From Equations to Execution

Real Problems in Energy & Financial Trading

Athens, 31/10/2025

ppc trading

Public Power Corporation

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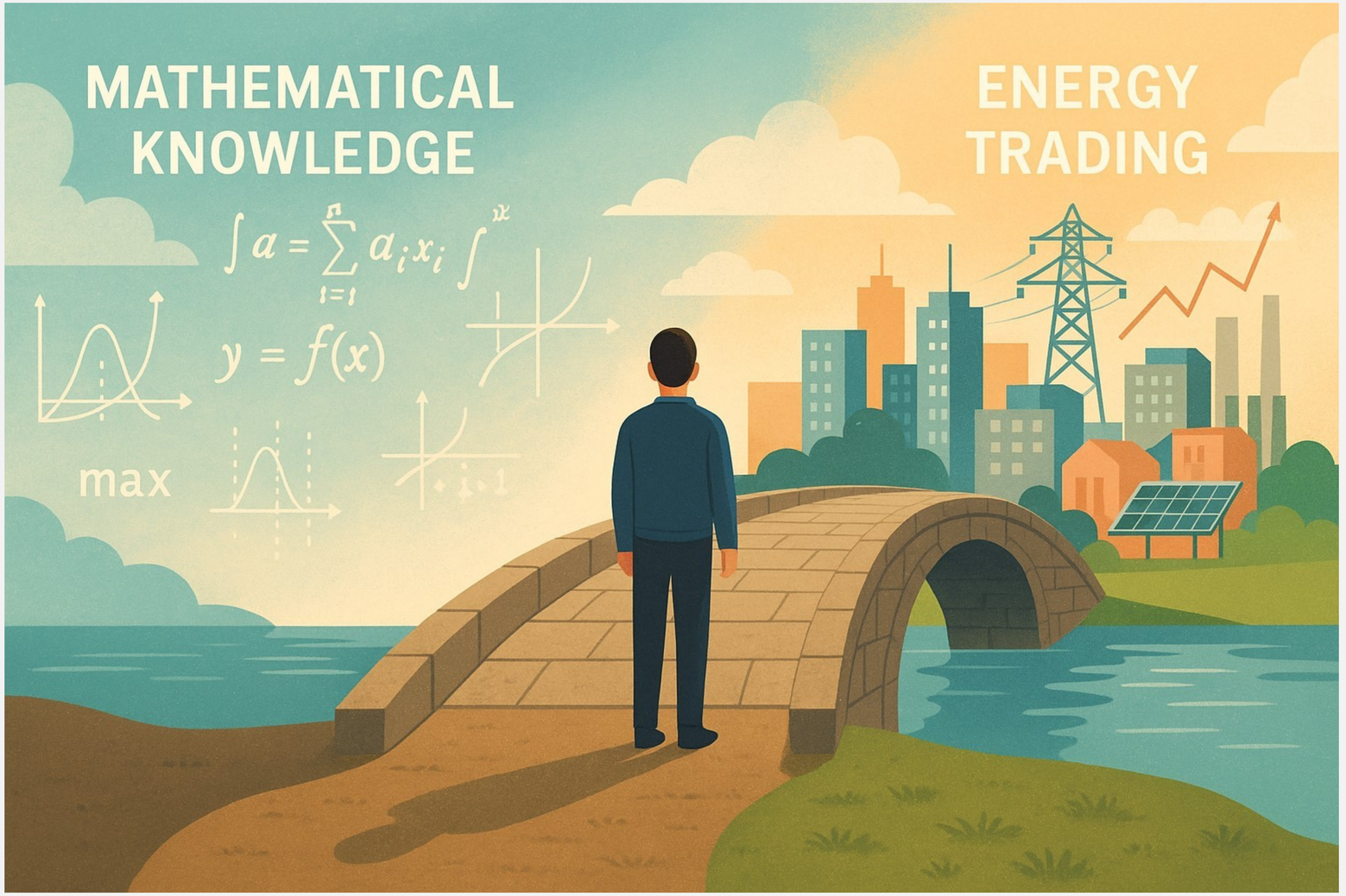
Many rivers to cross



4 stories for today

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Story #1: Volatility

What happens internationally always shapes our work locally.

Story #2: Price forecasting

shield customers and producers from market swings.

Story #3: Physical Energy Markets

Shedding light on the black box.

Story #4: RES

The elephant in the room is green.

Story #1
Volatility

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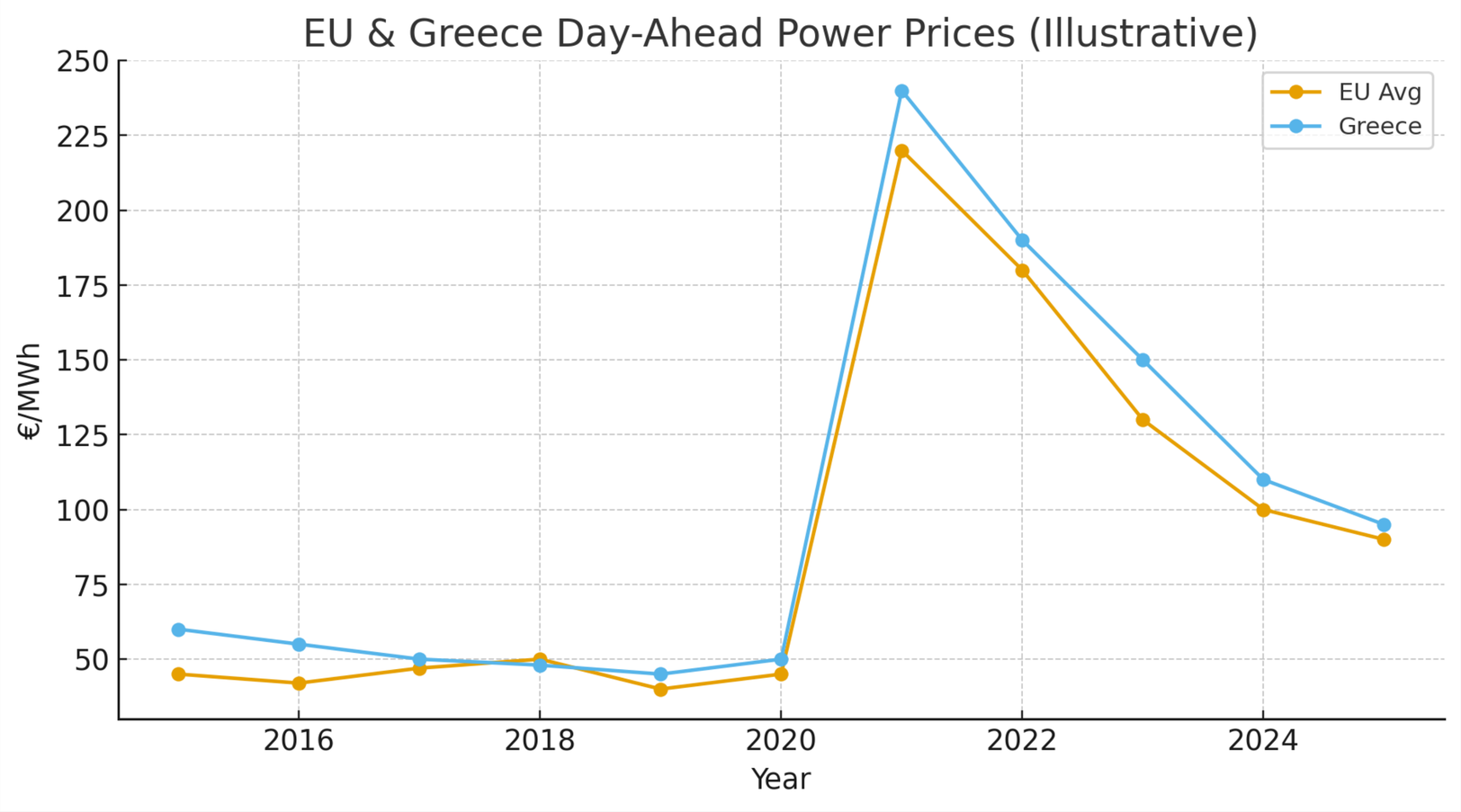
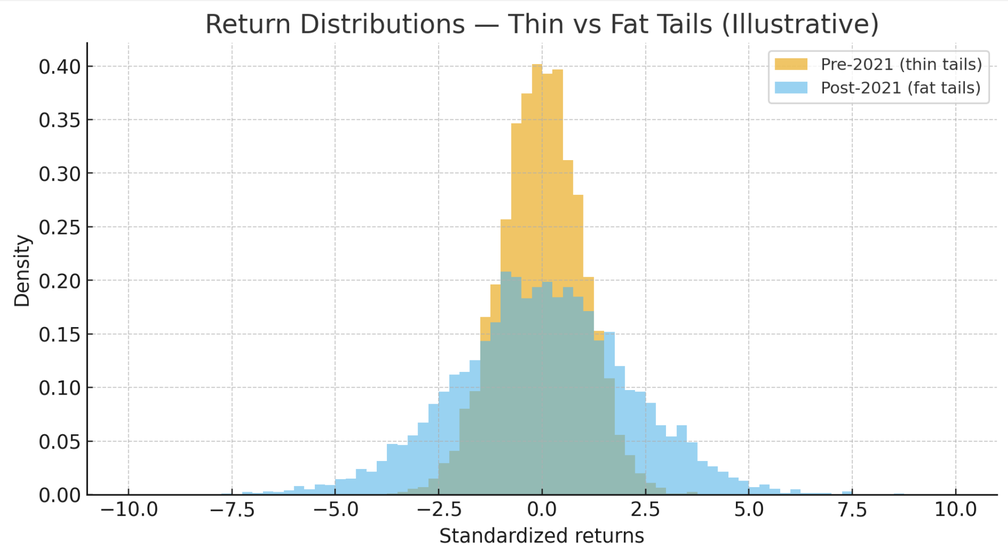
What kind of tools do I need to cope with that?



Thin vs Fat Tails in Power Prices

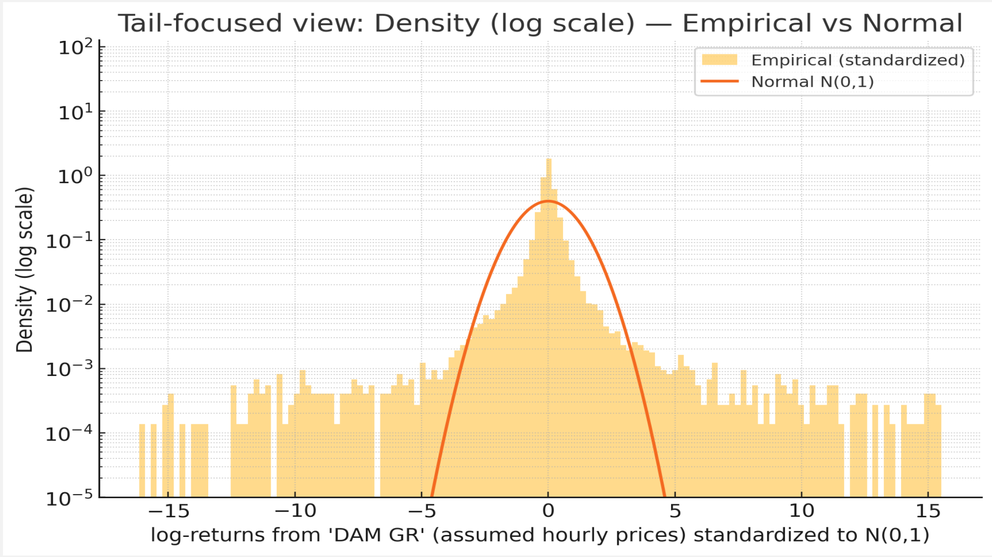


Volatility & Tails — Key Equations

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

$$P(X > x) \approx k x^{-\alpha}, \quad \xi = 1/\alpha$$

GARCH captures clustering; EVT parameterizes heavy tails for extreme events.



Post-2021 distributions exhibit heavier tails — motivating EVT/stochastic volatility.

AI-Powered Risk Management

Traditional models (GARCH, EVT) explain structured volatility and tail risk. AI systems extend them — learning, adapting, and predicting risk regimes in real time.

Layer	Method	Role
Volatility Modeling	GARCH / EGARCH / TGARCH	Capture time-varying risk
Tail Modeling	EVT / GPD	Quantify extreme price spikes
Learning & Adaptation	LSTM / Transformers	Learn nonlinear temporal structure
Decision Layer	Reinforcement Learning	Optimize bids/hedges/SoC under constraints

AI-augmented GARCH–EVT frameworks merge statistical interpretability with adaptive intelligence — enabling real-time, explainable, tail-aware risk management.

GARCH(1,1): $\sigma_t^2 = \omega + \alpha\,\varepsilon_{t-1}^2 + \beta\,\sigma_{t-1}^2$

EVT (GPD): $P(X > x \mid X > u) \approx (1 + \xi\,(x-u)/\beta)^{-1/\xi}$

RL Objective: $J(\theta) = \mathbb{E}\left[\sum_{t=0}^{T-1} \gamma^t r_t\right]$

Risk-aware: $J_{\text{risk}} = J - \kappa\,\text{CVaR}_\alpha\left(-\sum \gamma^t r_t\right)$

Story #2
Price Forecasting

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Different stakeholders – different needs

Standard Products

Non-Standard Products

Trading teams providing solution

RES Owners

Consumers

Math as a tool for decision making

Let’s dive into our data landscape

Wind

Nuclear

Lake filling rate

Solar PV

Unit Availability

EUA

TTF

ATC

Temperature

PMI

GDP

Bonds

Brent

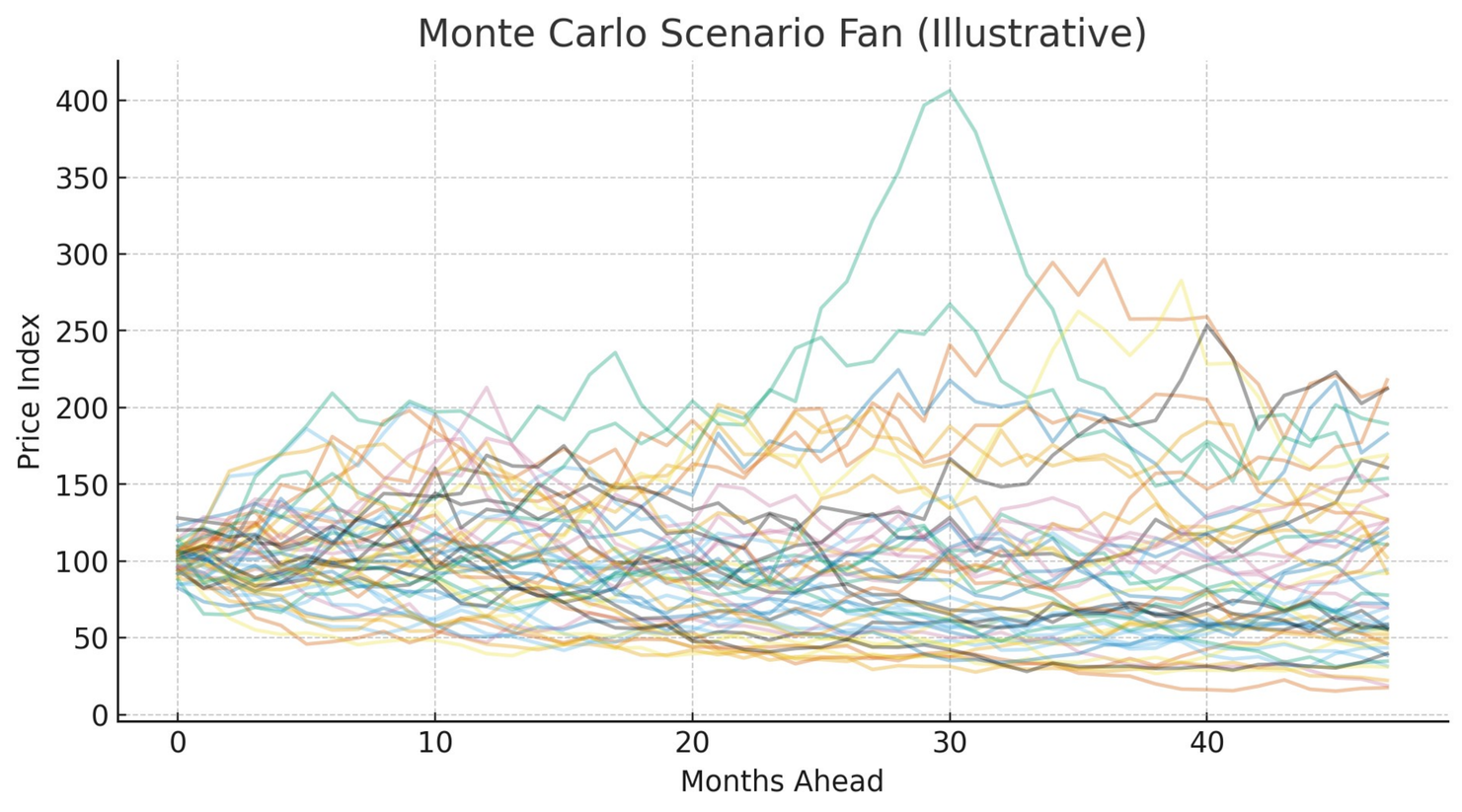
EU Gas Storage

RES Growth

Gas Infra Maintenance

Piece / war

Scenario Fan



Scenario Modelling — GBM Path Dynamics (Illustrative)

$$S_{t+\Delta t} = S_t e^{(\mu - \frac{1}{2}\sigma^2)\Delta t + \sigma\sqrt{\Delta t} Z_t}$$

Story #3
Physical Energy Markets

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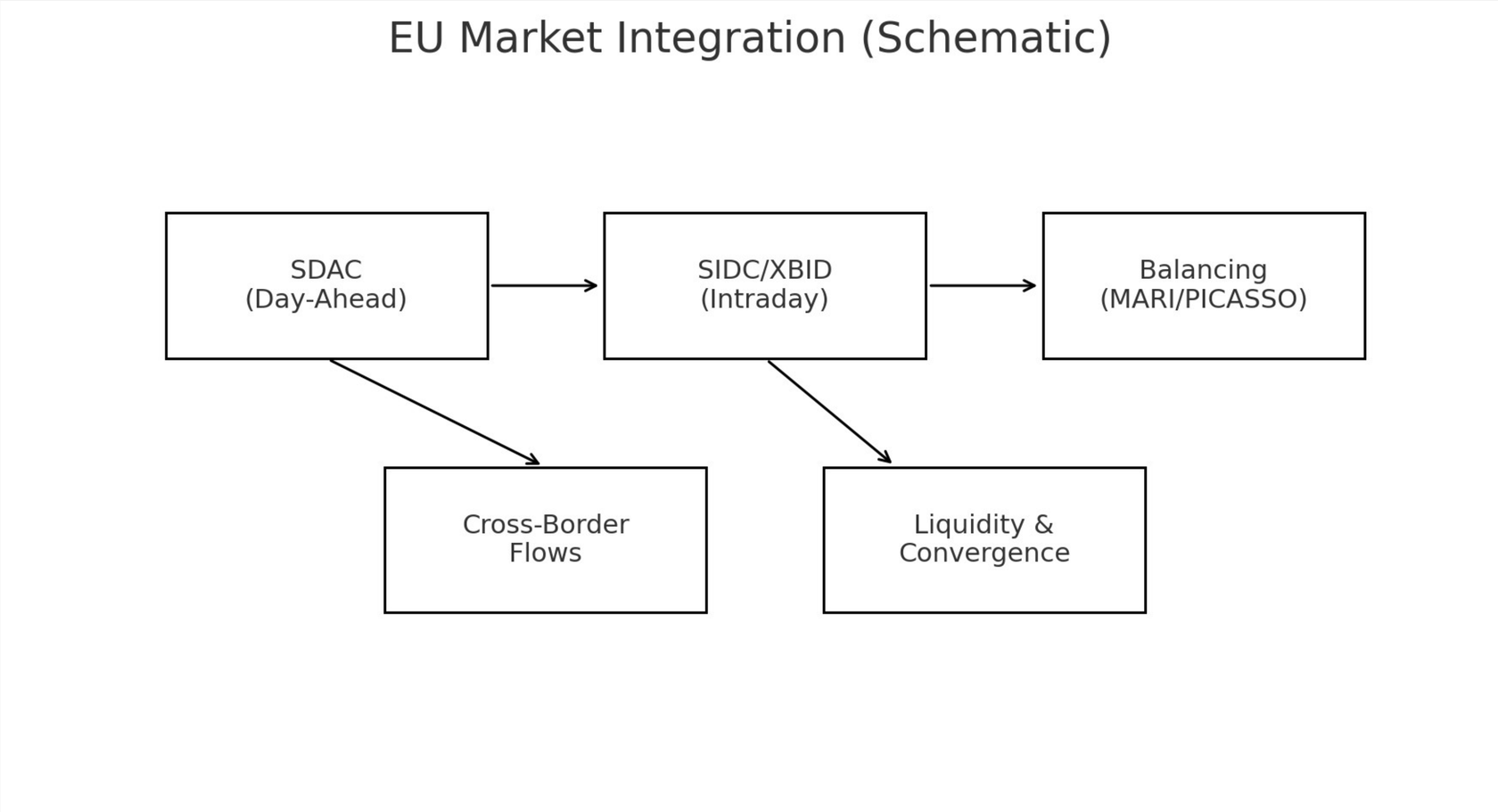
So, there’s more than one market?



What is SDAC and how does it work?

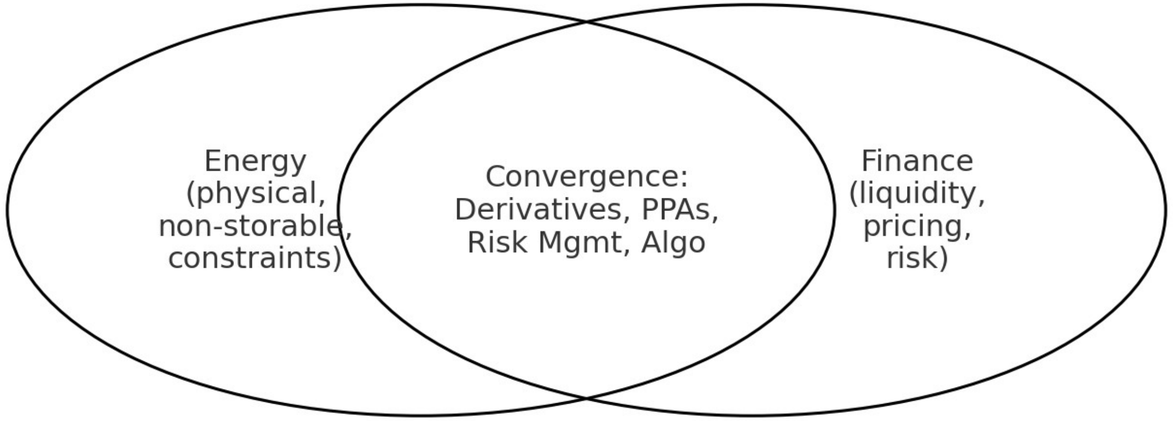
Market Clearing (Abstracted)

$$\min \sum_i C_i(P_i)$$

$$\text{s.t. } \sum_i P_i = D, \quad \text{and network constraints}$$

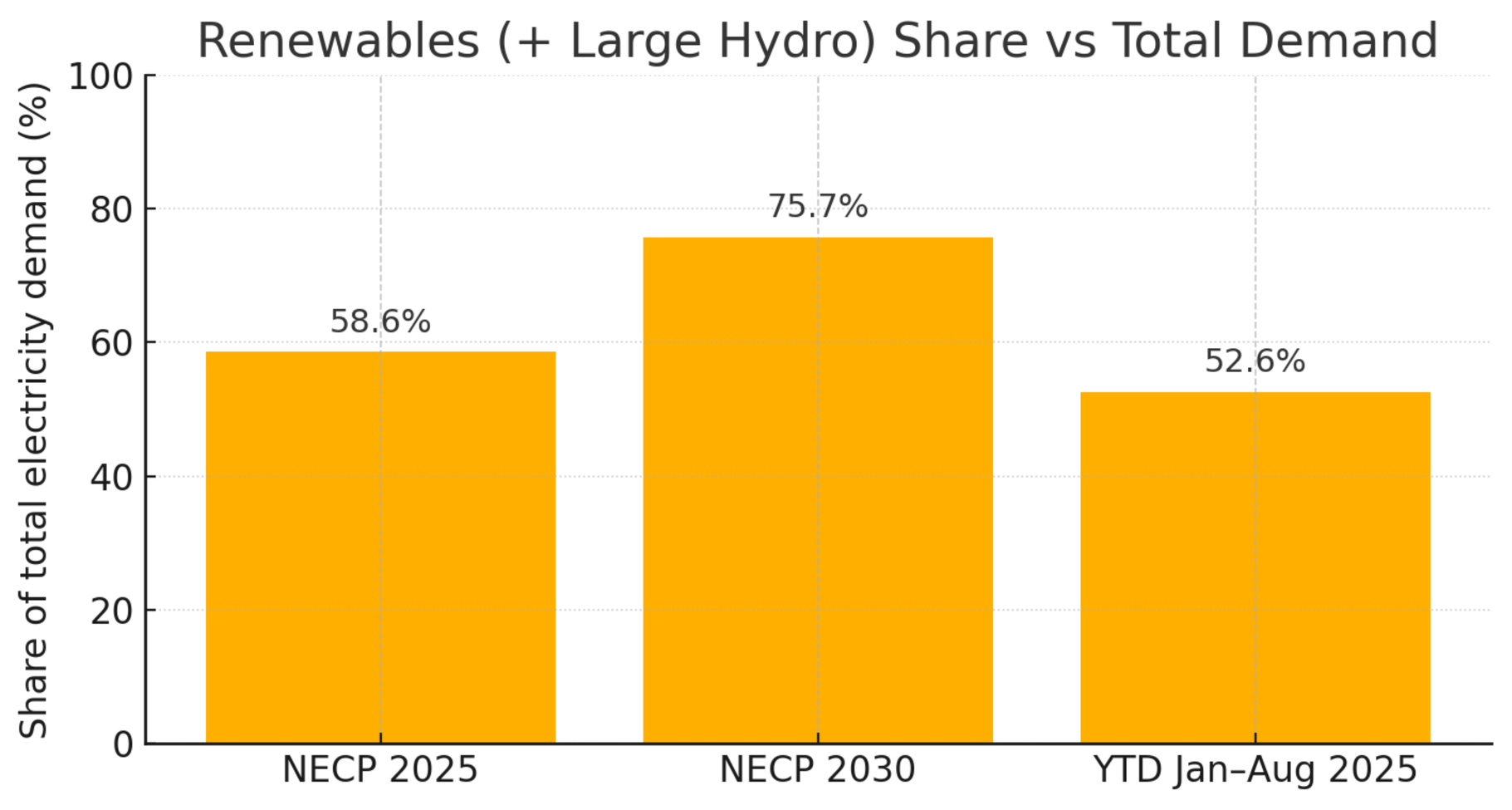
Clearing minimizes cost subject to demand balance and network constraints.

Physical vs Financial – Two worlds, one reality



Story #4
The king in energy chess

Why Green is king?



Domain Knowledge &
Data Analysis:

Side by side

Data Analyst	Data Analyst	Energy Trader	Energy Trader
Data Analyst	Data Analyst	Energy Trader	Energy Trader
Data Analyst	Data Analyst	Energy Trader	Energy Trader
Data Analyst	Data Analyst	Energy Trader	Energy Trader

Minion, Athens

- ✓ **From production to consumption**
- ✓ Brainstorm together, achieve together
- ✓ Collaborate to innovate
- ✓ Synergy in action: teamwork makes the dream work
- ✓ Two teams, one vision: excellence!

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From Theory to Market — Your Turn to Cross the Bridge

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Ένα με
το μέλλον