

value

# Developing Custom Trading Algorithms in a REMIT II Compliant Environment



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- What is REMIT II and what are the Implications?

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- What are Examples of Problematic Market Situations?

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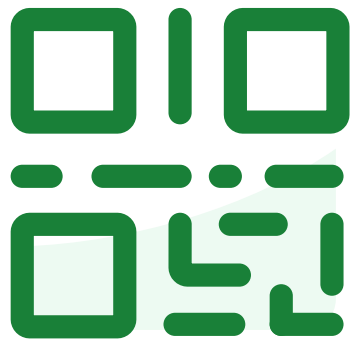
- What would an Advanced Risk Management Framework look like?

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- What is the Best Practice Development Process for Custom Algorithms in the Context of a Stricter Regulatory Environment?

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**How confident are you in your current understanding of REMIT II requirements for algorithmic trading?**

# An Introduction to REMIT II

- The revised Regulation on Wholesale Energy Market Integrity and Transparency (EU Regulation 2024/1106) was published 17 April 2024 and **entered force on 7 May 2024**
- The European Parliament has effectively **extended the requirements of the Regulatory Technical Standards 6 (RTS 6)**, defined by MiFID II for algorithmic trading activities in financial instruments, to cover algorithmic trading in **wholesale energy products**
- **National Regulatory Authorities (NRAs)** are provided with both **regular and ad hoc supervisory** roles over participants engaging in algorithmic trading activities
- The **Agency for the Cooperation of Energy Regulators (ACER)** has been granted **supervisory powers**, particularly focusing on suspected cases of cross-border market manipulation
- Market participants must **implement systems and procedures to identify potential breaches of REMIT** and detect and report suspicious orders and transactions

# What are the Most Relevant Aspects of REMIT II?

## Article 5a

- **Resilience:** Effective systems and risk controls must be in place
- **Trading Limits:** There must be safeguards to prevent sending erroneous orders or disrupting the market
- **Business Continuity:** There must be contingency plans for system failures
- **Mandatory Notification:** Participants using algorithmic trading must inform the respective NRA and ACER
- **Documentation:** Proper documentation on the use of algorithms must be provided
- **Record Keeping:** Keep records for five years to support compliance

## Article 15

- **Mandatory Reporting:** If suspicion arises of a breach of **Articles 3, 4, or 5** (insider trading or market manipulation), notify **ACER** and the **relevant national regulator**
- **Internal Controls Required:**
  - Systems to **detect potential breaches**
  - **Independent surveillance** free from conflicts of interest
  - Procedures to **report suspicious activity**

# But What Actually is an Algorithm?

REMIT II defines a number of criteria for a trading system to be considered “algorithmic”:

- Applies to **wholesale energy products** traded on or off organised marketplaces (OMPs)
- Involves a computer algorithm that:
  - **Automatically determines** key order parameters (e.g. initiation, timing price, quantity)
  - Manages orders after submission
  - Operates with **limited or no human input**

Typically **includes** the following:

- Execution algorithms (e.g. VWAP/TWAP engines for imbalance management)
- Flexibility trading algorithms (e.g. asset-backed volatility trading)
- Market-making algorithms

Typically **excludes** the following:

- Systems used for routing orders
- Order confirming processes
- Post-trade processing
- Tasks that do not involve trade decision-making





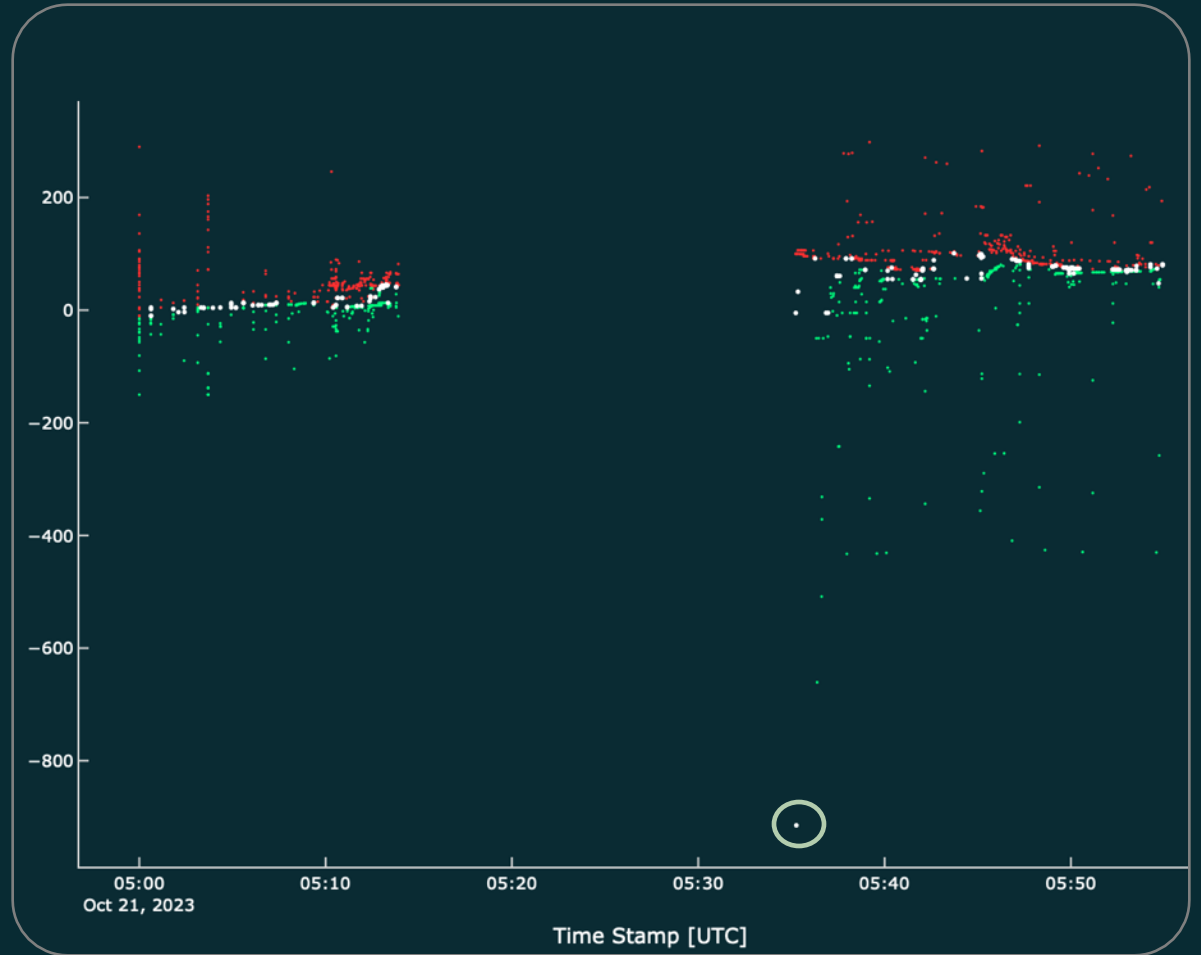
**Scenario: A fully automated system independently determines order price & position size and creates a bidding matrix for the Day-Ahead auction.**

**Is this considered algorithmic trading under REMIT II?**

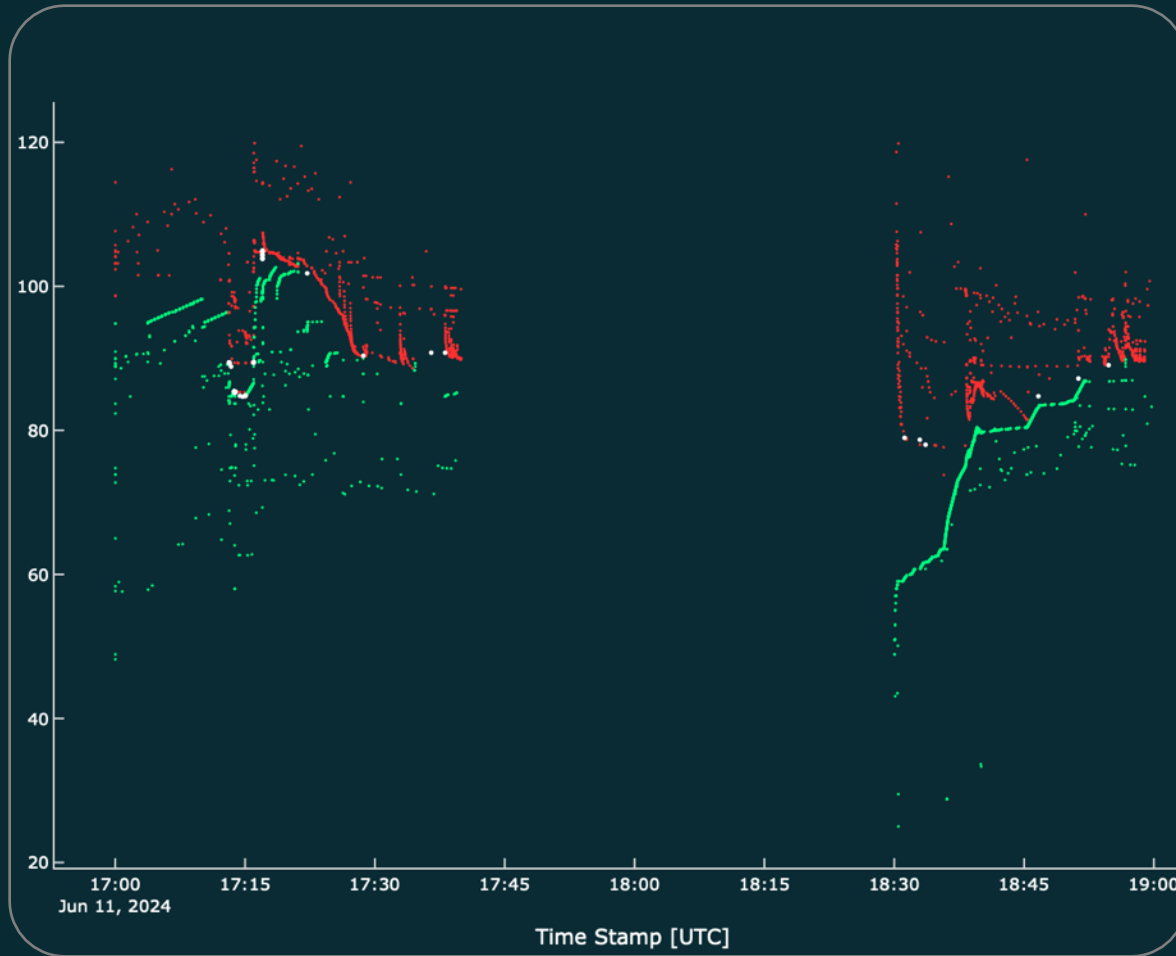
# Out-of-Market Pricing and the Signals it Sends

## Scenario:

- EPEX experienced an unplanned outage.
- The figure shows the continuous order book for the quarter hour contract on 21 October 2023 06:00–06:15 UTC in Germany, Amprion on the same day between 05:00–05:55 UTC.
- **Potential Market Manipulation Risk:** Pricing significantly outside of prevailing market levels can distort market signals and may be perceived as an attempt to manipulate market outcomes



# Algorithmic Feedback Loops



## Scenario:

- Unplanned outage at EPEX.
- The figure shows the continuous order book for a quarter hour contract with delivery on 11 June 2024 22:15–22:30 UTC in Amprion.
- **Self-Reinforcing Price Distortions:** Algorithmic trading systems can unintentionally create feedback loops that amplify price movements.
- **Unintentional Market Manipulation:** Even without malicious intent, algorithmic strategies may generate patterns that fall under the definition of market manipulation

# Cross-Trades as Potential Risk

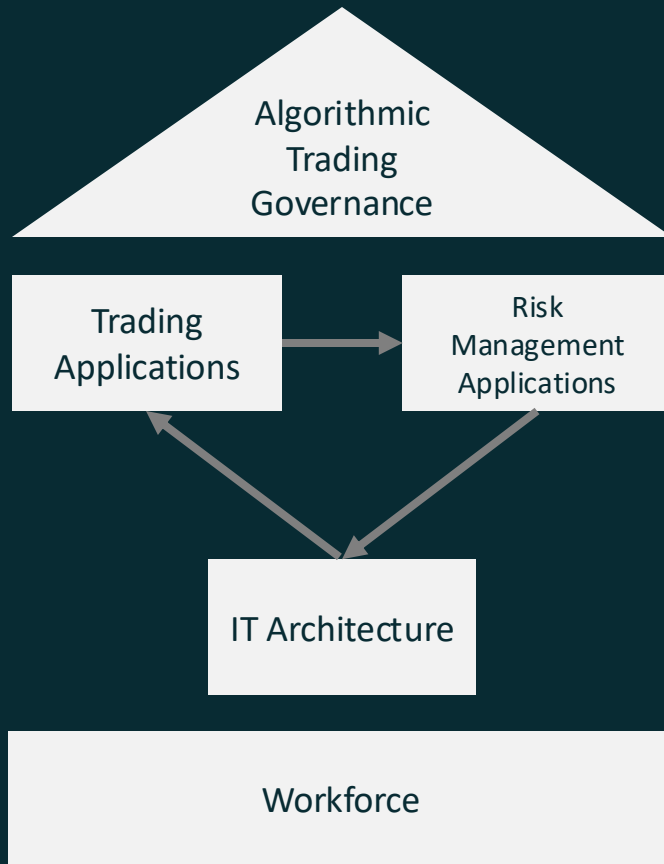
## Scenario:

- Snapshot of executed transaction for hourly delivery on 29 July 2024 00:00–01:00 UTC in Amprion.
- NL Tennet – DE Amprion Cross-Border available capacity on 28 July 2024 between 17:00–21:30 UTC.
- **Wash Trades as Potential Market Manipulation:** Absence of change of beneficial interest or market risk is transferred between parties acting in concert or collusion.

## Public Trade Records

Trade ID	Buy Delivery Area	Sell Delivery Area	Exec Time	Quantity [MW]	Price [€/MWh]	Updated At	Self Trade
1737844529	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:22:24.043Z	0.2	74.01	2024-07-28T20:22:24.043Z	False
1737844567	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:22:25.789Z	1	74.38	2024-07-28T20:22:25.789Z	False
1737845363	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:23:08.366Z	2.7	75.4	2024-07-28T20:23:08.366Z	False
1737847376	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:24:47.203Z	0.2	76.46	2024-07-28T20:24:47.203Z	False
1737847392	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:24:47.306Z	2	76.71	2024-07-28T20:24:47.306Z	False
1737847983	10YDE-ENBW---N	10YDE-RWENET--I	2024-07-28T20:25:22.862Z	0.1	76.05	2024-07-28T20:25:22.862Z	False
1737848514	10YDE-EON----1	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	6.3	76.89	2024-07-28T20:26:45.695Z	False
1737848515	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	4.9	76.81	2024-07-28T20:26:45.695Z	True
1737848516	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848517	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848518	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848519	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848520	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848521	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848522	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848523	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848524	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848525	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848526	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848527	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848528	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848529	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848530	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848531	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848532	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	5	76.81	2024-07-28T20:26:45.695Z	True
1737848533	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.695Z	3.8	76.81	2024-07-28T20:26:45.695Z	True
1737848534	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.822Z	1.2	76.81	2024-07-28T20:26:45.822Z	False
1737848535	10YNL-----L	10YDE-RWENET--I	2024-07-28T20:26:45.822Z	0.8	76.81	2024-07-28T20:26:45.822Z	False
1737848544	10YDE-EON----1	10YDE-RWENET--I	2024-07-28T20:26:45.907Z	1.5	76.5	2024-07-28T20:26:45.907Z	False
1737848545	10YDE-VE----2	10YDE-RWENET--I	2024-07-28T20:26:45.907Z	0.5	76.36	2024-07-28T20:26:45.907Z	False
1737849718	10YDE-RWENET--I	10YDE-VE----2	2024-07-28T20:28:49.451Z	0.1	77.2	2024-07-28T20:28:49.451Z	False

# Advanced Algorithmic Trading and Risk Management Framework



## Trading Processes

- Access to rich data backbone (historical market data, weather data etc.)
- Efficient DevOps process to allow front office to quickly iterate
- Front-to-end automation of all pre- and post-trade processes

## Risk Management Processes

- Modelling financial risk to dynamically configure limit settings
- Address operational risk with real-time monitoring, alerting and kill-switch functionality
- Dedicated risk manager role

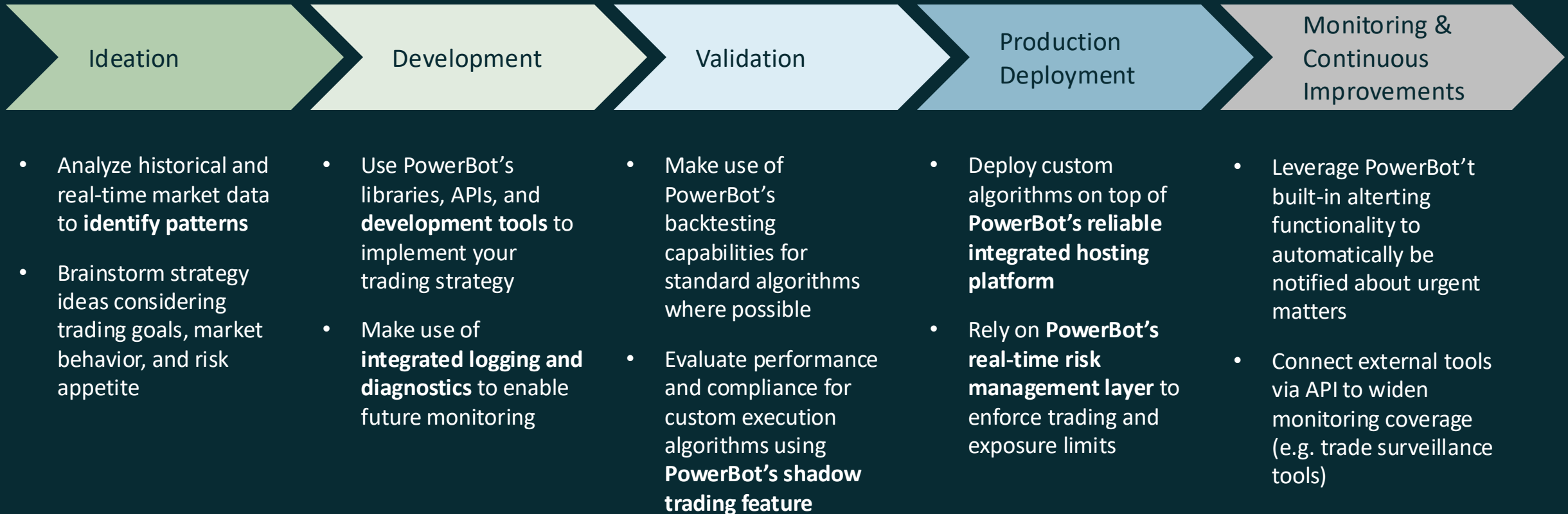
## IT Architecture

- Establish effective business continuity and disaster recovery procedures
- Enable record keeping, ensuring comprehensive audit trails are available

## Key Points

- A well functioning compliance framework builds on multiple pillars
- IT architecture as key enabler for processes

# The Compliance Pipeline for Custom Algorithms



# Ideation – Execution vs Signal Algorithms

## Execution Algorithms

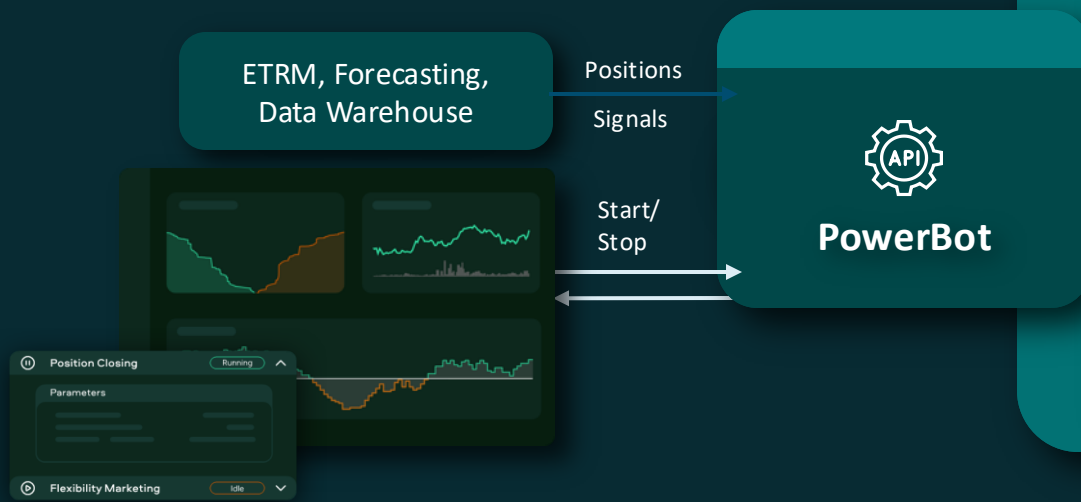
- Splits large orders into smaller slices and executes them throughout the day to match the **Volume-Weighted Average Price** (VWAP), reducing market impact
- Adjusts execution pace dynamically based on **real-time trading volume**, seeking to stay aligned with the market's activity profile
- Prioritizes **low slippage, minimal signaling risk**, and stealth execution

## Signal Algorithms

- Continuously analyzes **market data**, such as price trends, technical indicators, order book dynamics, or fundamental events, to **detect actionable patterns**
- Generates **entry or exit signals** based on predefined logic or models, which can be rule-based, statistical, or machine learning-driven
- Acts as the **decision engine** in a trading system, sending trade intent (e.g., buy/sell signals) to execution algorithms without directly placing orders

# Development – Tool Kits

- Algorithm base class for Python that implements **default algorithm architecture**
- **Algorithm deployment tools** for Kubernetes and Docker Compose with high availability



## PowerBot Algorithm Orchestrator (Kubernetes/Docker)

Algo 1

Market Trigger Events (Web Socket)

Event Queue Orchestrator

```
myAlgo(trigger) {  
  
  ob = get_orderbook(trigger.contract)  
  net_pos = ob.net_pos  
  my_orders = ob.my_orders  
  
  open_pos = ob.signal.long - ob.signal.short - net_pos  
  
  price = ob.signal.price_forecast  
  qty = open_pos  
  
  if (open_pos > 0) {  
    create_order(ob.contract, price, qty)  
  } else {  
    ...  
  }  
}
```

Worker Thread #2

Worker Thread #3

Algo 2

Algo 3



# Validation - Operational Controls and Pre-Trade Checks

- **Built-in Safety Layer:** Pre-trade limit checks are **native features** of PowerBot and automatically available to all custom trading algorithms
- **Customizable Risk Parameters:** Users can configure thresholds such as maximum position exposure, cash limits, upper limits for order management transactions and others.
- **Real-Time Enforcement:** Limits are enforced before any order reaches the market, helping prevent erroneous orders and ensuring regulatory compliance

Risk Management Settings - Portfolio: P\_SC

Delivery Areas

Position Limits

Cash Limits

Order Action Quota Limits

Position limits can be set for combination of exchange and delivery area. This controls the allowed net position per timeframe of a particular contract (XBID and LOCAL Contract) for the particular portfolio, in MW (e.g. from -20 MW to +50 MW) and the absolute trading volume in MW (e.g. 100 MW).

Exchange\*

EPEX

Delivery Area\*

DK1 (10YDK-1-----W)

Net position limit

min

-20

MW

max

20

MW

Net position exposure limit

min

-30

MW

max

50

MW

Absolute position limit

abs. pos

25

MW

Net Position

Exchange	Delivery Area	Min	Max	Min Exposure	Max Exposure	Abs. Pos.
EPEX	SGD	-20.0	20.0	-300.0	200.0	25.0

Cancel

Save

Risk Management Settings - Portfolio: 01

Delivery Areas

Position Limits

Cash Limits

Order Action Quota Limits

Cash limits are configured per currency and allow you to control the daily net cash position (e.g. -50,000 to +100,000) on a trading day (midnight to midnight in local time). The cash limit is defined for each exchange individually on a portfolio-level.

Exchange

NordPool

Currency\*

EUR

negative

-50000

€

positive

87000

€

Exchange

Currency

Negative

Positive

EPEX

EUR

-100,000.00

150,000.00

NORDPOOL

EUR

-50,000.00

87,000.00

Cancel

Save

Details

Overview

ID

01

Name

Portfolio 1

Type

Standard

Tenant ID

01

Tenant Name

Tenant 1

Settings

Default Account IDs

Risk Management

Trading Areas

Exchange

EPEX SPOT

Delivery Area

AMP

Position Limits

Exchange	Delivery Area	Min Net Pos.	Max Net Pos.	Absolute Pos.
EPEX SPOT	AMP	-50.0	80.0	120.0

Cash Limits

Exchange	Direction	Currency	Limit
EPEX SPOT	NEG	EUR	-100,000.00
	POS	EUR	150,000.00
Nord Pool	NEG	EUR	-50,000.00
	POS	EUR	87,000.00

Order Action Quota Limit

Exchange

EPEX SPOT

Order Quota Limit

90%

Order Count Limit

Auction Limits

value

# Validation - Business Continuity & Emergency Systems

- **Emergency Stop:** Instantly halts trading to prevent regulatory breaches or abnormal behavior
- **Alerts & Notifications:** Custom algorithms can trigger real-time alerts and email warnings.

01:00 - 01:15	T	QH-20250513-01	0.2	87.16	↓ 87.38	4.0		
01:15 - 01:30	T	QH-20250513-02				2.3		
01:30 - 01:45	T	QH-20250513-03				8.0		
01:45 - 02:00	T	QH-20250513-04				0.1		
02:00 - 03:00	T	PH-20250513-01				3.0	132.60	132.60
02:00 - 02:15	T	QH-20250513-05				3.3		
02:15 - 02:30	T	QH-20250513-06				3.2		
02:30 - 02:45	T	QH-20250513-07				7.0		
02:45 - 03:00	T	QH-20250513-08				6.5		
03:00 - 04:00	T	PH-20250513-03	1.0	59.01	82.40	2.5	95.56	95.56

Emergency Stop

Activating the Emergency Stop will enable Safe Mode. Safe mode has the following effects:

- all algorithm instances are stopped and can't be started
- all active orders are deleted from the market
- order entry and modification is disabled
- trades can still be recalled

Cancel

Confirm Emergency Stop

## Alerting

### Notification Policies

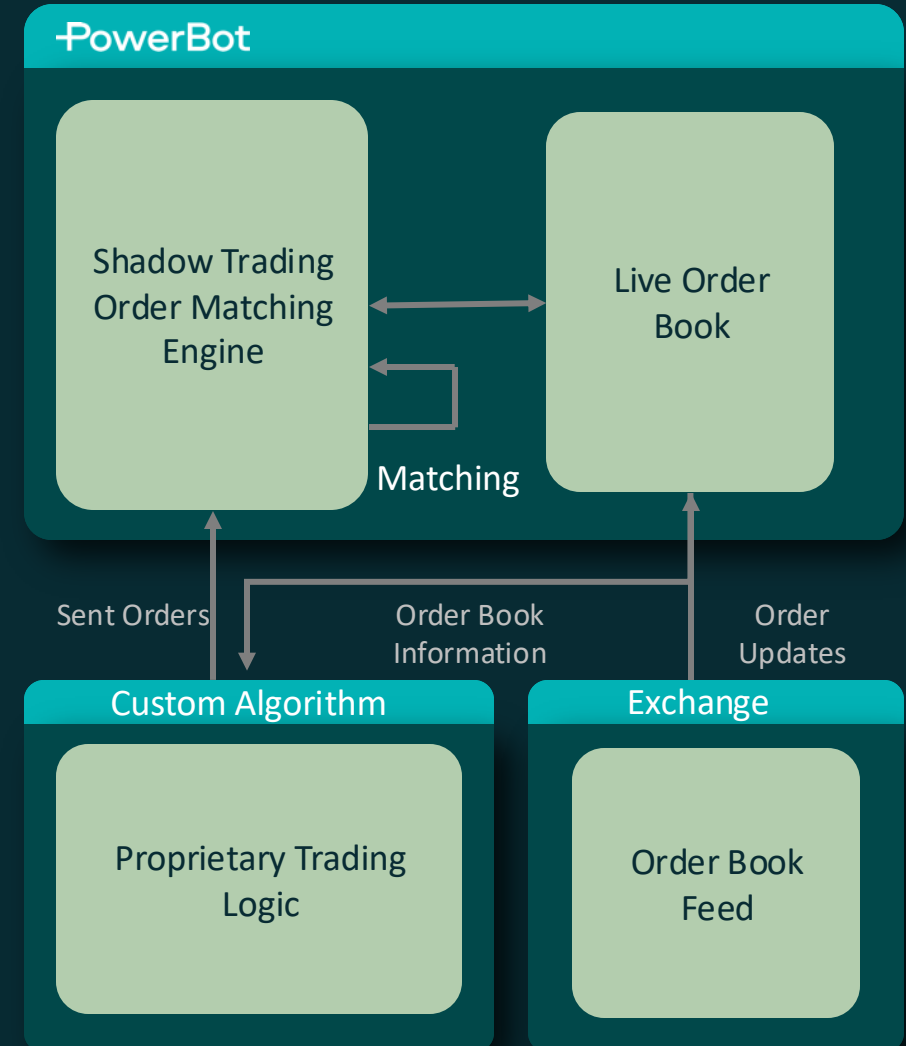
Name	Min Severity	Active ↓	Tags	Delay	Notification Targets	Description
Click to Add Policy						
Algo Failures	Low	✓	module = algorithms	5 minutes	Logs	Sends notifications for algo failures
ETRM Import Errors	Medium	✓	source = etrm-import step = import	1 hour	E-Mail (backoffice@example.com)	
PC Algo	High	✓	algorithm_name = PC_ALGO	1 minute	Logs	Log PC algo alerts

### Alerts

Unique Identifier	Severity	Resolved ↑	Tags	Count	Last Occurrence	First Occurrence	Message
PC_ALGO   A_ALR   LALR   position cannot be closed!	Error	✗	instance_id: LALR algorithm_id: A_ALR algorithm_name: PC_ALGO algorithm_level: position	2	53 seconds ago	1 minute ago	Position cannot be closed. Reason: best ask is 1000, MAX_BUY_PRICE: 500.
PC_ALGO   A_ALR   LALR   signals are invalid!	Error	✗	instance_id: LALR algorithm_id: A_ALR algorithm_name: PC_ALGO algorithm_level: signal	10	2 minutes ago	13 minutes ago	OPPORTUNITY_MARGIN must be a positive number, received: -6.

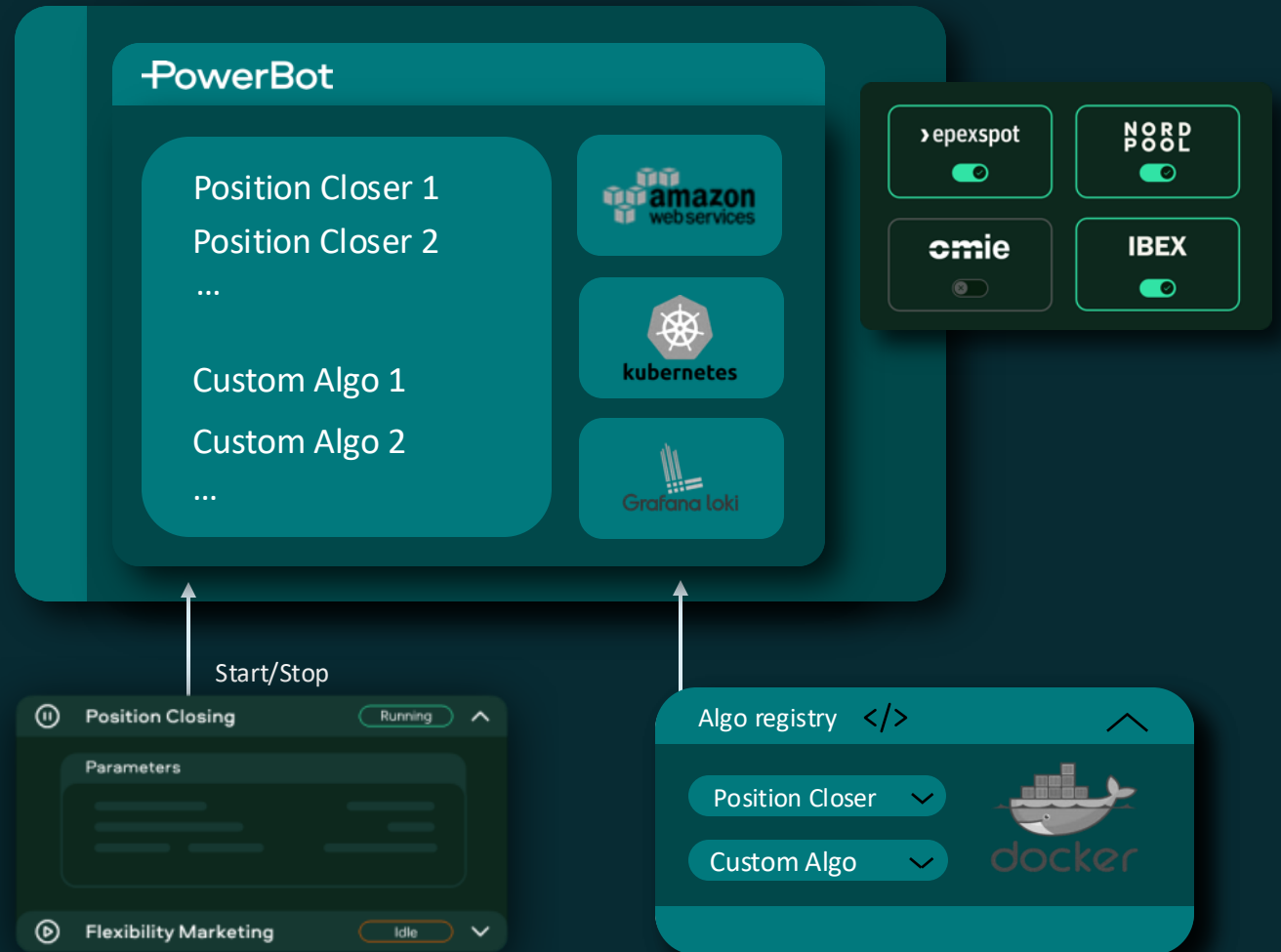
# Validation – Shadow Trading as Playground

- **Safe Testing Environment:** Shadow/Paper trading allows algorithms to run in live market conditions without financial risk, enabling performance validation before real deployment.
- **Compliance Assurance:** Helps identify and correct behaviors that may breach regulatory rules, ensuring strategies align with compliance standards before going live.



# Production Deployment – Remote Execution Service

- Redundant production system (high availability) and staging environment
- API first architecture
- OpenAPI specification (REST) with automatic client generation
- Additional WebSocket topics for real time data streaming



# Conclusion

- **Tighter REMIT II Rules:** Recent updates have increased regulatory demands and oversight.
- **Robust Risk Framework Needed:**
  - Market data access for validation.
  - Automated pre-/post-trade workflows.
  - Risk modeling for dynamic limits.
  - IT resilience and continuity planning.
- **Algorithm Development Lifecycle:**
  - Ideation → Development → Validation → Deployment → Monitoring.
- **Use Platform Features:** Built-in tools can support and streamline each development stage.



**Following today's workshop, what do you see as the main obstacles in developing custom algorithms (in a REMIT II compliant way)?**