open energi

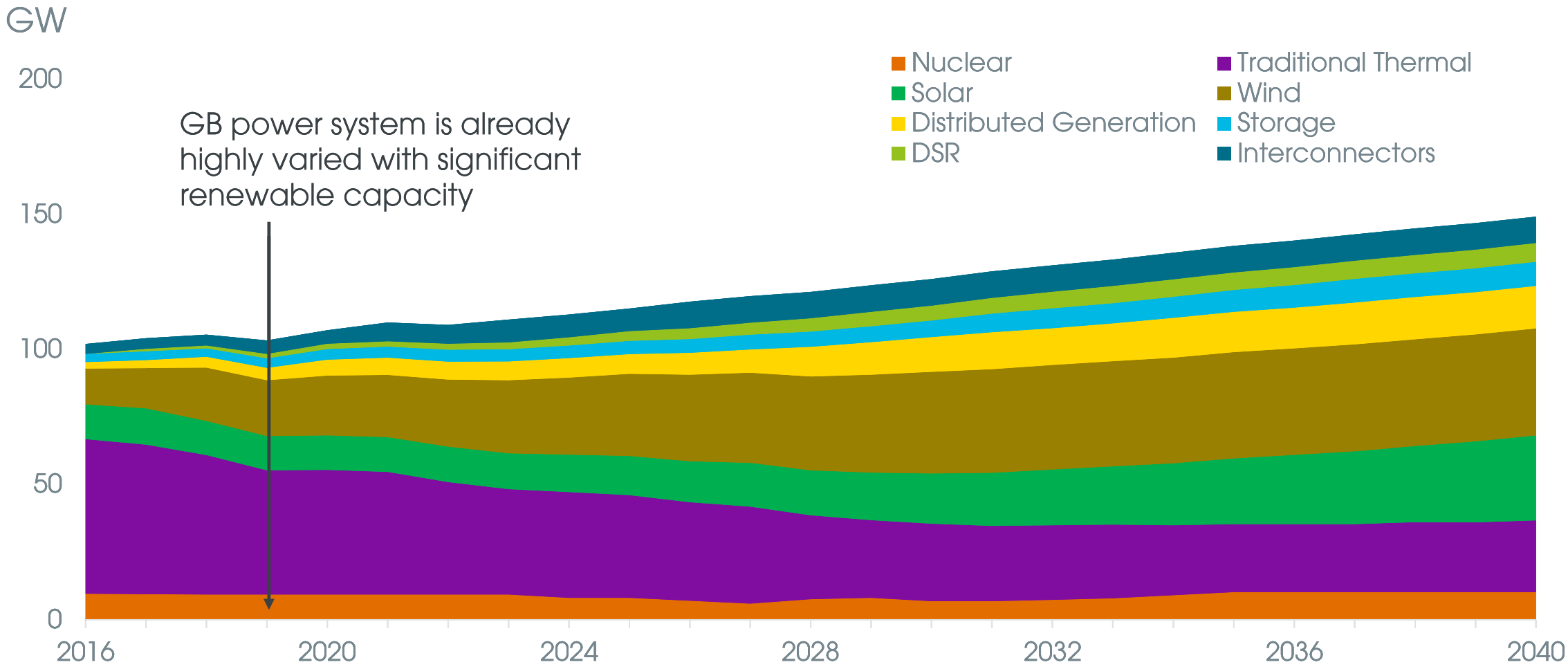
How Behind the Meter storage is changing how we trade power

Wendel Hortop

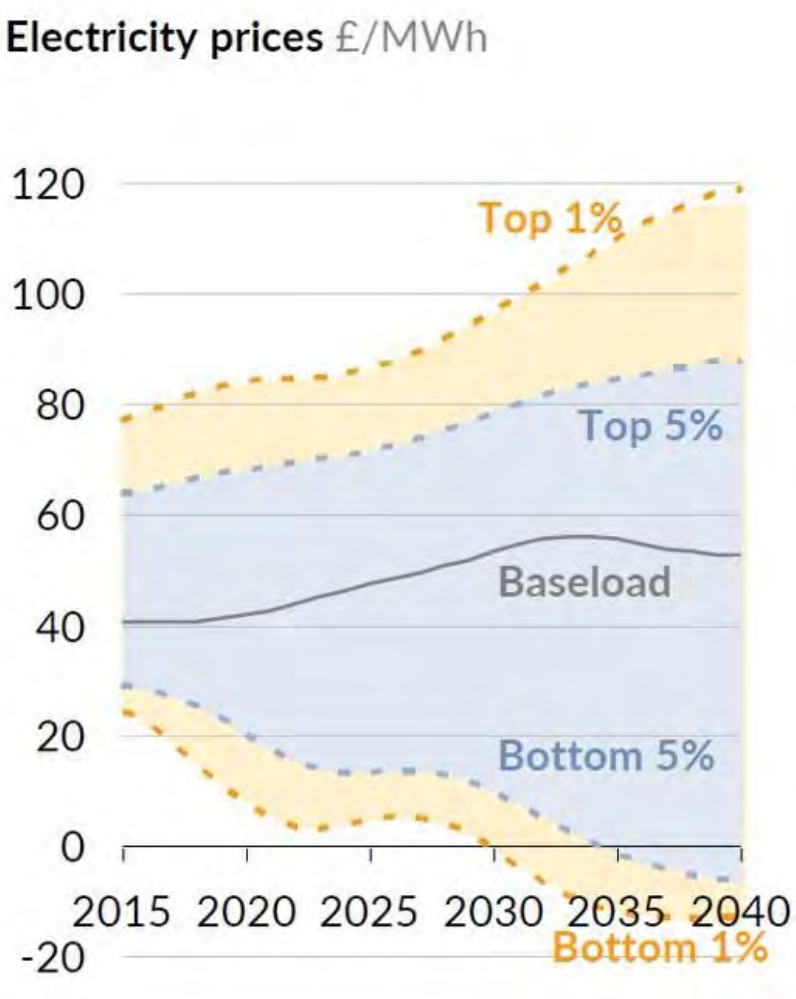
June 2019

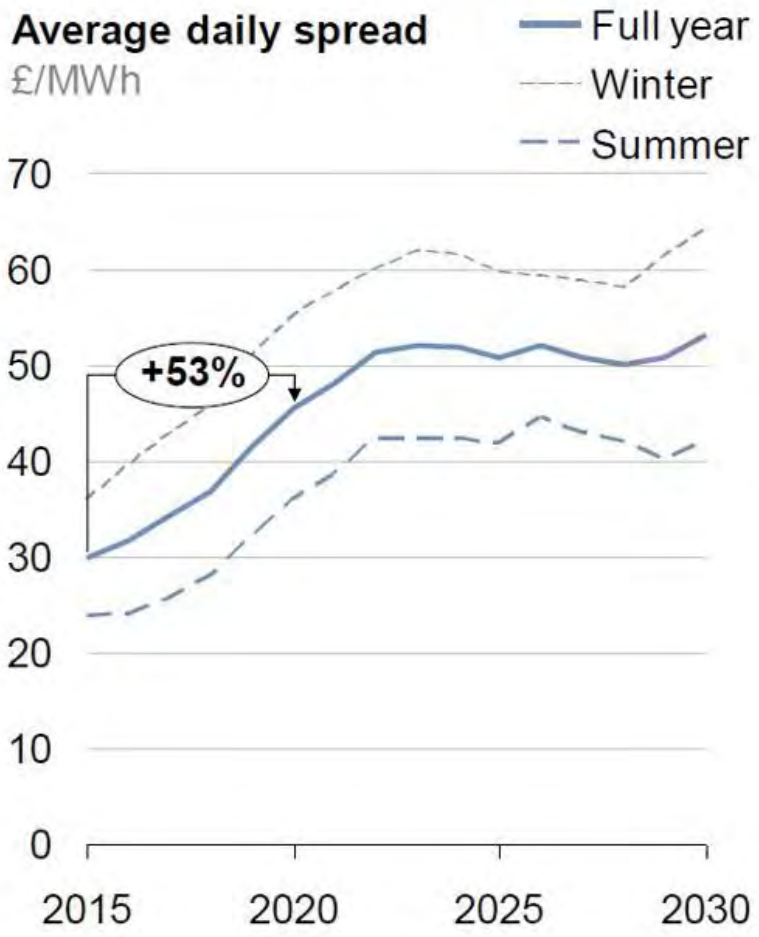

Creating an environmentally conscious and profitable world through access to clean energy

Our energy system is changing…

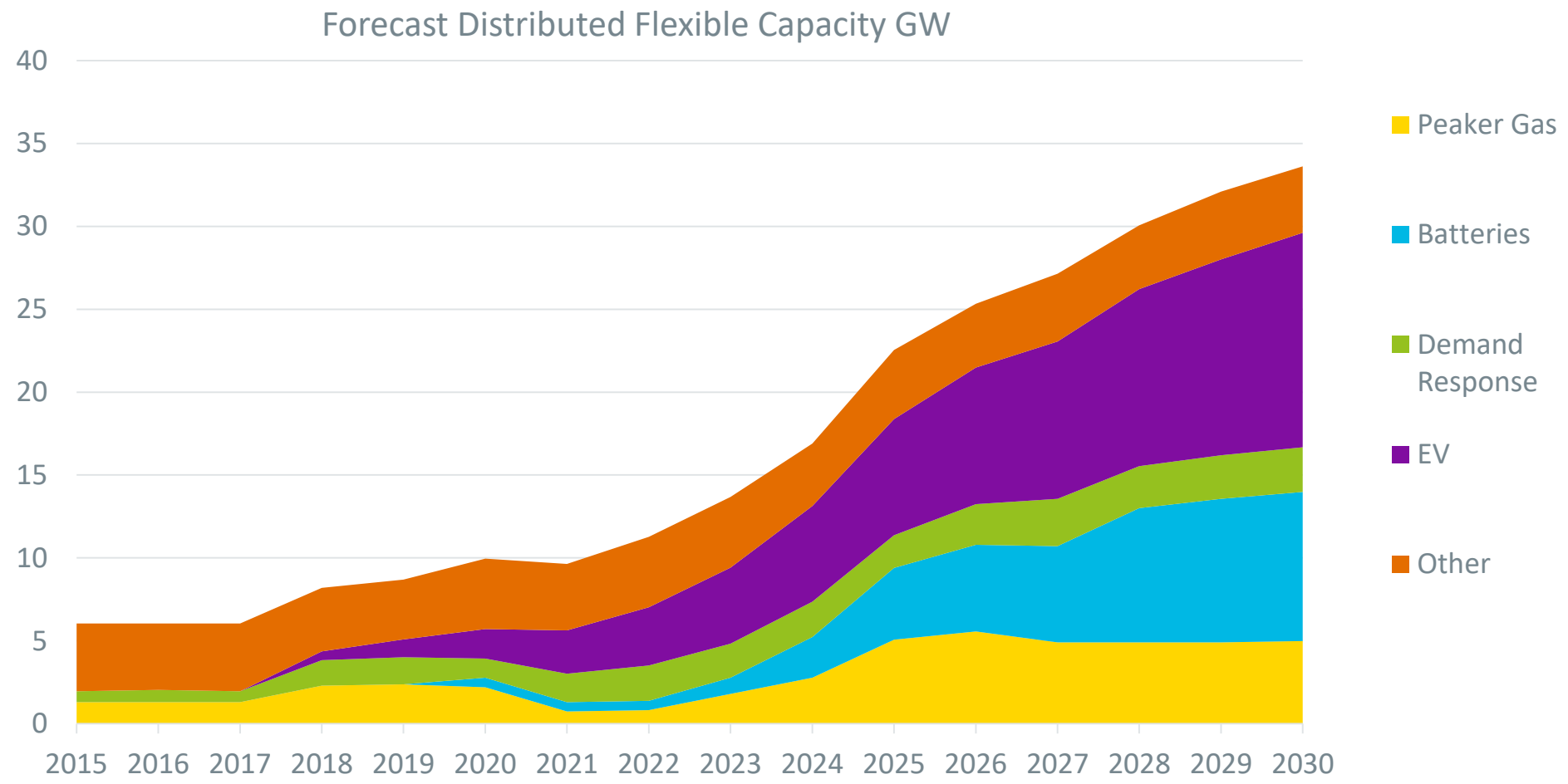


… which is leading to more price volatility…





…and flexibility is likely to be the winner



How has behind-the meter storage changed?

open energi

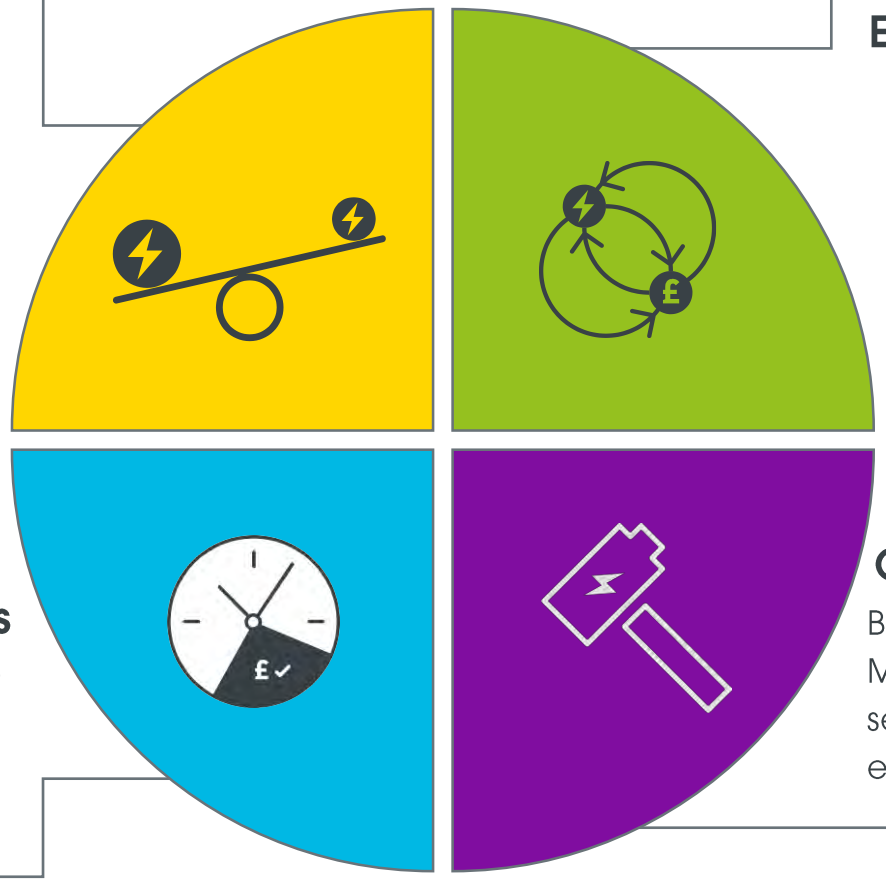
What forms a storage revenue stack?

Balancing services

Battery storage can provide frequency response services to help National Grid balance electricity supply and demand in real-time. Growing renewable penetration is increasing demand for fast-acting frequency response.

Energy markets

Increased volatility in wholesale electricity markets creates opportunities for batteries to respond to market signals and take advantage of price arbitrage opportunities.



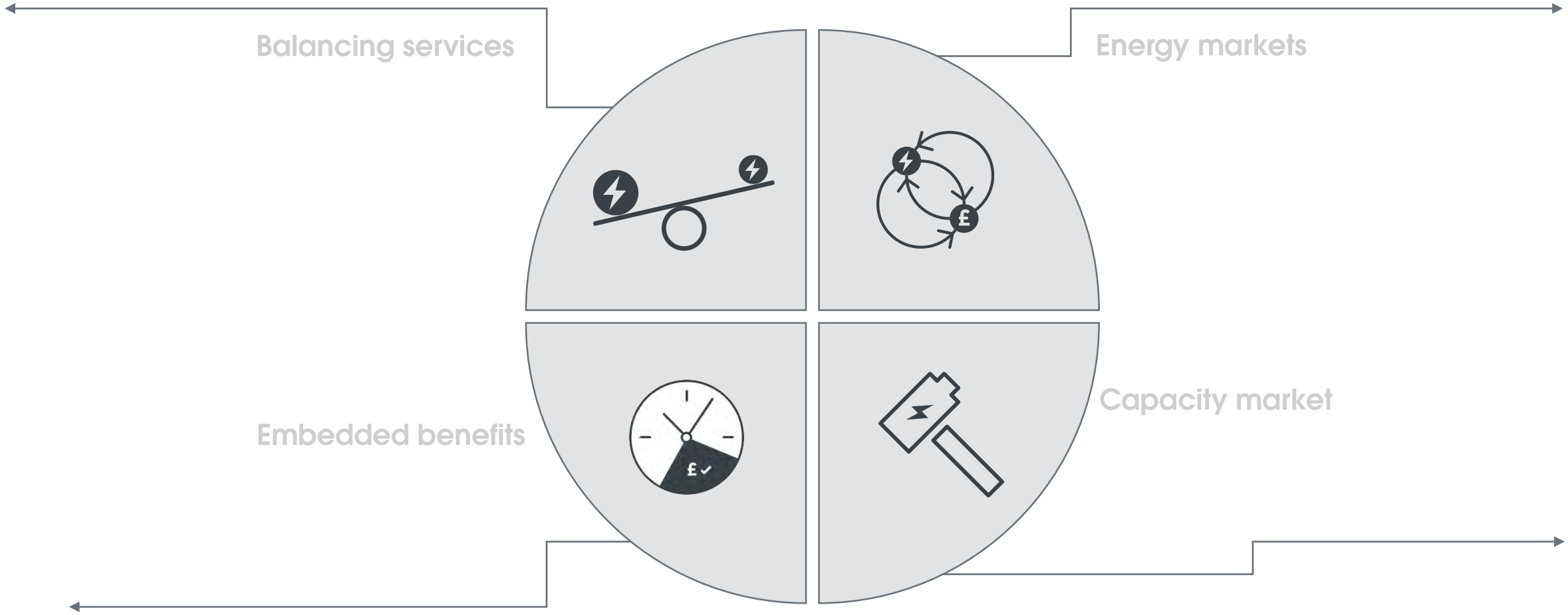
Embedded benefits

Distribution-connected batteries are not liable for some network charges and can secure payments for reducing suppliers' net demand and network charges.

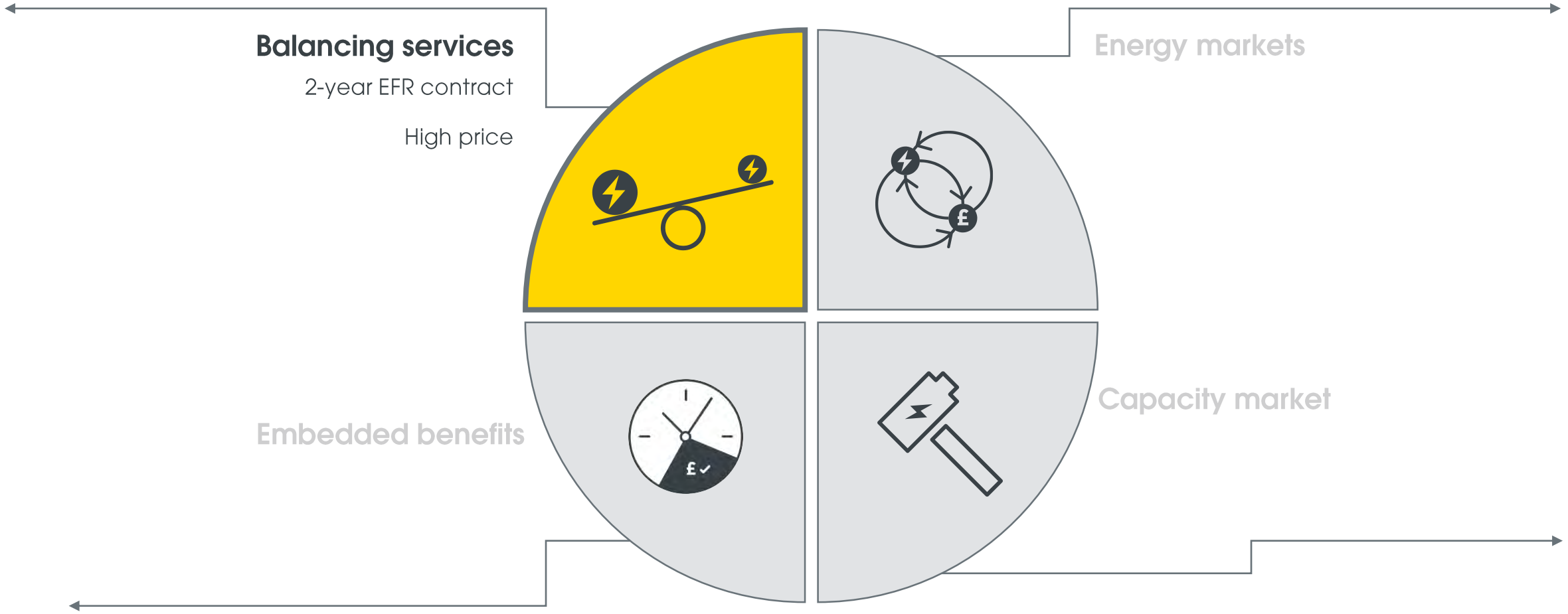
Capacity market

Batteries can participate in the Capacity Market and earn subsidies to help increase security of supply during system 'stress' events.

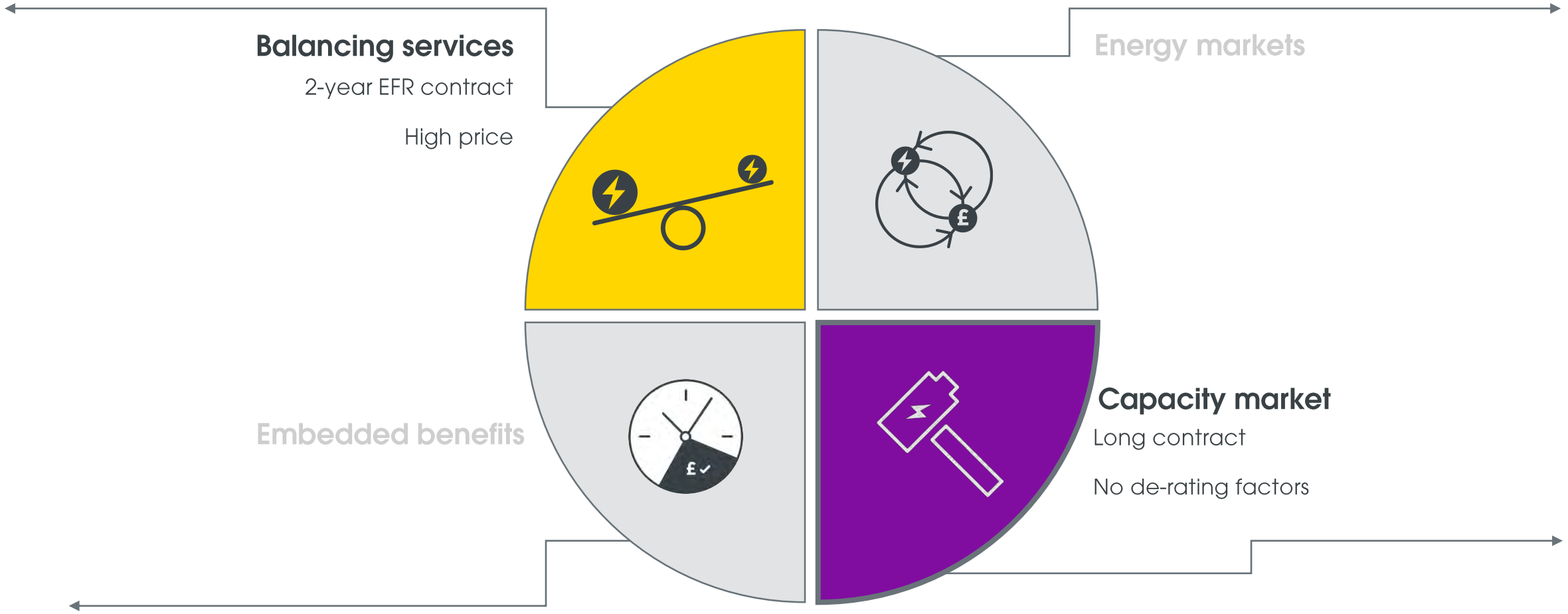
The evolution of the energy storage revenue stack…



The evolution of the energy storage revenue stack…



The evolution of the energy storage revenue stack…



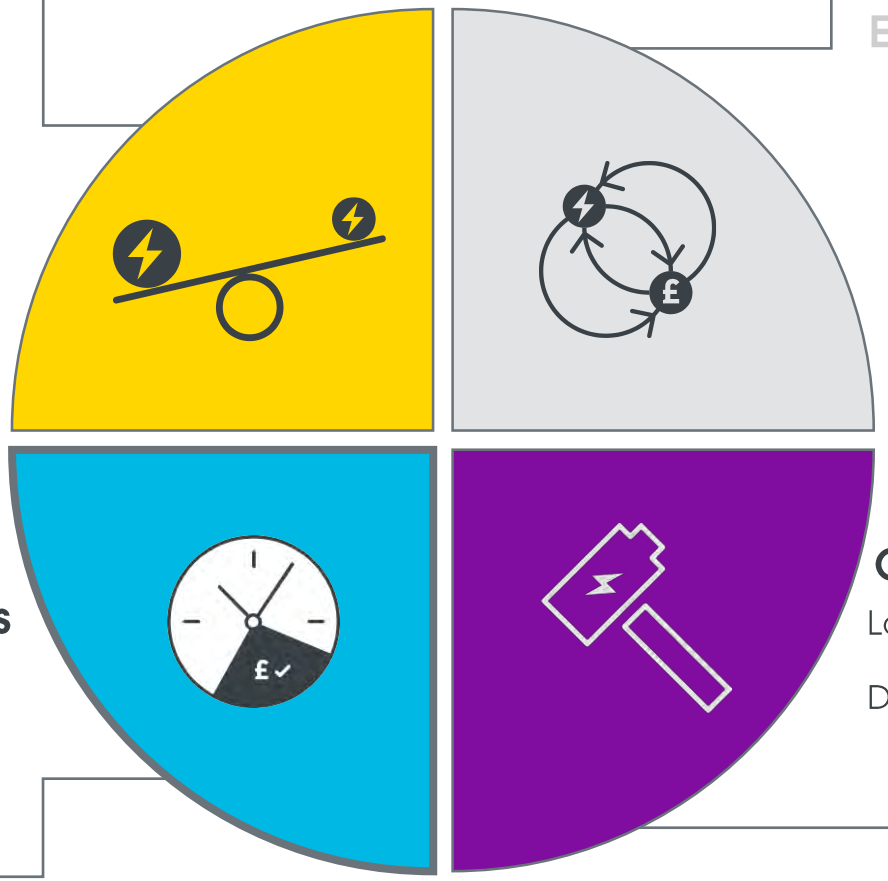
The evolution of the energy storage revenue stack…

Balancing services

FFR tenders: long-term or month-ahead

Prices still high

Energy markets



Embedded benefits

Triads (both import and export)

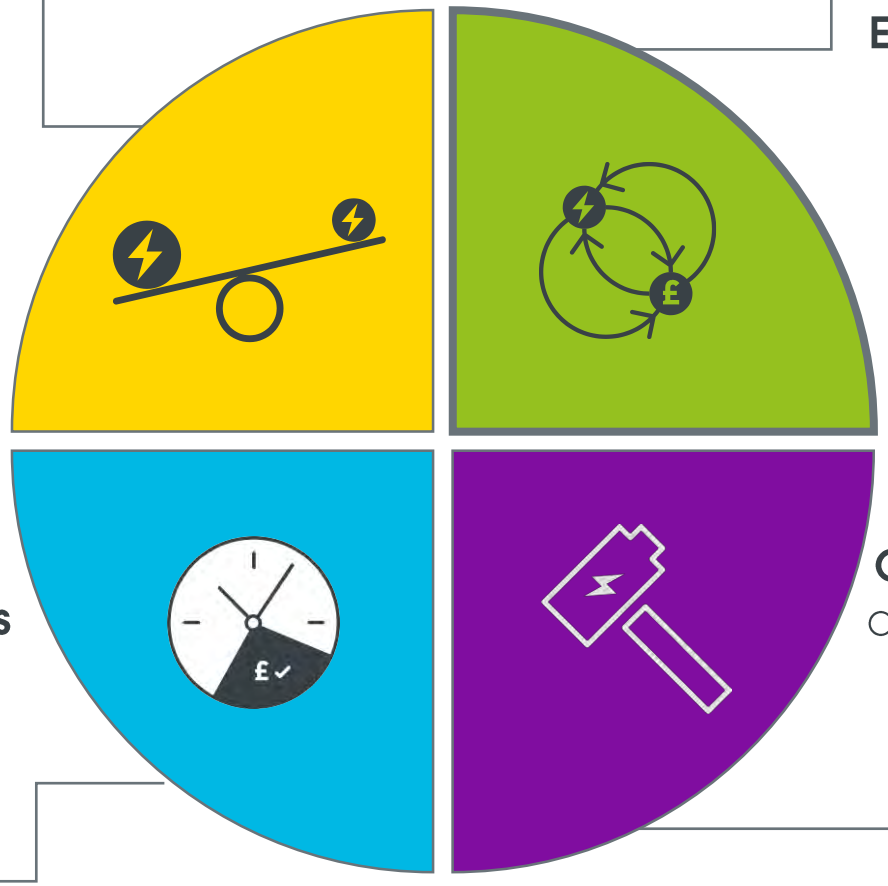
High red-band pricing

Capacity market

Long contract

De-rating factors applied for storage

The evolution of the energy storage revenue stack…



Balancing services

FFR: Month-ahead only

Prices have crashed

Energy markets

Day-ahead trading

Imbalance optimisation

Some price volatility

Occasional extreme pricing events

Embedded benefits

Export triads slashed, import under review

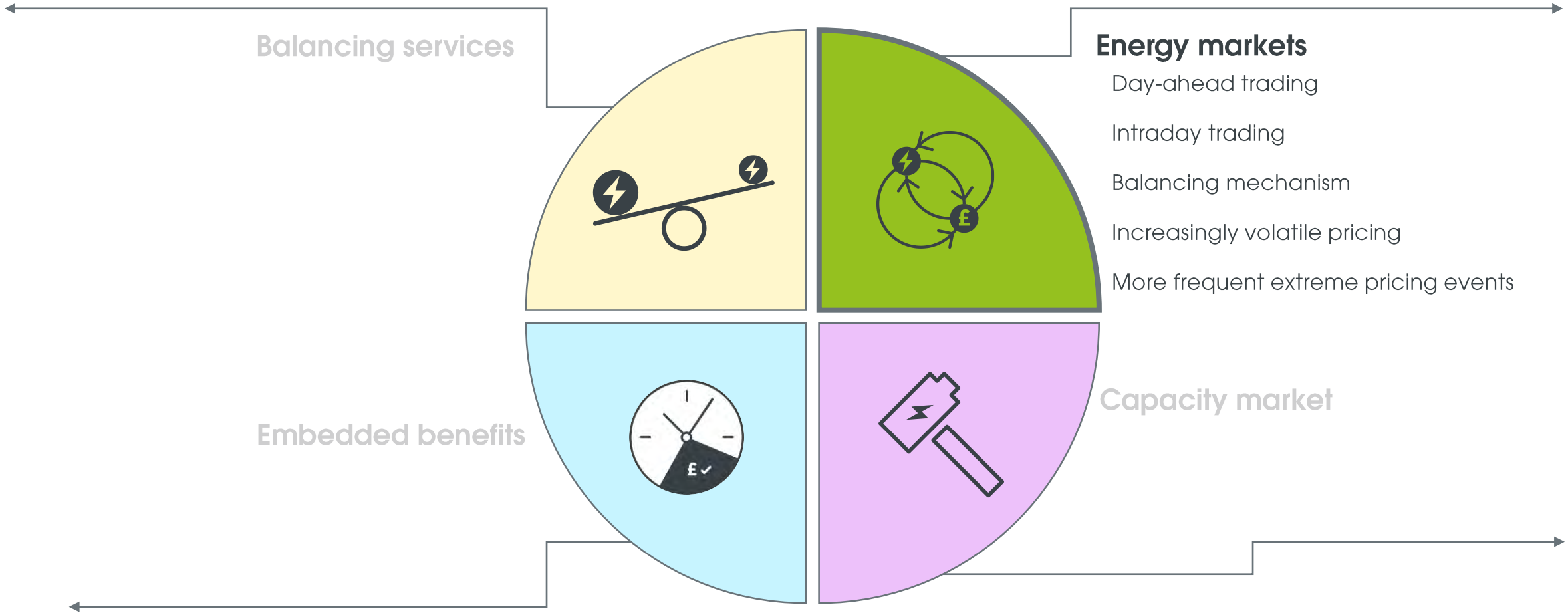
Red-band prices reduced

CM Levy (only on offsetting import)

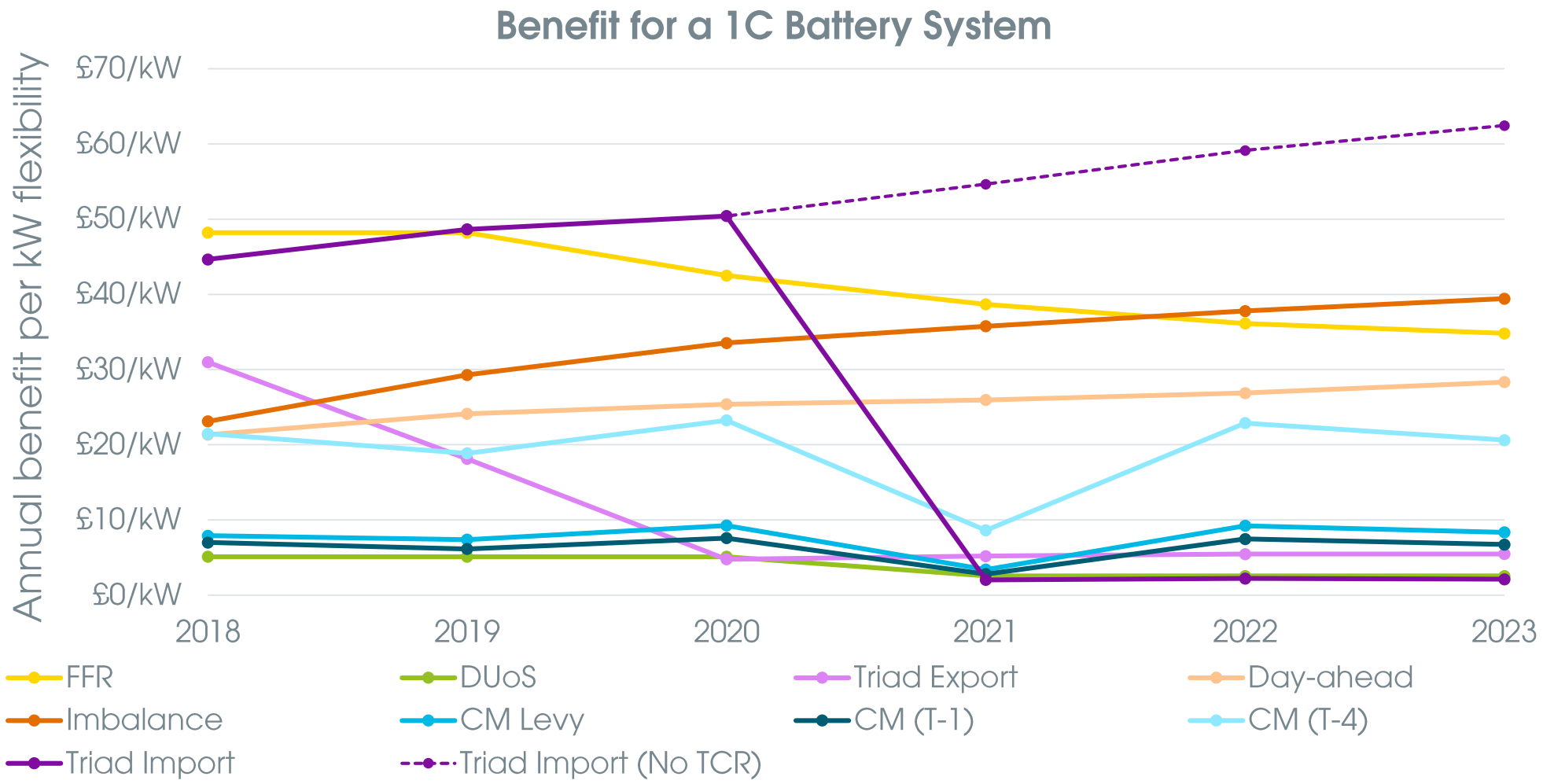
Capacity market

Capacity market suspension

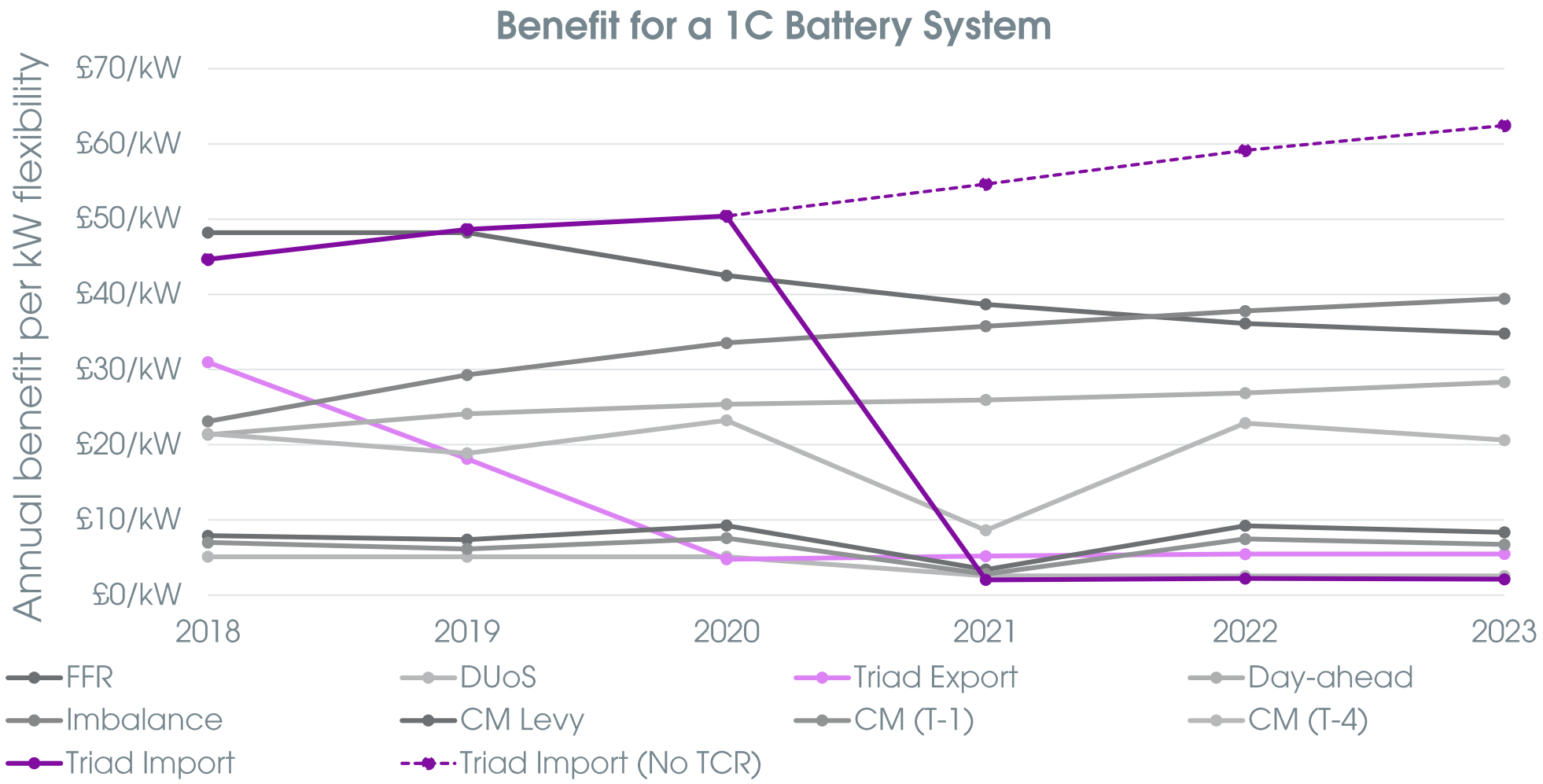
The evolution of the energy storage revenue stack…



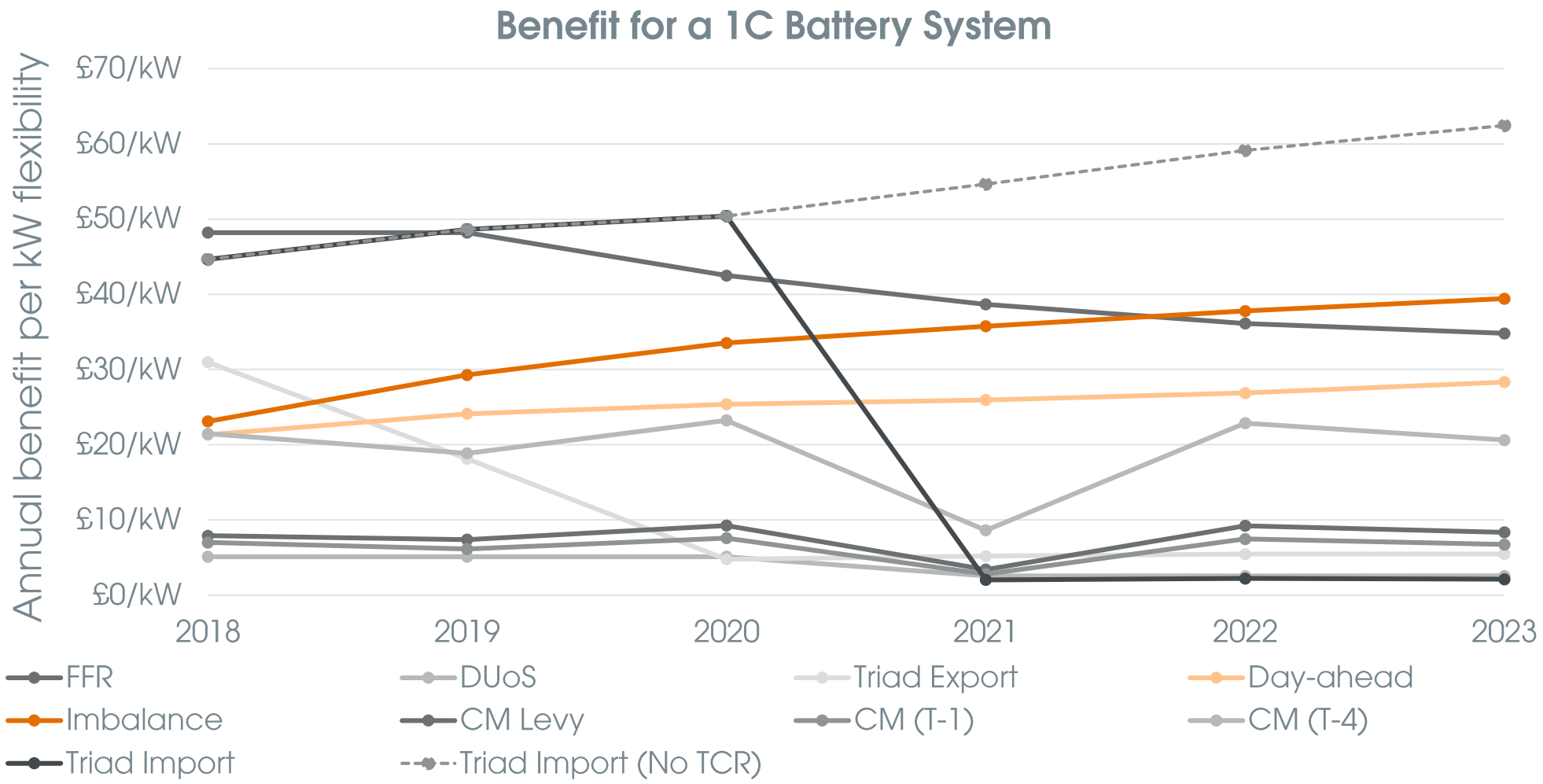
These all contribute to a mixed revenue stack…



…however triads are likely to be removed by 2023 latest…



…with energy trading value increasing to take its place



How do supplier relationships change?

open energi

What is the traditional supplier relationship for behind the meter storage?

Commodity price

Fixed

- Lock-in long term fixed price for import
- Reduces risk

Supplier charges

Pass-through

- Allows peak-price avoidance, primarily triads

Supplier engagement

Limited/none

- Supplier has little or no knowledge of actions performed on-site

What does it look like now?

Commodity price

Flexible

- Trading on futures market
- Reacting to imbalance
- Increased risk, but increased value

Supplier charges

Pass-through

- Allows peak-price avoidance, primarily triads

Supplier engagement

Full participant

- Supplier provides price forecast
- Supplier is an active participant of any actions taken
- Supplier takes on trading risk

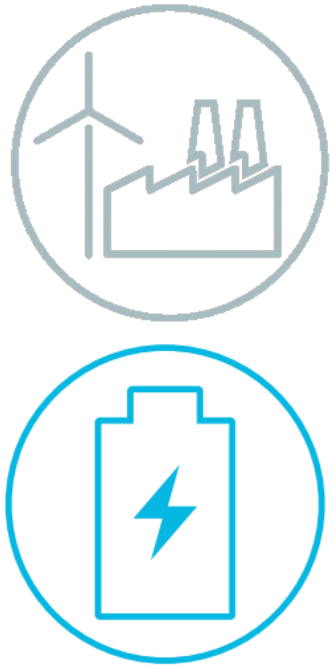
How do we optimise the assets?

open energi

Trading, optimising and dispatching Behind the Meter storage means increased complexity…

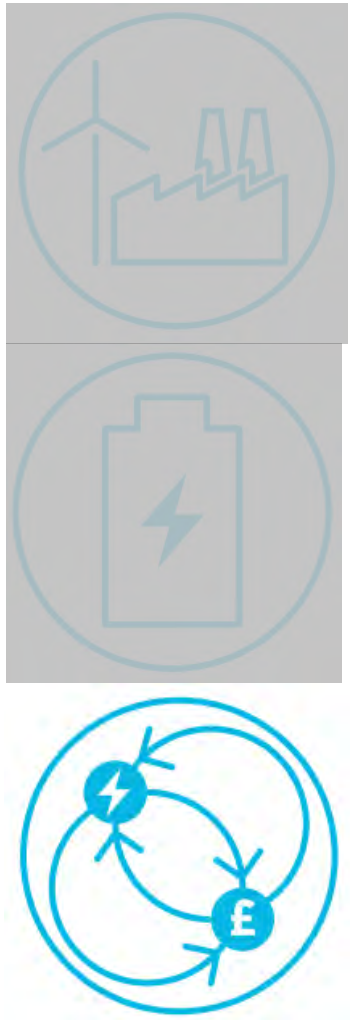
- Site demand
- On-site generation
- Site import/export constraints

Trading, optimising and dispatching Behind the Meter storage means increased complexity…



- Site demand
- On-site generation
- Site import/export constraints
- Battery state of charge
- Battery efficiency
- System degradation & throughput cost

Trading, optimising and dispatching Behind the Meter storage means increased complexity…



- Site demand
- On-site generation
- Site import/export constraints
- Battery state of charge
- Battery efficiency
- System degradation & throughput cost
- Commodity costs
- Non-commodity costs
- Import/export price differences

…which means automation is key

Moving from manned trading desk to cloud-based, AI controlled trading and dispatch means:

- Improved optimisation with more complex inputs
- More frequent optimisation and trading, opening up more opportunities within day
- Trading of increased number of smaller, distributed assets

Dynamic Demand 2.0 Optimiser

Open Energi's DD2.0 Optimiser produces the best demand or generation profile for the asset according to market forecasts and the latest price signals.

This optimisation is carried out incrementally in three timeframes:

1. A long-term optimisation profile is generated ahead of time based on long-term price signals (day-ahead prices, value of FFR contract, etc).

2. During the day, the long-term profile is refined with any intraday signals such as spot trading or imbalance opportunities.

3. Real-time services such as FFR are overlaid on top of the intraday signal if it is economical to do so.

This optimisation process ensures that the asset is always performing the most economical action given the available information and that it is possible to seamlessly change over between contracts based on their monetary value.

Case Study: battery storage

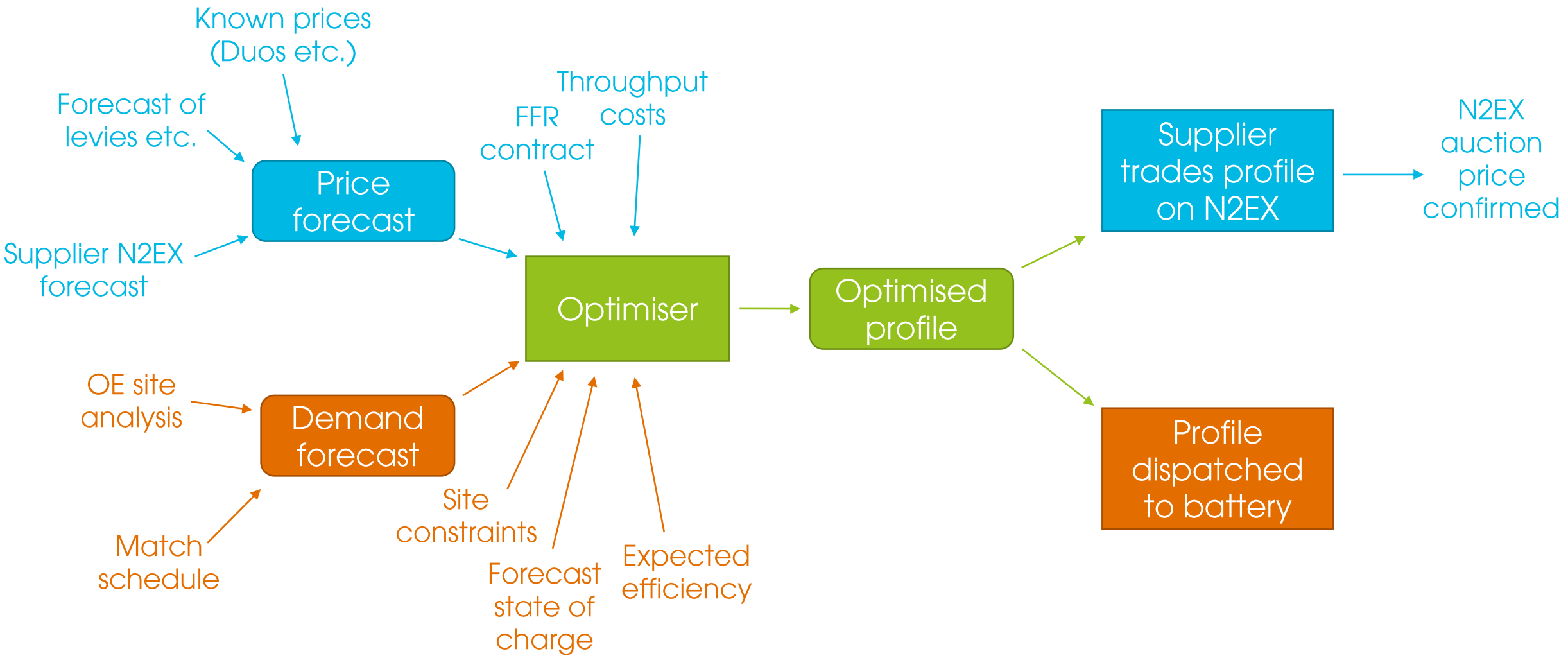
Arsenal Football Club & Pivot Power

"Battery storage is an incredibly flexible asset and we're delighted to be working with Open Energi to ensure Arsenal receive the maximum benefits from this system. Open Energi's track record of optimising and managing batteries speaks for itself and their insight and expertise has been invaluable in bringing this project to fruition."

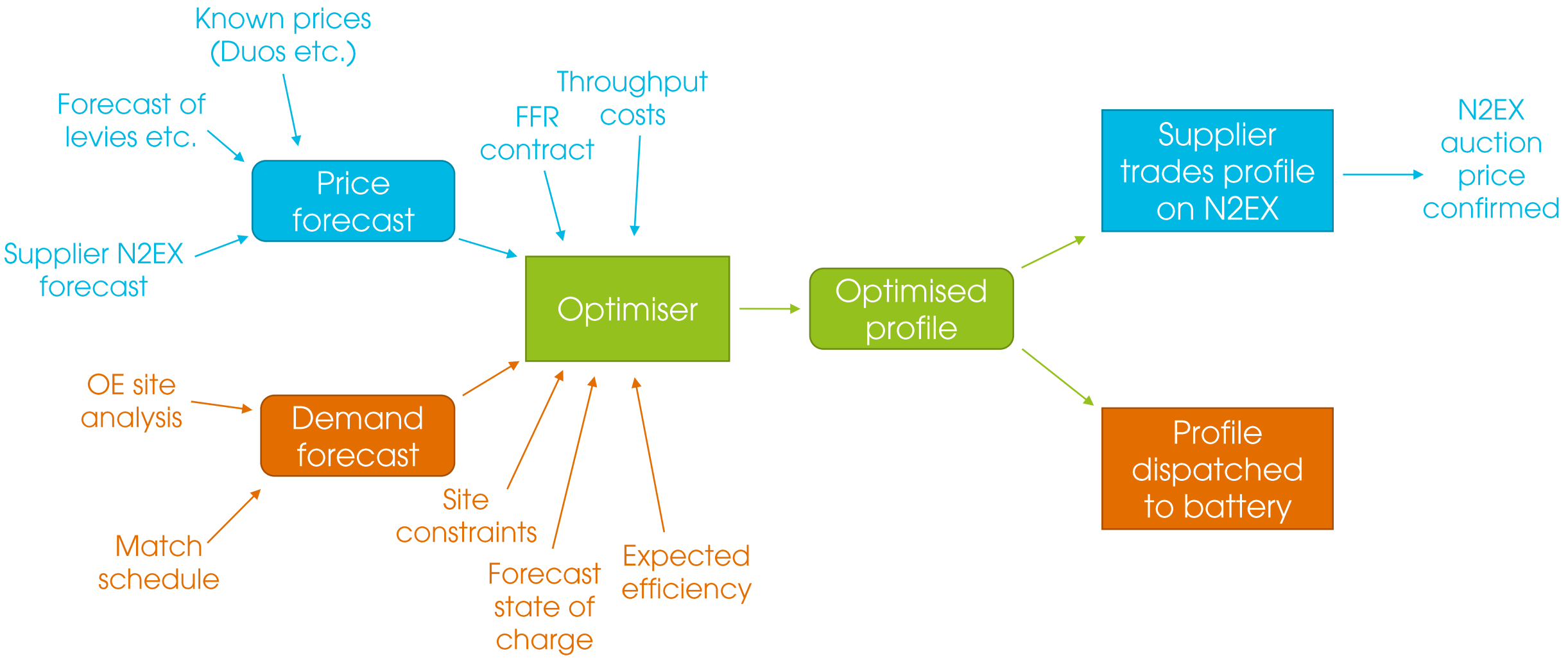
Matt Allen, Founder & CEO
Pivot Power

- Open Energi is automating trading and optimisation of a battery storage system installed at Arsenal on behalf of Pivot Power.
- The 2MW/2.5MWh battery can store enough energy to run Emirates Stadium from kick-off to full time.
- Dynamic Demand 2.0 trades and optimises the battery in real-time against a combination of day-ahead, intra-day and real-time price signals whilst managing state of charge and limiting degradation.
- It is bringing Arsenal immediate benefits, cutting electricity bills, and earning money by supporting a low-carbon grid.

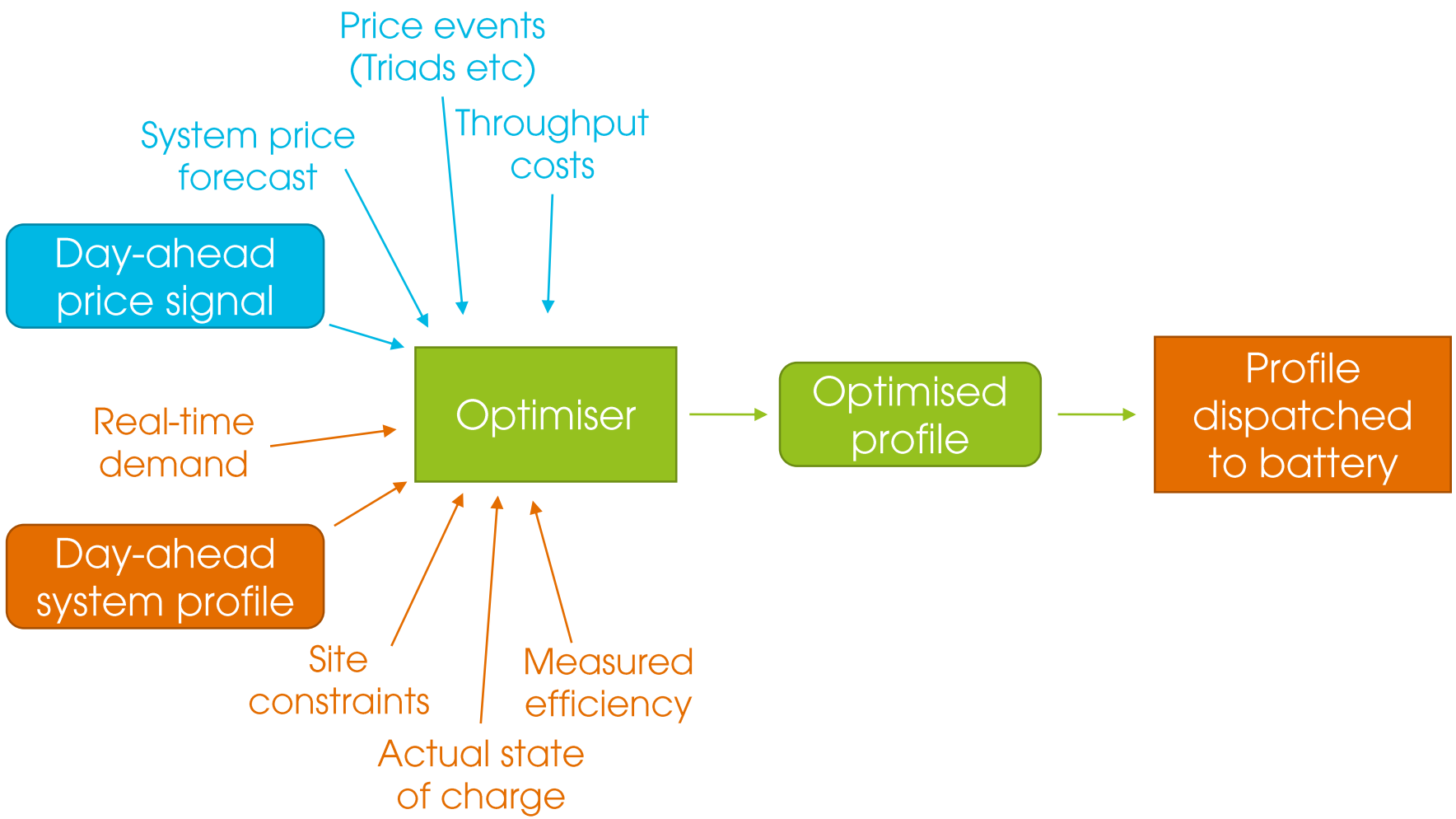
Day-ahead optimisation flow



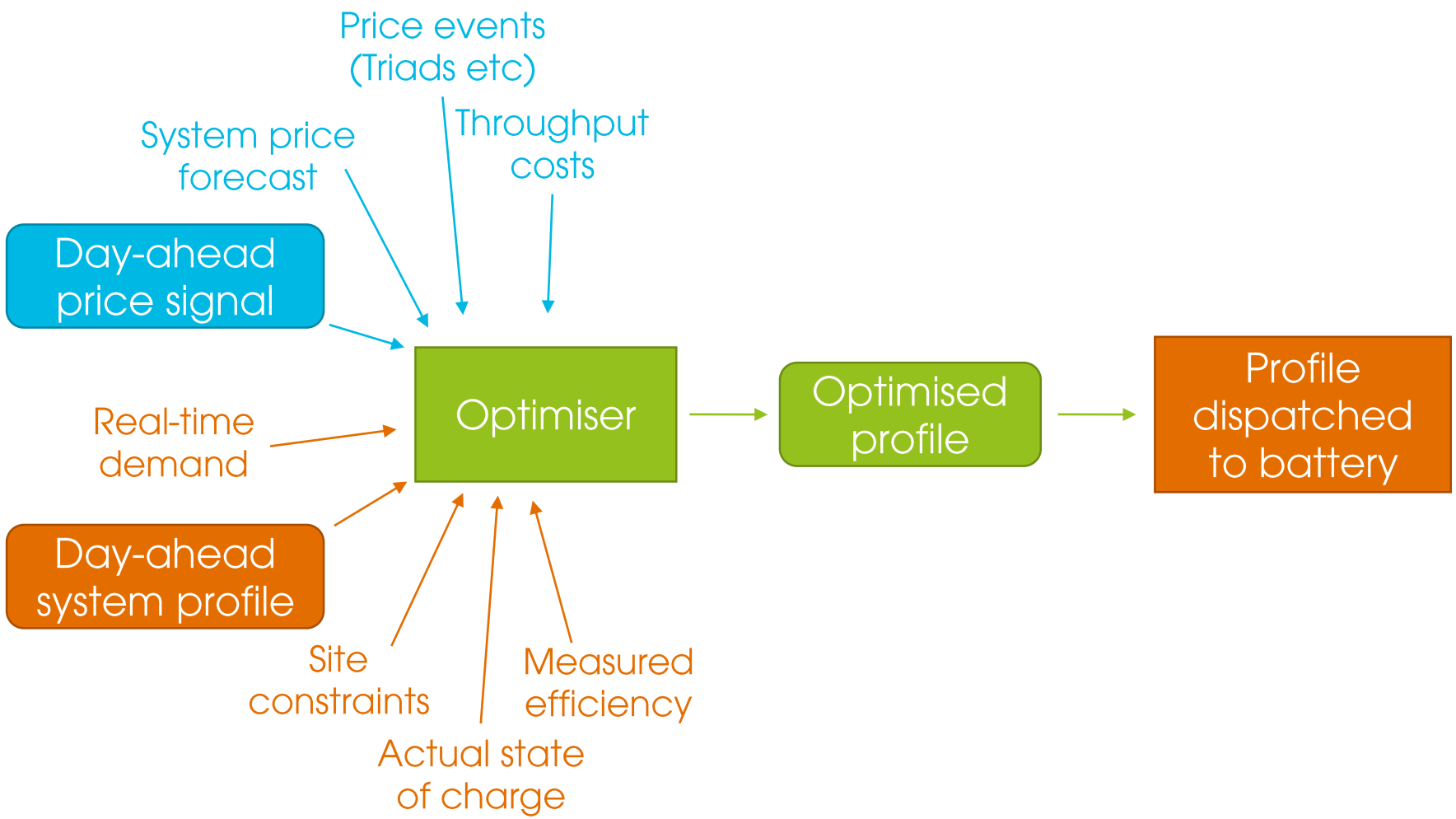
Day-ahead optimisation flow



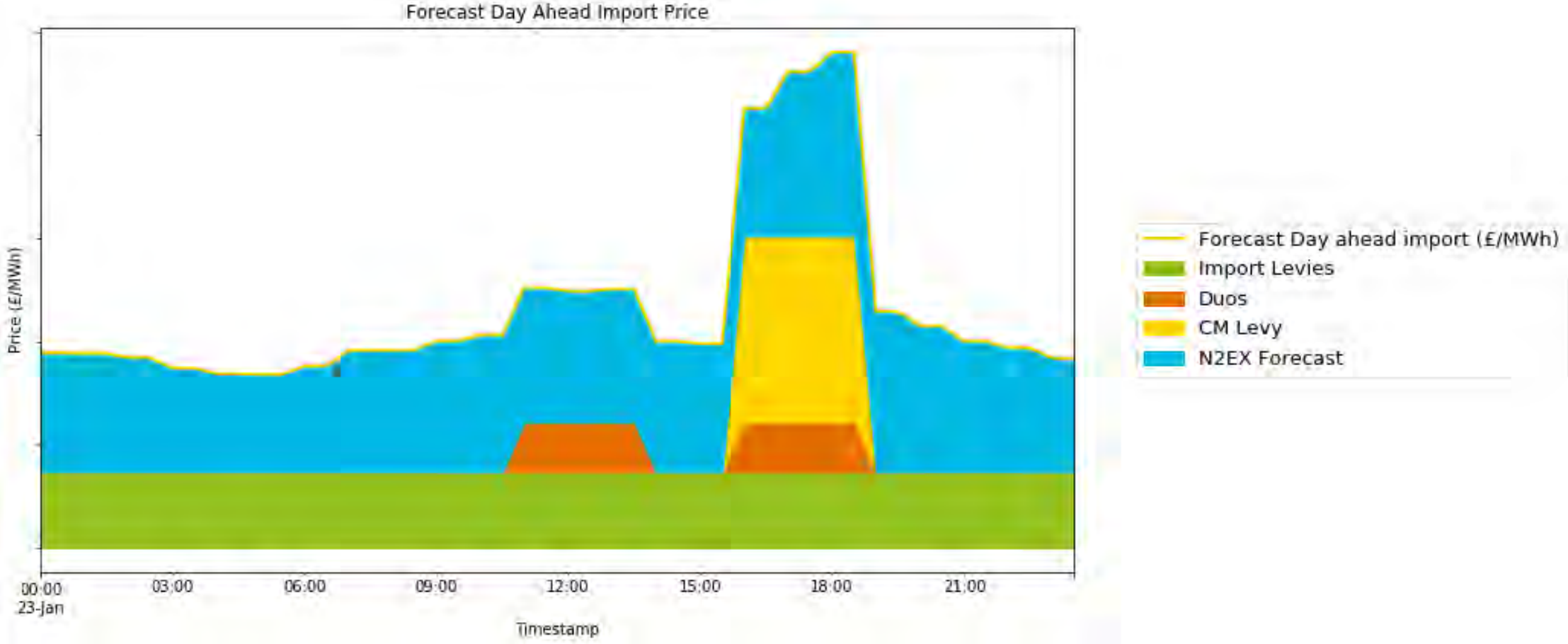
Within-day optimisation flow



Within-day optimisation flow

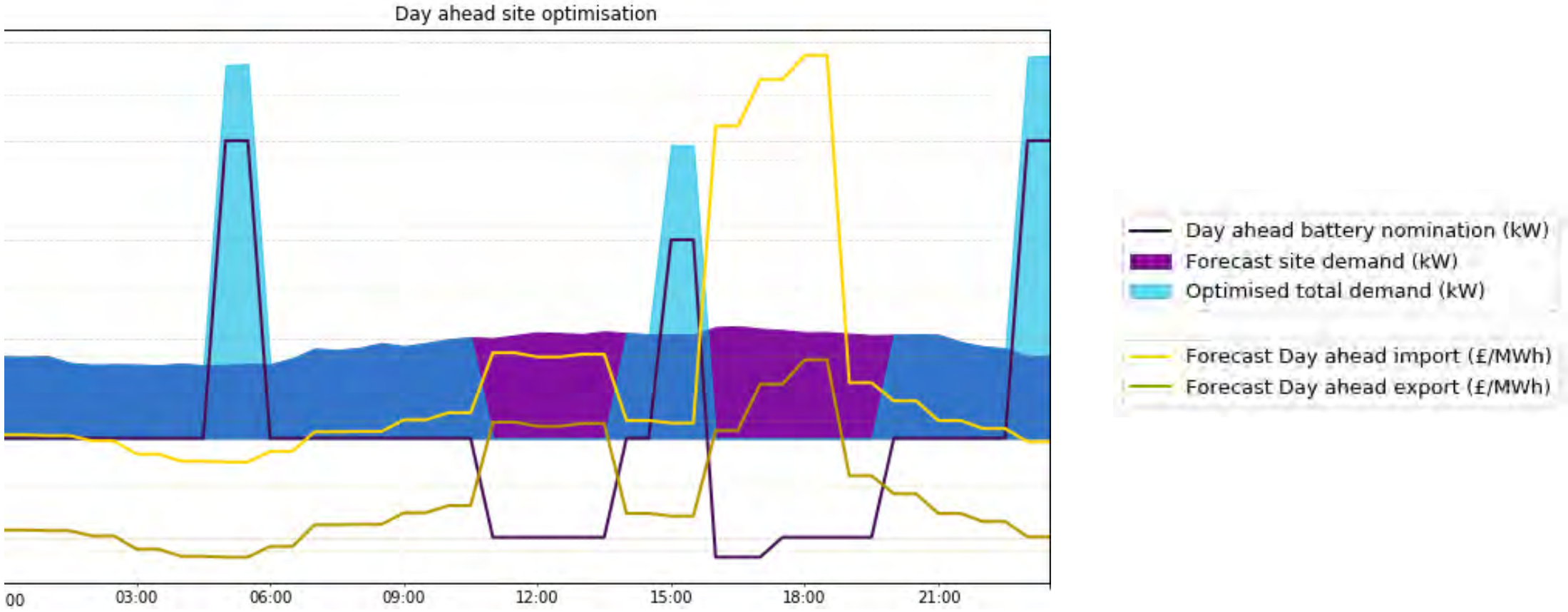


Combining known and forecast price signals a day-ahead price signal is generated



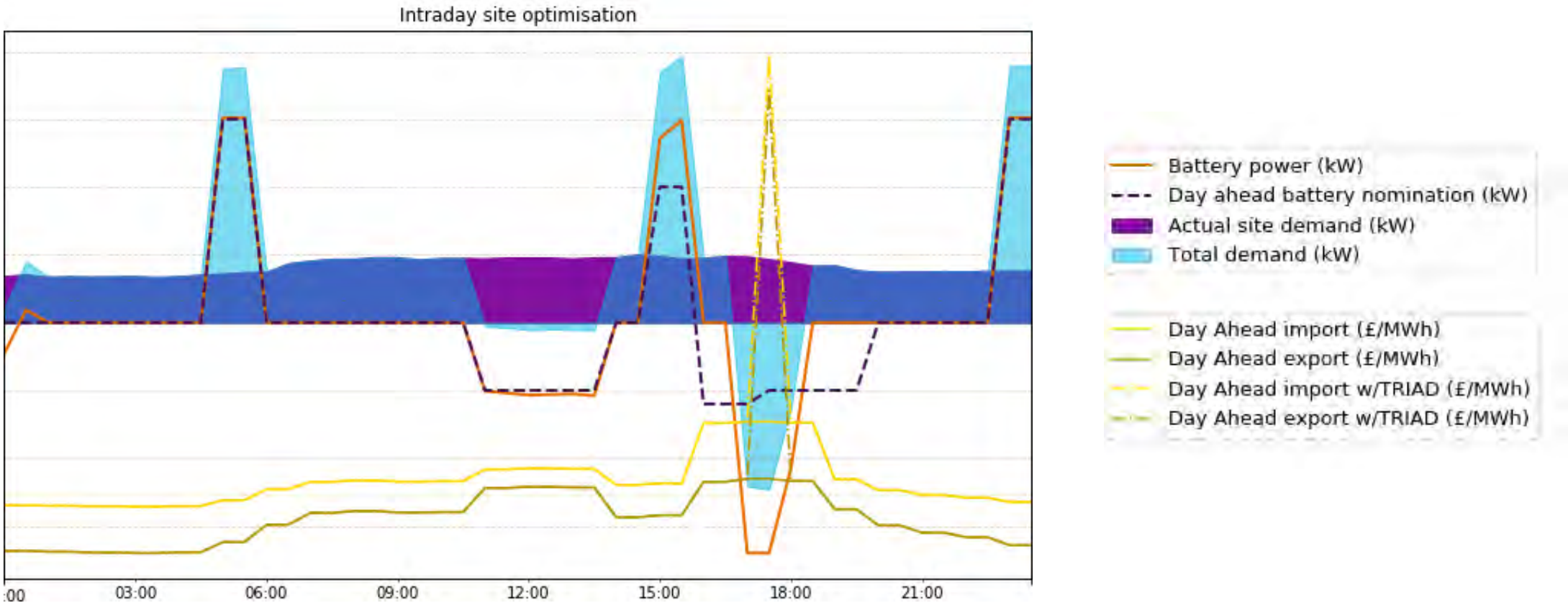
open energi

Along with our forecast of site demand an optimised battery profile is generated and returned to supplier



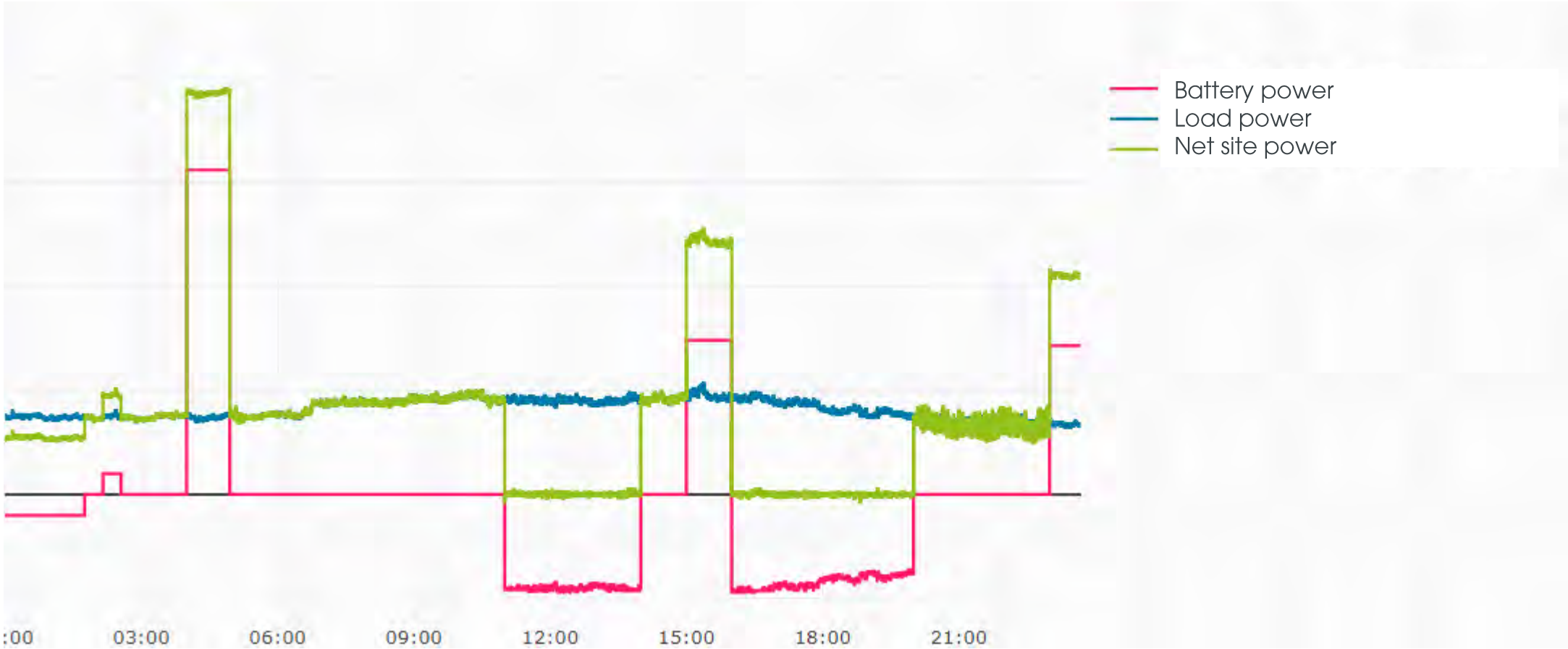
open energi

Within-day price events are forecast and system profile reoptimised



open energi

Active load following maximizes revenue from offsetting import charges



open energi

What's next?

open energi

Let's expand trading to other behind-the-meter assets

open energi

UK Head Office

6th Floor
239 Old Marylebone Rd
Marylebone
London
NW1 5QT

+44 (0) 20 3051 0600

wendel.hortop@openenergi.com

openenergi.com