


# Energy Planning Without Barriers

  
From Regional Vision to National Action

## THE SOLUTION

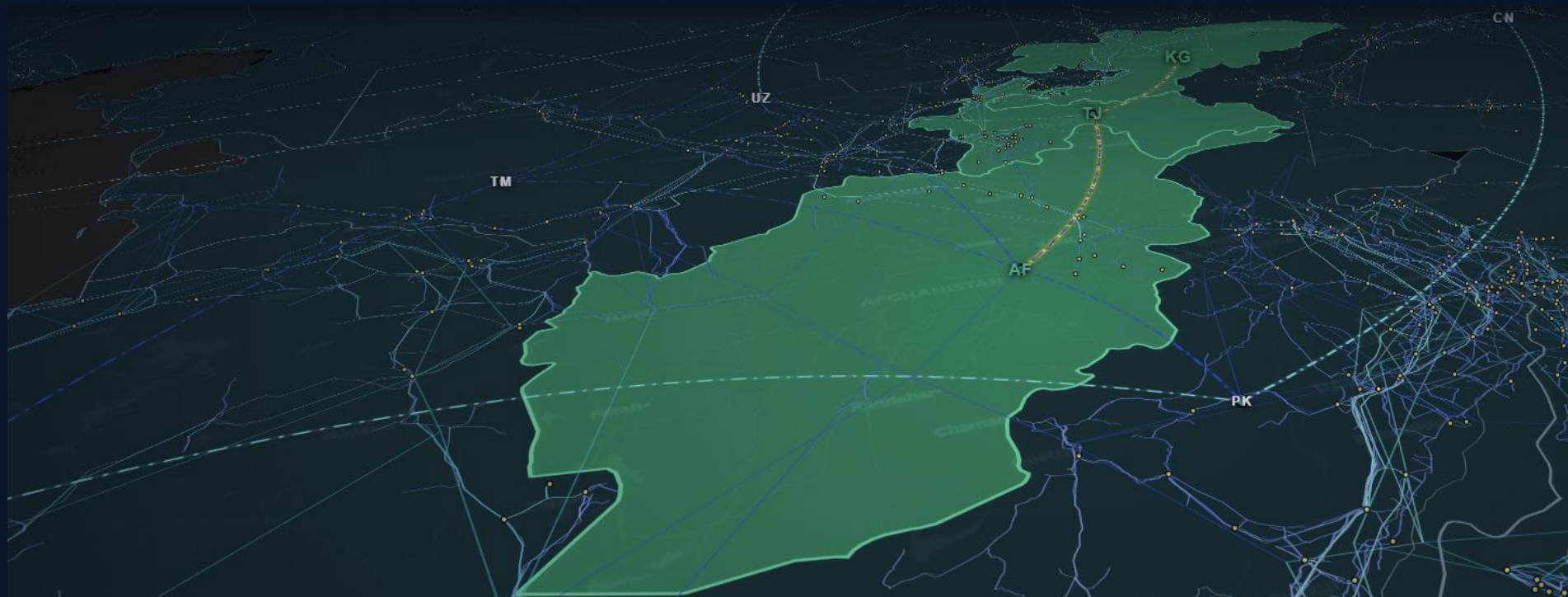
# First Unified Global Energy Optimisation Platform

Production-ready infrastructure: market and network now extended to 120 countries across CAREC, EU and Africa



## What the Platform Does

Solves the regional economic dispatch problem hour by hour for an entire year, deciding how much each power plant generates and how much electricity flows across transmission links, with the same engine extended to 120 countries (CAREC, EU, Africa) for cross-regional analysis.



## MISSIONS

8 available



### Stress-test demand growth

Scale demand on selected countries; see where the system bends.



### Test a fuel price shock

Push gas, coal, oil prices and watch dispatch reshuffle.



### Explore congestion

Find the choke-points: which corridors saturate first?



### Evaluate a new interconnector

Add a corridor; estimate welfare gain via CBA.



### Run capacity expansion

Co-optimize new generation, storage, and transmission.



### Compare country data versions

Show what changed in a country's template — line by line.



### Create CBA assessment

TYNDP 2024 welfare decomposition for a regional project.



### Browse my scenarios



# Mission Control — Immersive Energy Atlas

A 3D world view of the global power system. Every plant, every transmission line, every cross-border flow — visible, queryable, and linked back to the model.

**Hadjret Enouss Power Plant** 1.23 GW

● Gas ● Operating

COUNTRY	ES	TECHNOLOGY	Gas
ONLINE	—	PLANT ID	173680073
SOURCE	OpenStreetMap	MORE INFO	Wikidata · Q56373...

Source: Esri, Maxar, Earthstar Geographics

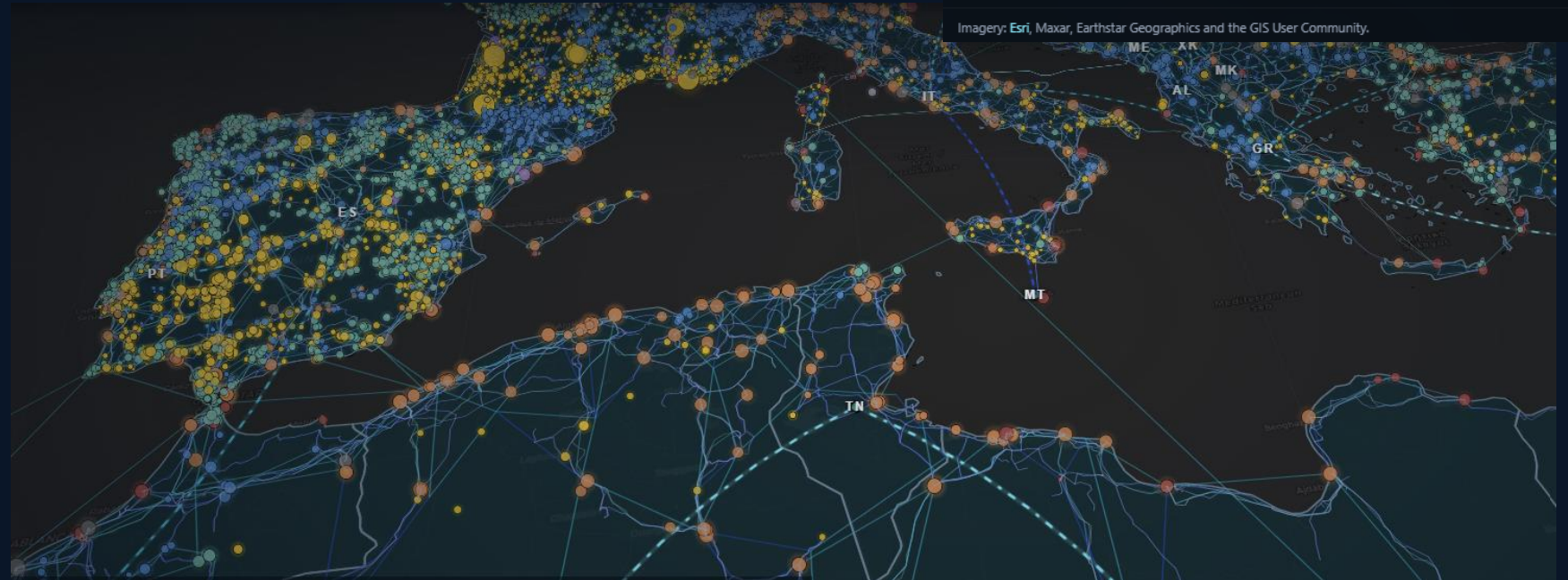
Imagery: Esri, Maxar, Earthstar Geographics and the GIS User Community.

NEARBY PLANTS (WITHIN 30 KM)

● Centrale électrique de Baraki	72 MW
● Centrale électrique de Beni Mered	48 MW
● Centrale électrique d'Ahmer El Aïn	72 MW
● Centrale électrique de Boufarik 2	705 MW

## Optimizing by click

- 41,625 Power Plants
- 580,000+ HV Lines
- 122 Countries
- Voltage palette 110–1150 kV
- Animated cross-border arcs
- 120 with sub-national national grids
- Open-Meteo / ERA5 weather

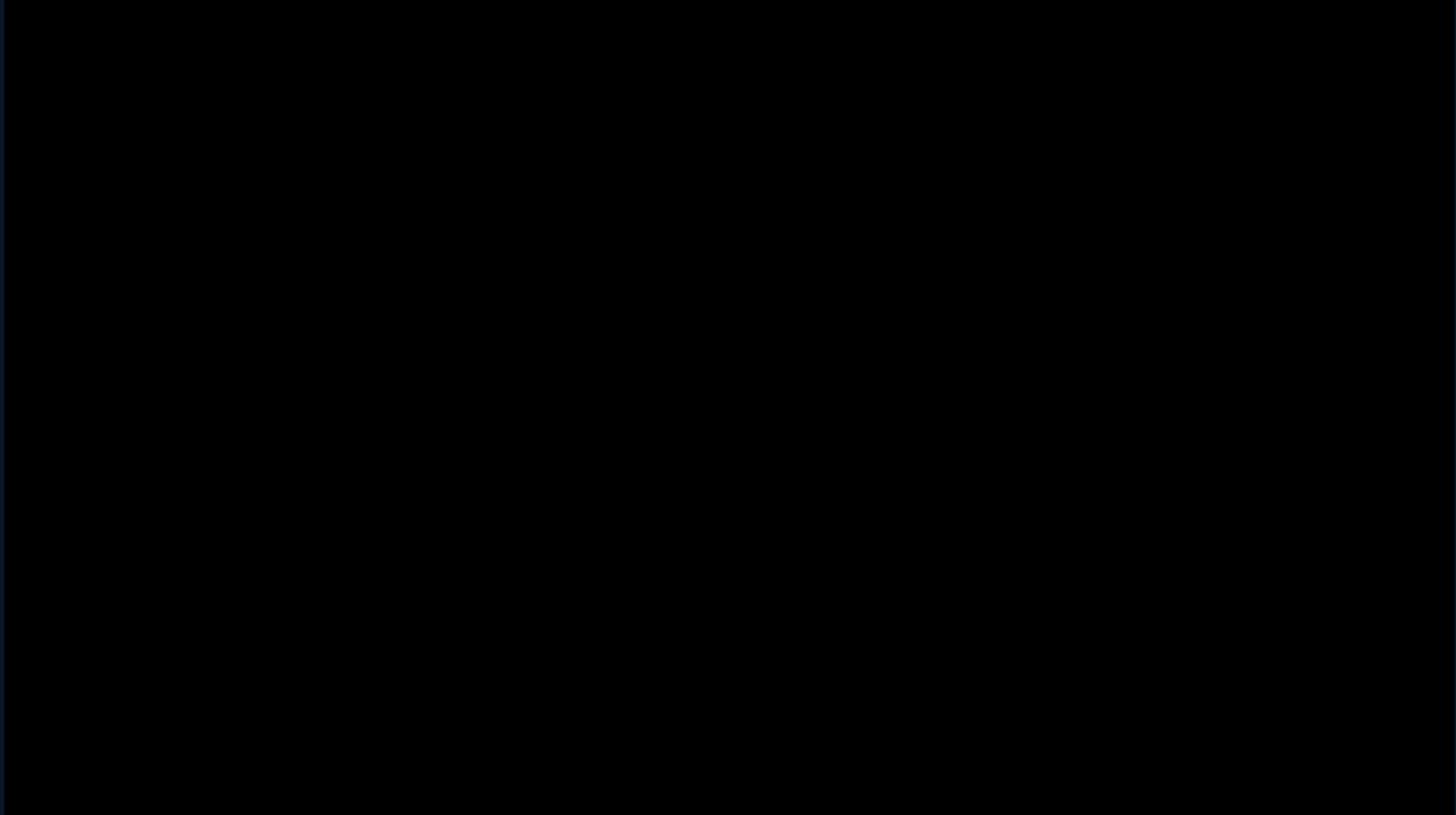


“From a boardroom narrative to a ground-truth network, in two clicks.”

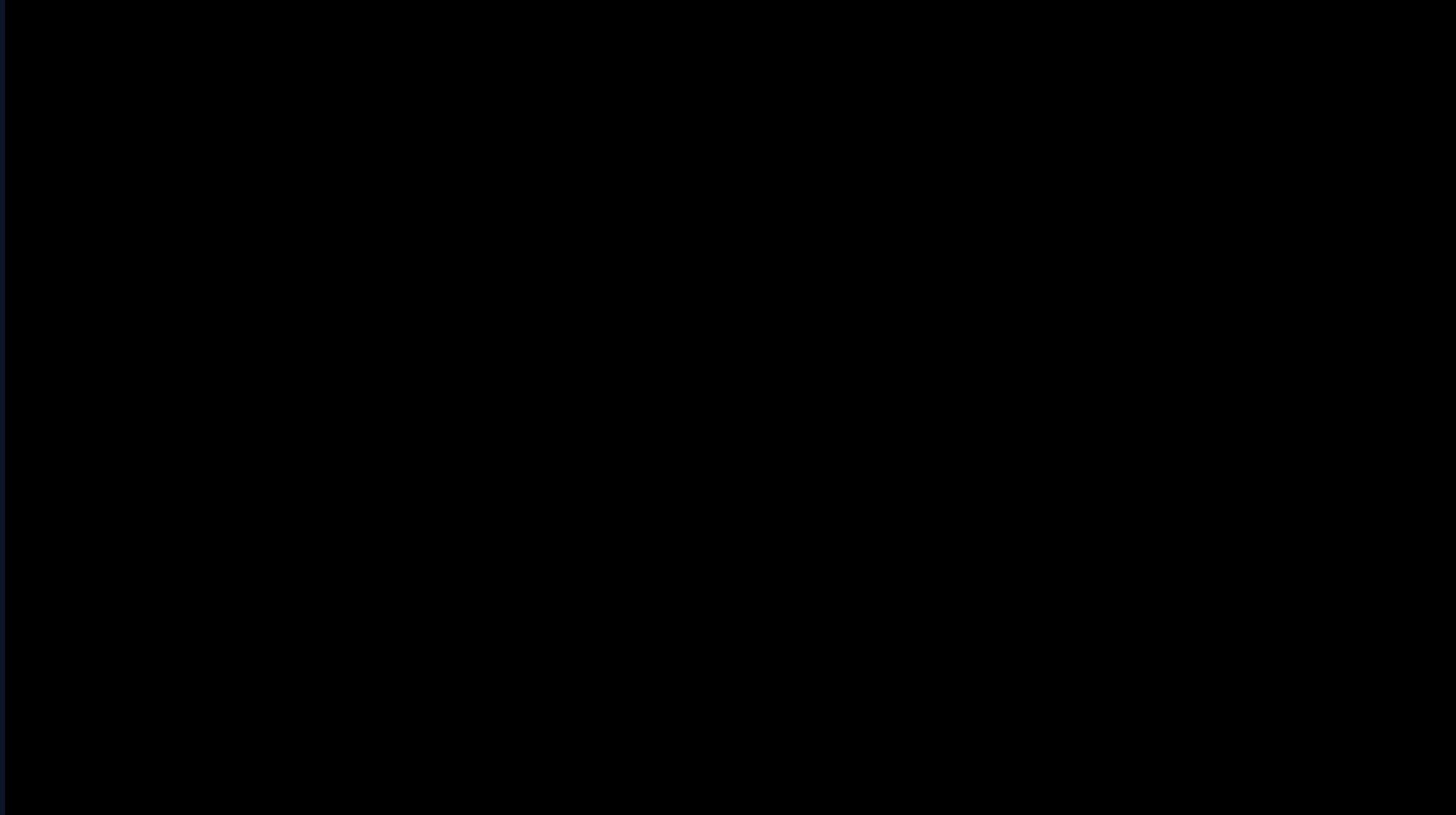
# Mission Control — Immersive Energy Atlas



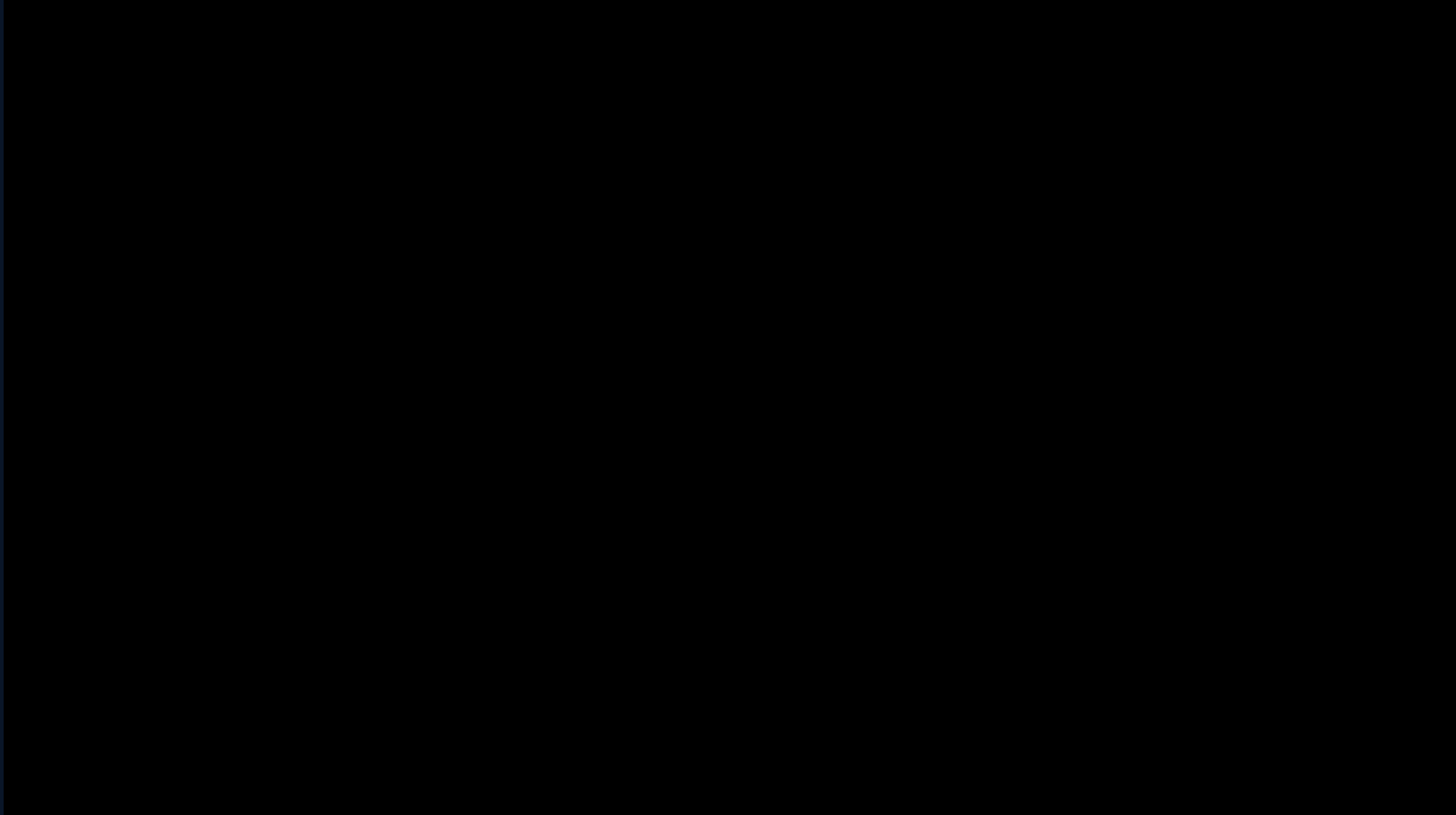
# Build your layer of market intelligence on top of real data



# Track progress in real time



# Let OpenArc guide you through key market intelligence



# Data Marketplace — Country-Owned, Version-Controlled

Each country owns its own data templates. Every change is logged, diffable, and reversible. Sovereignty is built in, not bolted on.

## STRUCTURE

### 7-Sheet Country Template

- Country\_Info (VOLL, peak)
- Generators (unit-by-unit)
- Battery\_Storage
- Transmission (NTC / lines)
- Fuel\_Prices
- Demand\_Profile (hourly)
- VRE\_Hydro\_Profiles

## GOVERNANCE

### Versioning + Audit Log

- Visual side-by-side compare
- Highlights changed cells
- Full audit log per template
- Reversible to any prior version

**Country Data Templates**  
Browse, download, and upload country energy system data across the region

Audit Log | Regenerate Baselines

All | **Regional** | National Plan

122 COUNTRIES | 3258 TOTAL PLANTS | 1,446,800 TOTAL CAPACITY (MW)

Country	Plants	Capacity (MW)	Interconnectors	Peak Demand (MW)	Updated	By
United Arab Emirates	7	769	4	1,057	2026-04-24 20:41:57	admin
Afghanistan	0	0	3	1,204	2026-05-18 21:26:16	admin
Albania	0	0	3	1,296	2026-05-17 21:09:10	admin
Armenia	8	3,271	3	1,296	2026-05-17 21:09:10	admin
Angola	0	0	1	1,534	2026-05-18 21:26:26	admin
Austria	0	0	6	9,134	2026-05-18 21:26:36	admin
Azerbaijan	7	7,872	1	4,194	2026-04-07 17:41:30	admin
Bosnia and Herzegovina	0	0	3	1,800	2026-05-18 21:26:47	admin
Bangladesh	57	11,840	5	12,766	2026-05-17 21:09:15	admin
Belgium	0	0	5	10,810	2026-05-18 21:26:56	admin
Burkina Faso	0	0	3	322	2026-05-18 21:27:05	admin
Bulgaria	0	0	3	6,024	2026-05-18 21:27:15	admin

“Inputs you own. Changes you can prove. Versions you can revert.”

# Cost-Benefit Assessment

Bankable project economics computed from the same dispatch model.  
PINT / TOOT methodology, five indicators, hourly welfare attribution.

## APPROACHES

### PINT & TOOT – TYNDP aligned

- PINT: Project IN: baseline vs baseline + project
- TOOT: Take Out One at a Time: baseline + project vs baseline
- Auto-pairs scenarios + runs both
- Same engine, no methodology gap

## INDICATORS

### 5 Benefit Categories

- B1 SEW: Socioeconomic Welfare
- B2 CO<sub>2</sub> : Societal premium (SCC €20–100/t)
- B3 RES : Renewable integration (GWh)

**Project Assessment**  
Define transmission & supply projects on the map, then run a TYNDP-style Cost-Benefit Analysis.

**Assessment Setup**

Assessment Name: e.g. KZ-KG NTC Upgrade + Solar

Baseline Scenario: Default (no scenario)

Horizons: **Preview (168h)** Full Year (8760h)

Approach: **PINT** TOOT

Project in Test: compare baseline vs baseline+project

**Run CBA Assessment**

Click on the map to add at least one project

**Post Assessments**

**KZ-CN 10GW link demo** Completed

PINT: 168h, 3 projects  
2022-04-07 17:41

**REFERENCE (BASELINE)**  
No modifications  
Preview (168h) | Run #1

**VS**

**PROJECT CASE**  
**KZ-CN 10GW link demo**  
CN-KZ NTC 10000 MW | KZ wind\_croston +15000 MW | KZ solar +10000 MW  
Preview (168h) | Run #2

**SUMMARY** PINT approach — project in test

**DETAILED ANALYSIS**

Welfare Decomposition | Benefit Indicators | Country Analysis | Congestion & Flows

**Key Metrics — Reference vs Project**

	Reference	Project	Δ
System Cost	761.84 M€	656.45 M€	105.38 M€
CO <sub>2</sub> Emissions	7,058,892.1 t	6,038,428.6 t	1,020,464 t
Renewable Gen	29.6%	37.8%	-7,107 MWh (8.2 ppt)
Unserved Energy	0 MWh	0 MWh	0 MWh
Congestion Hours	2,095	2,276	-181

**CONSUMER SURPLUS (ACS)**  
-15.67 M€  
Ref: 44.89 B€ — Proj: 44.87 B€

**PRODUCER SURPLUS (APS)**  
+120.31 M€  
Ref: 425.61 M€ — Proj: 545.92 M€

**CONGESTION RENT (ACR)**  
+0.74 M€  
Ref: 18.09 M€ — Proj: 18.83 M€

**TOTAL SOCIAL & ECONOMIC WELFARE (ASEW)**  
+105.38 M€  
CS + PS + CongRent = +105.38 M€

“Every benefit traced back to the dispatch hour that produced it.”





# Long Term Capacity Expansion

Co-optimize new build across generators, storage, and transmission under budget caps and renewable targets. The same LP engine; longer horizon, more decision variables.

## CANDIDATES

### Reference Technology and Financial data

- Solar PV, wind onshore / offshore
- Thermal gas, thermal coal
- BESS 4h, 8h, 24h long-duration
- New transmission links
- Overnight CAPEX €/kW
- Lifetime by technology

## COSTS

### Policy Levers

- Total budget cap (€)
- Renewable energy target (% gen)
- Optimal MW per candidate
- System-cost trajectory
- Plant-by-plant build plan
- One-click → operational scenario

“From scenario to investment programme in a single workflow.”

## KZ test — Run #1

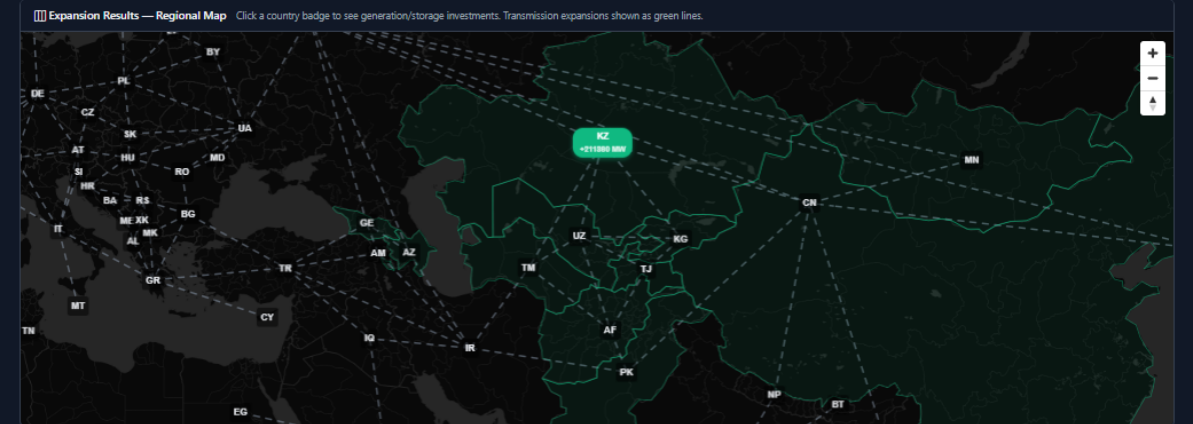
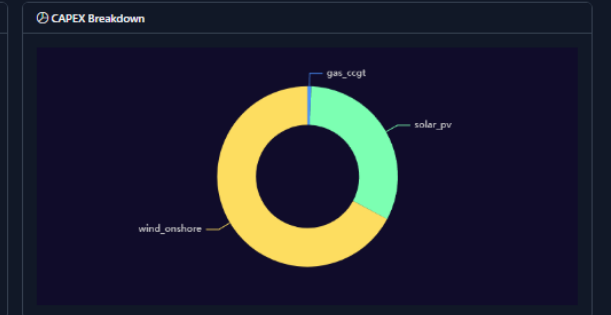
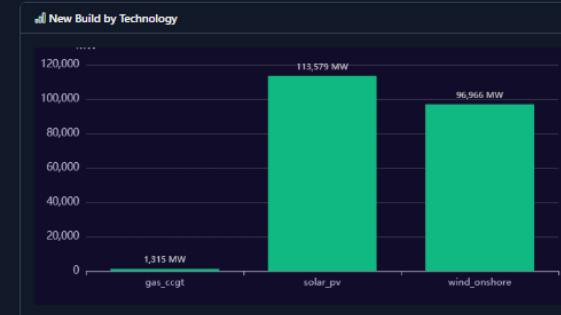
Target year 2035 | 2920 snapshots at 3h | Solved in 3658.9s

[Create Operational Scenario](#) [← Back to Study](#)

<b>211,860</b> NEW BUILD (MW)	<b>13.6 B</b> ANNUAL CAPEX (EUR)	<b>5.5 B</b> ANNUAL OPEX (EUR)	<b>19.1 B</b> TOTAL SYSTEM COST (EUR)	<b>21.4%</b> RENEWABLE SHARE	<b>50,059,478</b> CO2 (TONNES)	<b>3 / 3</b> CANDIDATES BUILT
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Optimized Capacities [Download CSV](#)

Country	Technology	Type	Baseline (MW)	New Build (MW)	Total (MW)	CAPEX (EUR/yr)
KZ	solar_pv	generator	7,158	+113,579	120,737	4,386,581,502
KZ	wind_onshore	generator	3,896	+96,966	100,862	9,155,451,796
KZ	gas_ccgt	generator	46,250	+1,315	47,566	90,096,683
<b>Total</b>				<b>+211,860</b>		<b>13,632,129,981</b>





# Network Studies — Validating the Physical Grid

From economic dispatch to the physics of the network. OpenArc rebuilds a power-flow network from the model's own dispatch, proves it reproduces those flows, then runs a full grid-study stack.

## STEADY-STATE

### Power-Flow & Security

- DC load flow, I<sup>2</sup>R losses by country
- N-1 contingency security (LODF watch-list)
- PTDF sensitivity + flow decomposition
- dNTC: transfer capacity at a border
- AC voltage profile + map heatmap

## DYNAMICS & FAULTS

### Stability & Short-Circuit

- Technology-typical generic machine models
- Rotor-angle (transient) stability analysis
- Connection / hosting-capacity study

Outcomes
Stability Graphs

Analysis	Result	Tier
Voltage stability	Loadability margin +55% before voltage collapse (conservative reactive limits); weakest bus KZ-South @ 0.94 pu.	T2
dNTC (cross-border)	CN→KZ 2807 · KZ→UZ 2827 · TJ→UZ 6317 · TM→UZ 3102 · KG→KZ 3500 MW (indicative cutset NTC).	T2
Frequency stability	Inertia H 3.67 s (230 GW-s, 62.8 GW synchronous). 1000 MW trip → RoCoF 0.108 Hz/s, nadir 49.84 Hz, settle 49.96 Hz.	T2
Transient / rotor-angle	N-1 line trips STABLE (first swing ≤ ~30°). A 3-phase fault on the KZ North→Central coal-transit bus cleared late (> ~0.2 s critical clearing time) → loss of synchronism — the transient-stability bottleneck.	T2
Small-signal	Inter-area mode ~0.15 Hz, damping ~12% → well damped (small-signal stable).	T2

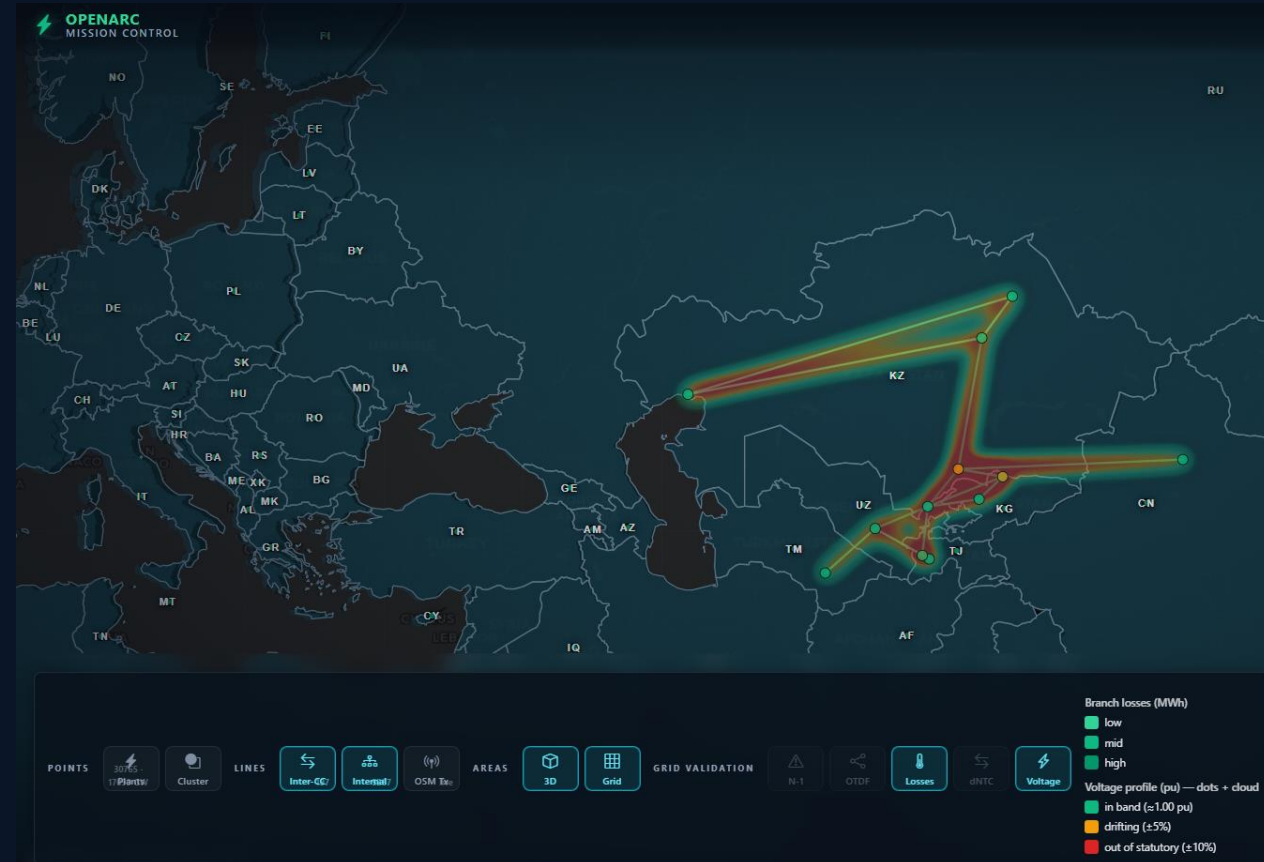
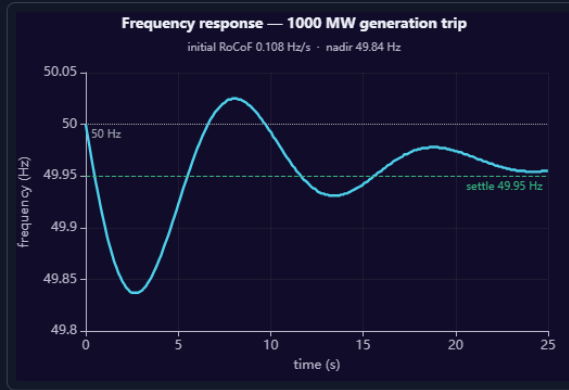
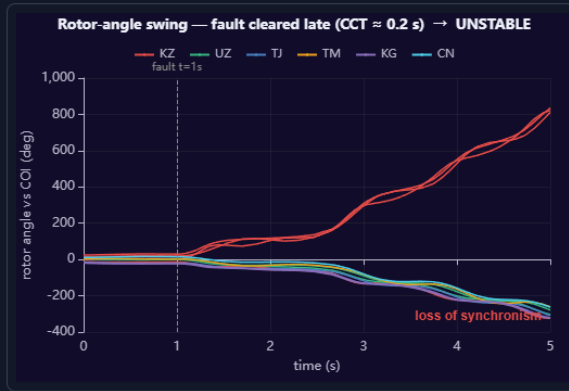
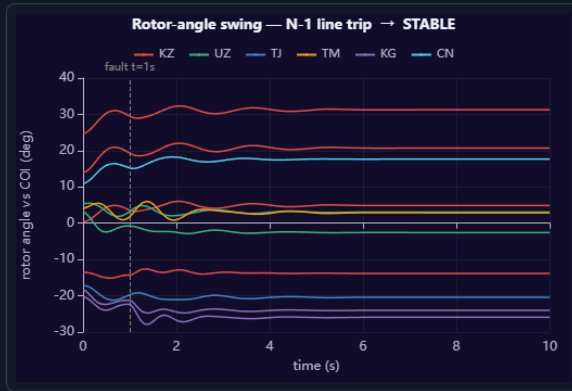
🔗 Connection study — 1000 MW Wind-Onshore — Kazakhstan (South KZ)

Most-affected corridor	KZ-South → UZ-Tashkent at 24% (+5 pp)
New thermal overloads	none
Voltage impact	negligible (~0 pu)
Hosting headroom at the POC	> 6 GW
Short-circuit contribution	~1.4 kA (IBR — current-limited, far below a synchronous plant of the same rating)
Verdict	Connectable with no 500 kV reinforcement

“The same network the market dispatched, now stress-tested as physical hardware.”

# Network Studies — Validating the Physical Grid

Outcomes Stability Graphs



“The same network the market dispatched, now stress-tested as physical hardware.”

# AI Assistant – Conversational Analytics, Local-First

Ask the platform in plain English. 15 analytical tools wired into a streaming chat. Runs on a local model — no data leaves your premises.

## ASK

### Natural-Language Queries

- “Loadshed in South Africa, scenario 17?”
- “Compare scenarios 12 and 18.”
- “List Germany data templates.”
- “Run a preview with +5 GW PV in Mongolia.”

## TOOLS

### 15 Analytical Tools

- list\_my\_scenarios / get\_scenario
- query\_loadshed / prices / emissions
- query\_interconnector\_flows
- compare\_runs / get\_results\_summary
- create\_and\_run\_scenario
- list\_marketplace\_templates

## ARCHITECTURE

### Local LLM, Streaming UX

- Served model on-premise
- Server-Sent Events for live tokens
- Tool-call traces visible to user
- No cloud dependency
- Data sovereignty preserved

## AUDIT

### Every Step Logged

- Full conversation history
- Per-message tool invocations
- Reproducible result trail
- Role-based access enforced

**“A research analyst on call. 24/7. Inside your firewall.”**

# What the Platform Answers Today

Concrete policy and investment questions answered in seconds to minutes



## Strategic Planning

What is the least-cost generation mix for the CAREC region?



## Interconnector Economics

What is the economic value of upgrading the Kazakhstan–China interconnector by 500 MW?



## Renewable Impact

How does a 5 GW solar expansion in Uzbekistan change marginal prices across the region?



## Security of Supply

What happens to supply security in Afghanistan if Pakistan's demand doubles?



## Carbon Policy

How does a carbon price of €50/tCO<sub>2</sub> shift the regional generation mix from coal to gas and renewables?



## Network studies

How does an N-1 contingency on a key cross-border line reshape the regional flow pattern, shifting PTDF-driven flows, I<sup>2</sup>R losses by country, and available dNTC at the border, while keeping the AC voltage profile within limits?



## Project Cost and Benefit Analysis

What is the cost-benefit ratio of a new battery storage project in Kazakhstan using TYNDP methodology?



## Every Question Becomes a Scenario

Each scenario produces full results: marginal prices, generation dispatch, cross-border flows, CO<sub>2</sub> emissions, adequacy metrics, and complete CBA assessment.

# Building Energy Cooperation on a Foundation of Transparency

Are you ready to be part of the OpenArc journey?



## Transparency

Open-source, auditable, reproducible



## Trust

Verified methodology, shared understanding



## Cooperation

Coordinated dispatch, shared benefits

GOOD AFTERNOON, ADMIN

### Where should we start today?

Click a country or a corridor on the map — or pick a mission below.

SELECTION Clear

Nothing selected yet. Tap a country or a corridor on the map.

MISSIONS 5 available

- Stress-test demand growth**  
Scale demand on selected countries; see where the system bends.
- Test a fuel price shock**  
Push gas, coal, oil prices and watch dispatch reshuffle.
- Run capacity expansion**  
Co-optimize new generation, storage, and transmission.
- Create CBA assessment**  
TYNDP 2024 welfare decomposition for a regional project.
- Browse my scenarios**  
Open recent scenarios and runs on the classic dashboard.
- Explore congestion**  
Find the choke-points: which corridors saturate first?  
SELECT 1 COUNTRY OR CORRIDOR
- Evaluate a new interconnector**  
Add a corridor; estimate welfare gain via CBA.  
SELECT 2 COUNTRIES OR 1 CORRIDOR
- Compare country data versions**  
Show what changed in a country's template — line by line.  
SELECT 1 COUNTRY