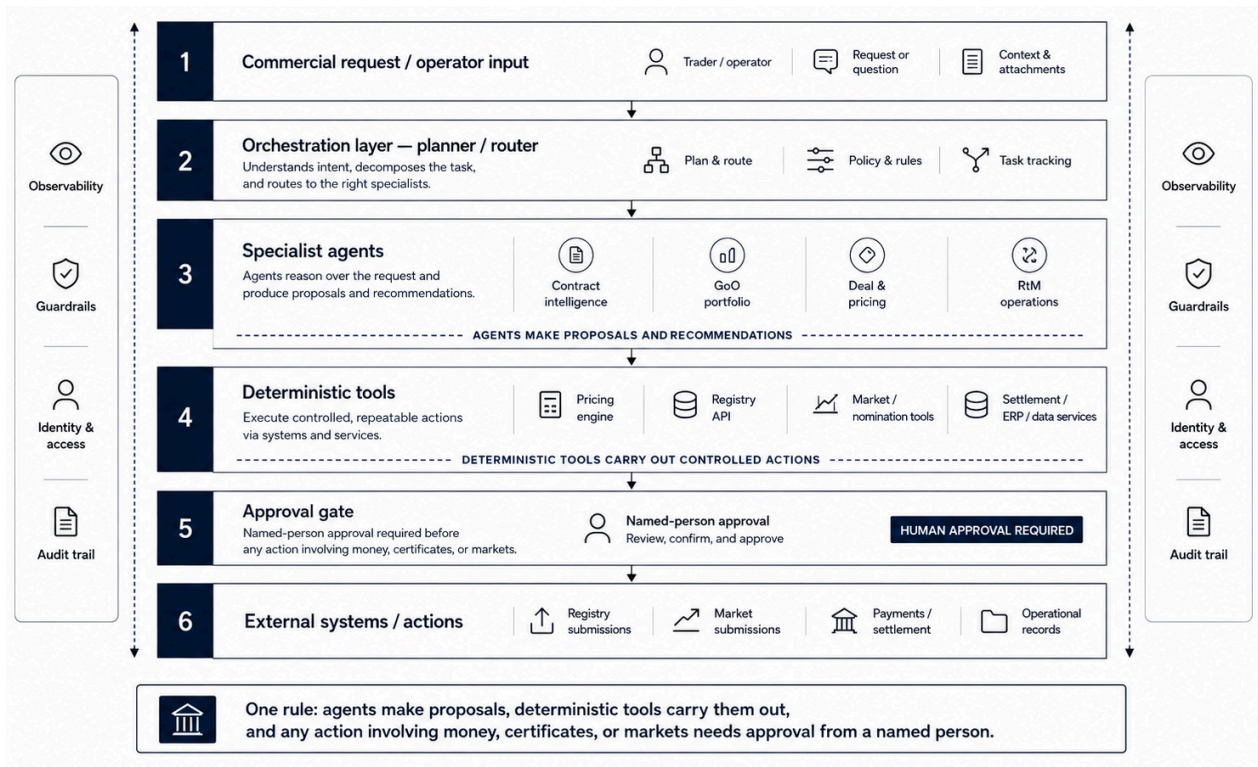
Keeping reasoning, execution, and approval separate

The architecture separated reasoning, execution and approval into distinct layers.

The orchestration layer acted as both planner and router. It interpreted requests, broke them into auditable sub-tasks, and assigned each one to the right specialist agent.

Specialist agents decided the next steps, but they did not directly change trading systems, transfer certificates, create external submissions, or do settlement calculations. Deterministic tools handled these actions using set interfaces, validation rules, access controls, and audit logs.

Any action that was financially or legally binding needed approval from a designated person before being sent to an external system, market process, or registry.



Six layers, one rule: agents make proposals, deterministic tools carry them out, and any action involving money, certificates, or markets needs approval from a named person. Observability, guardrails, and identity checks apply to every layer.

This separation was crucial.

The system did not use a language model for business logic like position updates, certificate transfers, or settlement calculations. These tasks were handled in the tool layer, where they could be tested, monitored, controlled, and audited.

This clear separation made the architecture strong enough for real trading operations, not just a proof of concept.

The agent model

Specialist agents matched to business capabilities

Agent	Responsibility
Contract intelligence	Reads and monitors PPA and GoO terms: delivery period, contracted volume, eligibility, penalties, optionality and settlement terms.
GoO portfolio	Matches demand to certificate inventory across technology, country, vintage and registry constraints.
Deal and pricing	Supports commercial structuring against curves, margin, shape risk, imbalance assumptions and certificate cost.
Route-to-market operations	Prepares nominations, bidding assumptions, imbalance analysis and settlement workflows.

Each agent was built to decide the next step, while deterministic tools carried out the action.

This avoided the common problem where the model handles both reasoning and execution, which is an unacceptable control weakness in trading.

How a request flows

Breaking down the 50 GWh request into auditable steps

#	Step	Owner	Output
01	Interpret contract terms	Contract intelligence	Delivery window, volume profile, GoO eligibility, matching rules, penalties, settlement terms
02	Check certificate availability	GoO portfolio	Matched / unmatched MWh by technology, country, vintage and registry
03	Price the commercial offer	Deal and pricing	Indicative price, curve assumptions, margin, risk adjustments, GoO cost
04	Prepare the operational plan	RtM operations	Nomination schedule, balancing assumptions, metering requirements, settlement workflow
05	Route for approval	Approval gate	Human review before any external, financial or legally binding action
06	Prepare or execute via controlled tools	Tool layer	Registry / market / ERP / settlement action, only through approved deterministic interfaces after sign-off
07	Record the evidence	Audit layer	Trace log, approval ID, timestamp, source data, decision record, action outcome

At every stage, the system showed its interpretation, uncertainties, source data, proposed actions, and approval requirements.

This transparency was important because a silent or unchecked error in trading can be very costly.

The control model

A copilot, not a fully autonomous trading engine

The control model was at the heart of the architecture.

The system could suggest and prepare actions, but it could not carry out any financially or legally binding steps on its own.

Moving money, transferring certificates, submitting to registries, making bids and trades, and market exposure all needed approval from a named person and followed a set execution path.

This was a strict rule, not just a preference. The project had significant legal and governance requirements, so the guardrails required human review. There was always at least one human check of the AI's output before any binding action.

The goal was not to remove human responsibility, but to make the review step clear, informed, and easy to audit.

Risk	Control
Unauthorised certificate transfer	Human approval required before any registry action.
Incorrect GoO redemption	Contract, eligibility and inventory checks before execution.
Unauthorised market position	Approval required before any bid, trade or market submission.
Incorrect commercial pricing	Assumptions surfaced for review; deterministic calculations owned by controlled tools.
Settlement discrepancy	Traceable link from source data to decision, approval and action.
Regulatory audit failure	Immutable action-and-approval log, reconstructable on demand.
Model error in business logic	Deterministic tools own calculations and state changes, not the LLM.
Permission leakage	Identity and access controls applied at tool and action level, not just at the chat interface.

Results

Measured in production during the last two weeks of the project

The figures below come from production data during the final two-week handover, when the system managed hundreds of live processes.

Figure	What it measures	Basis
~4h → ~20min (~92% reduction)	Time from request triage to a review-ready action plan	Production data, final two-week handover
Hundreds of live processes	Workflows handled during the two-week handover	Production telemetry
100% approval coverage	Binding actions routed through human approval	Mandatory legal and governance control

In addition to the measured results, the architecture delivered:

- **Fewer manual handoffs:** people shifted from routine coordination to focused review and approval. The reduction depended on the deal type — GoO matching was simpler than a full PPA, which needed more coordination across commercial, legal, operations, and settlement teams.
- **End-to-end transaction visibility:** interpretation, assumptions, source data, proposed actions, and approval status were shown at every step.
- **Simpler audit reconstruction:** requests, agent outputs, tool calls, approvals, and actions were all recorded in a central trace log.
- **Testable business logic:** deterministic rules remained in controlled tools rather than being hidden inside model prompts.

Reusability

Capabilities mapped to business functions, not just individual transactions

The agents matched business capabilities, so the same orchestration core could support similar transaction types without needing a system redesign.

Capability	Reusable across
Contract intelligence	PPAs, GoO agreements, REGOs, tolling agreements, supply and structured energy contracts
Portfolio matching	GoOs, REGOs, green claims, certificate inventory, customer demand and compliance reporting
Pricing support	Corporate PPAs, structured renewable offers, GoO-linked products and route-to-market pricing
RtM operations	Nominations, bidding, imbalance analysis, metering workflows and settlement preparation
Audit and governance	Compliance reviews, approval workflows, model governance and operational traceability

This created a reusable operating pattern for managing intelligent assistance across renewable energy workflows, instead of just a one-off automation.

Closing

Control comes before autonomy

Energy trading workflows are not fit for unchecked autonomy.

A model that can read contracts, suggest hedges, find matching certificates, or prepare nominations is valuable. But if that same model can move funds, submit bids, or transfer certificates without approval, it brings unacceptable risk.

This architecture solved that problem by using the LLM for reasoning and orchestration, but never as the system of record or execution engine.

For a European power trading firm, Blackdown designed, built and delivered a governed agentic workflow for PPA, GoO and route-to-market operations that went into production.

The system broke down complex transactions into auditable tasks, sent them to specialist agents, kept LLM reasoning separate from deterministic execution, and required human approval for every binding action.

During the handover, it cut per-request triage time from about 4 hours to around 20 minutes while handling hundreds of live processes.

The control standards needed in trading were built in from the start, not added later.

Need a governed AI workflow for energy trading or renewables operations? Let's talk about where agentic systems can safely cut manual work.

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