Analytathon 3: Energia Group

30.07.2021

Introduction: Francis Mallon

- **2007-2011: BSs Finance at QUB**
  - Trader Assistant: Delta Index

- **2011: Trader @ Delta Index**
  - Proprietary trading: equities, indices, FX, commodities
  - Strategies: Technical Analysis, Fundamental Analysis & Equity Pairs Trading

- **2012-Current: Senior Trading Analyst @ Energia Group**
  - Trainee Trading Analyst
  - Trading & Forecasting Analyst
  - Seconded to Energia Group for I-SEM Market Design: I-SEM Market Forecasting Lead
  - Senior Trading Analyst
    - Commercial Trading Strategies
    - Market Analysis
    - IT System & Trading Tools Development
    - Policy, Regulation & Market Design

Energia Group
A modern customer centric utility focusing on renewable technology

Energia Group Structure

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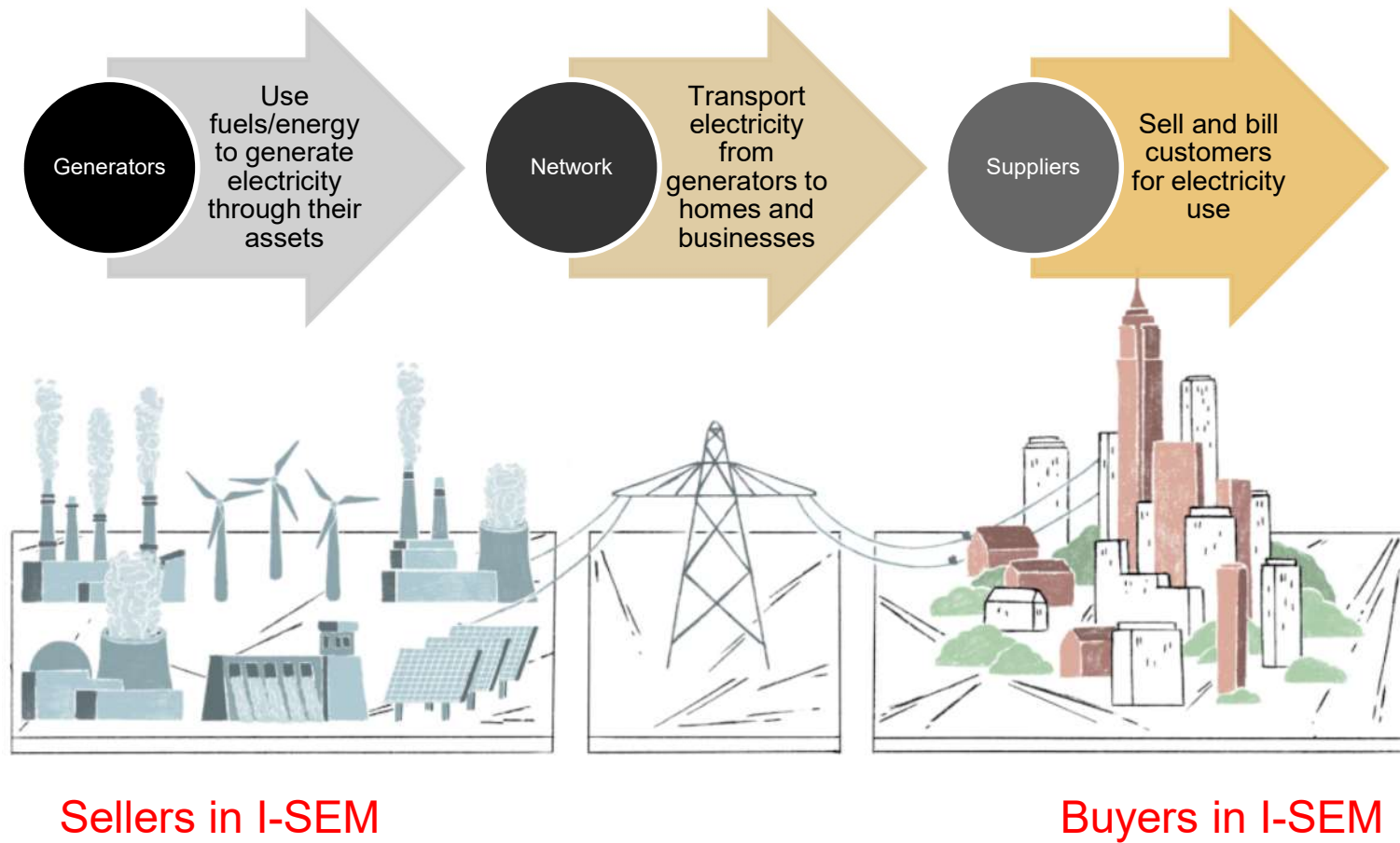| Customer Solutions	Renewables	Flexible Generation
power ni *part of energia group* energia	energia BIO ENERGY energia RENEWABLES	power ni Power Procurement Business *part of energia group* energia GENERATION

Currently supplying over 750,000 homes and businesses across Ireland with competitively priced electricity and gas. We supply approximately 25% of Ireland's total energy and 21% of Ireland's total wind power with electricity generated from biogas our next renewable energy solution.

€164.1m	848	277MW	762,800
FY20 EBITDA	Employees	Wind Assets	Customer Sites

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How the Irish Electricity system works

Generators — Use fuels/energy to generate electricity through their assets

Network — Transport electricity from generators to homes and businesses

Suppliers — Sell and bill customers for electricity use

Sellers in I-SEM

Buyers in I-SEM

The economics of the I-SEM markets

The electricity markets are where generators and suppliers meet to trade electricity via an auction. Each unit/supplier has the responsibility to do their own trading.
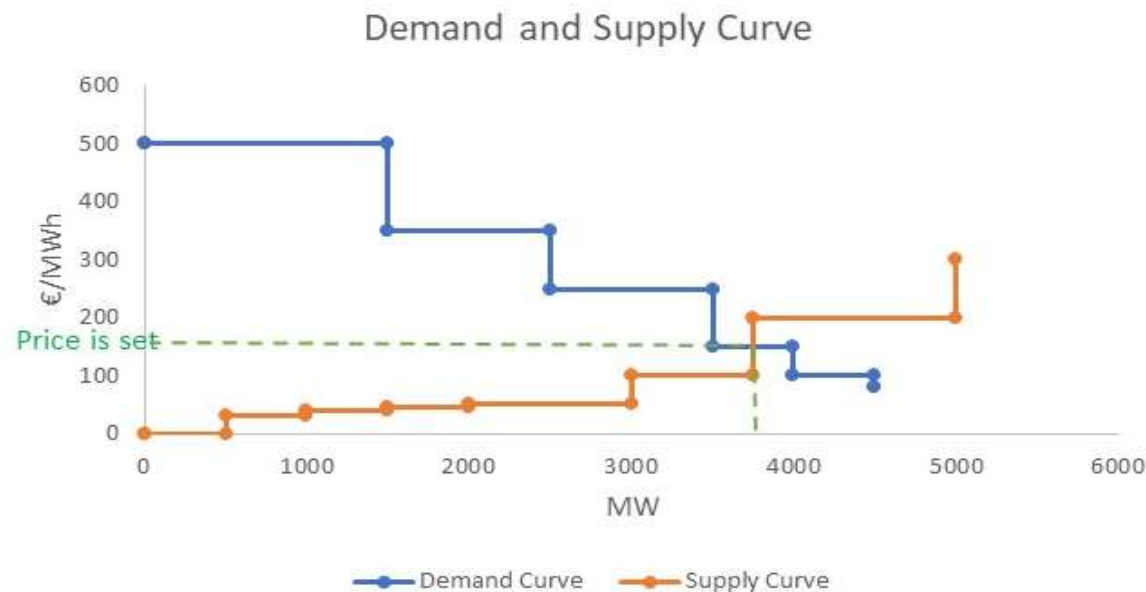
Suppler Curve (Sellers)

Generators
-sell the electricity they produce

Demand and Supply Curve

Demand Curve (Buyers)
Suppliers
-buy the electricity their customers consume

-Requires suppliers to forecast the use of electricity by their customers

5 key I-SEM Markets for each half hour period across the day:
DAM, IDA1-3, BM

I-SEM Auctions & Prices

- I-SEM Trading day is from 23:00 to 23:00. 48 Half Hour Periods. DAM Auction happens first, then IDA1, then IDA2, then IDA3…BM is the final price for a period

- Auction happen in advance of the time period e.g. 25/07/2021 23:00-23:30 is traded in DAM at 24/07/2021 11:00

- Some periods e.g. 23:00-23:30 have 3 prices, whereas other periods like 22:00-22:30 have 5 prices

- The same process happens 365 days a year, to keep the lights on!

- **Part 1 focuses on the variables that drive the DAM Price**

- **Part 2 focuses on developing trading strategies to try and profits across the different electricity prices**

  – For this project (and in general) you have to trade in the same time period, i.e. buy and sell in different markets for 23:00-23:30, you can't buy 23:00-23:30 and sell 07:00-07:30.

|		Auction Time	24/07/2021 11:00	24/07/2021 17:30	25/07/2021 08:00	25/07/2021 14:00	At Delivery
Calendar Date	Trade Date	Start Time	DAM Price (€/MWh)	IDA1 Price (€/MWh)	IDA2 Price (€/MWh)	IDA3 Price (€/MWh)	BM Price (€/MWh)
24/07/2021	25/07/2021	23:00:00	131.41	134.65			85.4
24/07/2021	25/07/2021	23:30:00	131.41	141.41			79.5
...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...
25/07/2021	25/07/2021	10:00:00	155.02	160			97.58
25/07/2021	25/07/2021	10:30:00	155.02	165.02			97.27
25/07/2021	25/07/2021	11:00:00	159.71	163.3	149.19		97.59
25/07/2021	25/07/2021	11:30:00	159.71	164.71	158.33		97.98
...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...
25/07/2021	25/07/2021	16:00:00	136.98	164.6	150		73.71
25/07/2021	25/07/2021	16:30:00	136.98	164.6	144.2		70.88
25/07/2021	25/07/2021	17:00:00	144.43	143	127.06	130.07	73.03
25/07/2021	25/07/2021	17:30:00	144.43	159.8	132.06	124	73.92
...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...
25/07/2021	25/07/2021	22:00:00	114.42	129	110.62	106	80.76
25/07/2021	25/07/2021	22:30:00	114.42	114.42	95.7	92	77.04

Project – Part 1, The rise of the I-SEM Day Ahead Price

The Day Ahead Market is the most liquid and important market across I-SEM, c70-90% of all traded volume happens in this market. So it is the most important price across the I-SEM markets.

In recent months, the Day Ahead Price has rose to all time highs.

- Based on the variables provided, what are the most significant factors of this recent increase?

- What factors might cause this price to drop back to more 'normal' /average levels in the future?

Evolution of the I-SEM Day Ahead Price
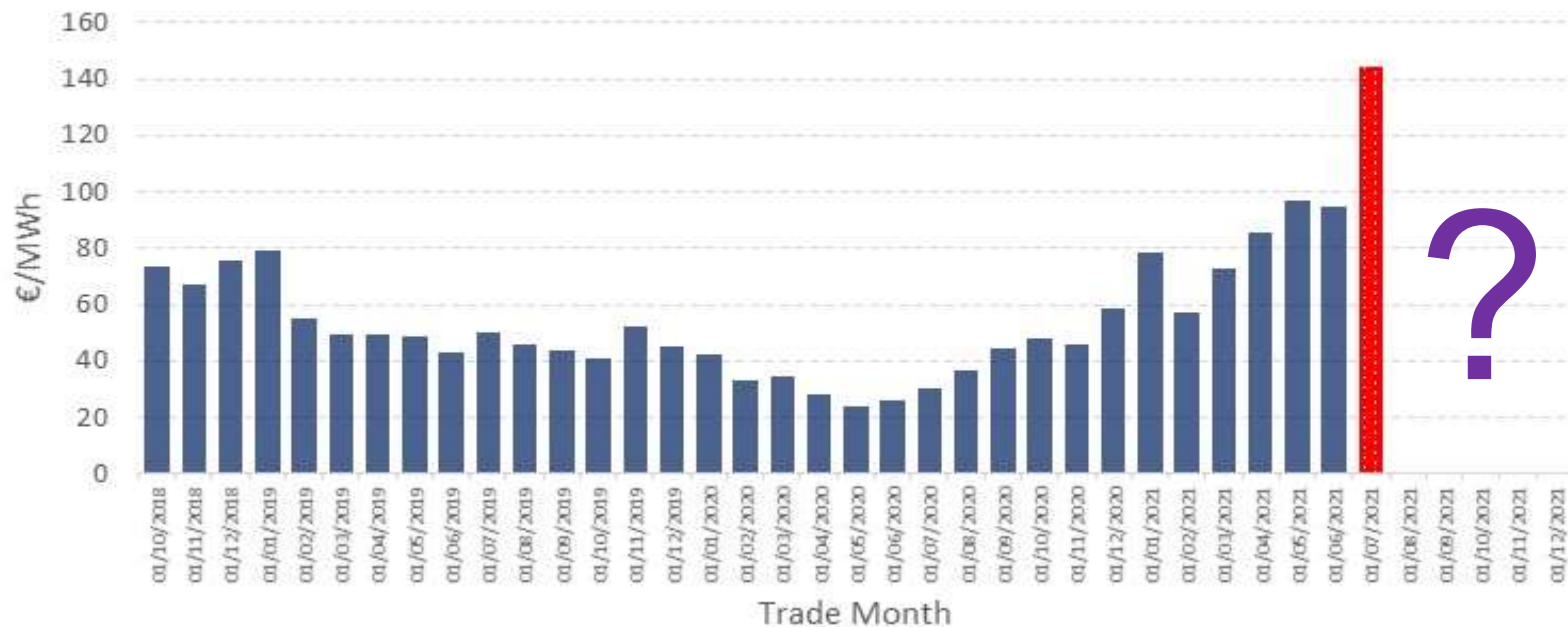
Project – Part 1, Relevant Information

- Electricity markets are priced on a marginal fuel basis for producing the next MW output. So the larger capital setup investment of these projects is somewhat separated from the day to day electricity pricing in each half hour period

  - For a gas thermal unit, the purchase of the gas to generate the electricity will be the cost that features in the I-SEM markets

  - Then taking wind units as a further example, wind turbines are expensive to build but for I-SEM Markets the wind as a fuel for the turbine is free. You don't pay to make the wind blow…So high wind is priced at c€0/MWh and hence helps drives down the electricity price

- The demand (i.e. consumption) MW level needs met in each period. This is mainly met by generator units, of which wind features. As wind is cheap/free net demand (i.e. Demand minus Wind) may be more important than demand itself. The net demand is the part of the demand/supply curve that needs met by other more traditional thermal stations that have a cost e.g. gas/coal/oil units

- Worldwide commodity prices are currently very high, mainly gas and carbon which are the dominant fuels for I-SEM generators. We have very little influence on these prices as they're imported from Europe, but they feature strongly in the electricity price formation

- As a result of high commodity prices/costs the fuel inputs for the breakeven thermal units is quite hight i.e. input costs for thermal units, their breakeven costs are also high

  - I have provided an estimated daily cost of these generators, and their costs by each different MW level

  - For context only: If the DAM price is above a generators costs and then are turned on, generators earn profit

- The availability of thermal units has been poor recently, however each unit has a different cost…so some 'missing' units are more important than others. It is also important to monitor the aggregate availability of these units.

Data

- I-SEM Day Ahead Price, we want to use the below variables to understand why it is so high.
  - Hourly data to show the detailed granularity but the increase is evident when viewing months data points
    - To give some perspective to this project, this I-SEM Day Ahead Price is approximately 50-60& of your electricity bill. So in the next few months the customers bills are going to be higher if they've used the same amount of electricity

- The Variables:
  - Commodity Prices for Gas, Carbon. Along with the perhaps less prominent Coal, Oil Distillate, FX Rate
  - Net Demand: Wind, Demand & Net Demand for Day Ahead Forecasts, Updated Continuous Forecasts (i.e. closer to the period) and actual wind output
  - Generator availability (i.e. generator units aren't always available, sometimes they require maintenance). Generators can only generate power when they're available.
  - Generator costs- an estimated daily break even cost of the generator is in orange.
    - Some generators are cheap at each MW level, some are cheap at their lower MW levels but more expensive at the their higher MW levels. E.g. GU_500130 on 20/03/2019 is €41/MWh for 113MW, to from 113MW to 151MW it jumps to €96/MWh (i.e. the next 38MW (151MW-113MW) costs €96/MWh) ....and from 239MW to 247MW a massive €545/MWh

Project – Part 1, The rise of the I-SEM Day Ahead Price

Recap

- Based on the variables provided, what are the most significant factors of this recent increase?

- What factors might cause this price to drop back to more 'normal' /average levels in the future?

Evolution of the I-SEM Day Ahead Price
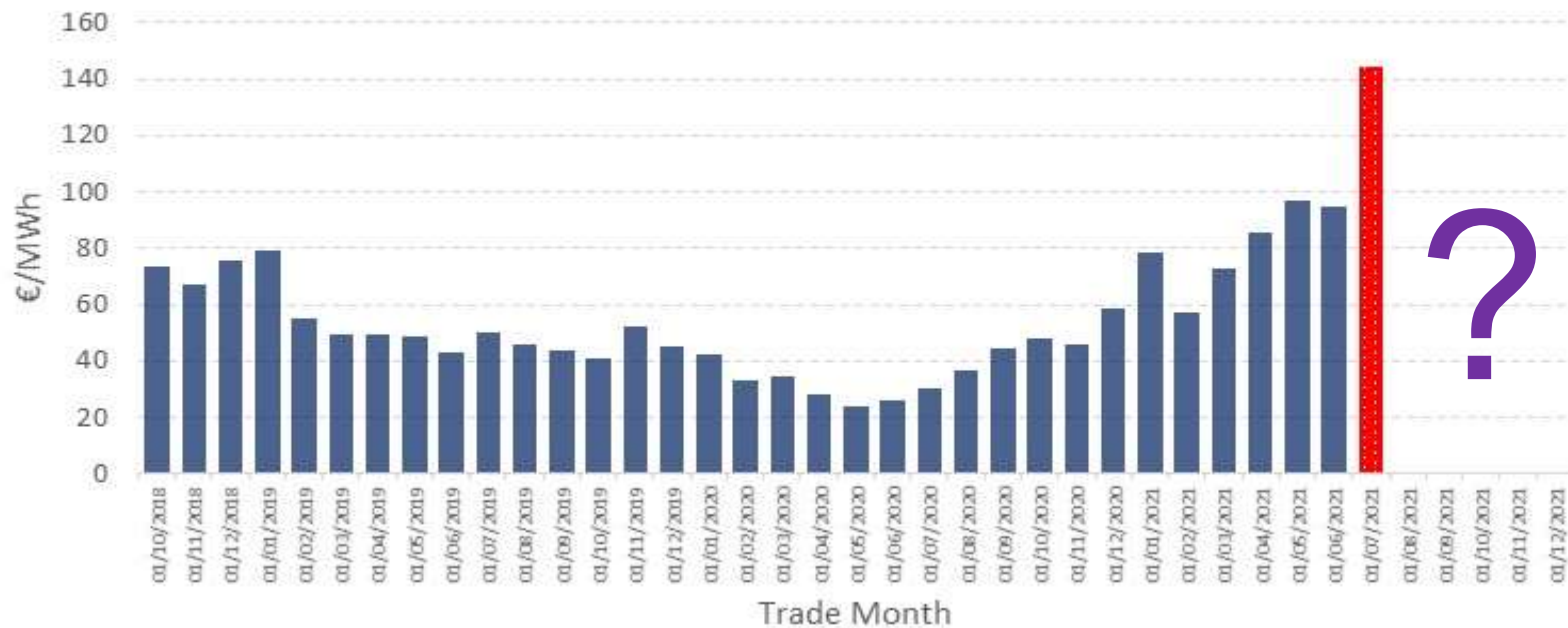
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Part 2: Developing Trading Strategies

What is Financial/Active Trading?

…this activity is all about conducting financial trades to capitalise on favourable price differences between I-SEM markets.

When conducting a trade, you have evaluated the risk of this trade and believe that the potential reward outweighs the potential loss. The nature of these trades, means that some will win, and some will lose. It is our responsibility to ensure that over the long run we win more than we lose, so that the activity is revenue generating for Energia Group.

I-SEM has 5 key markets that participants can trade in:

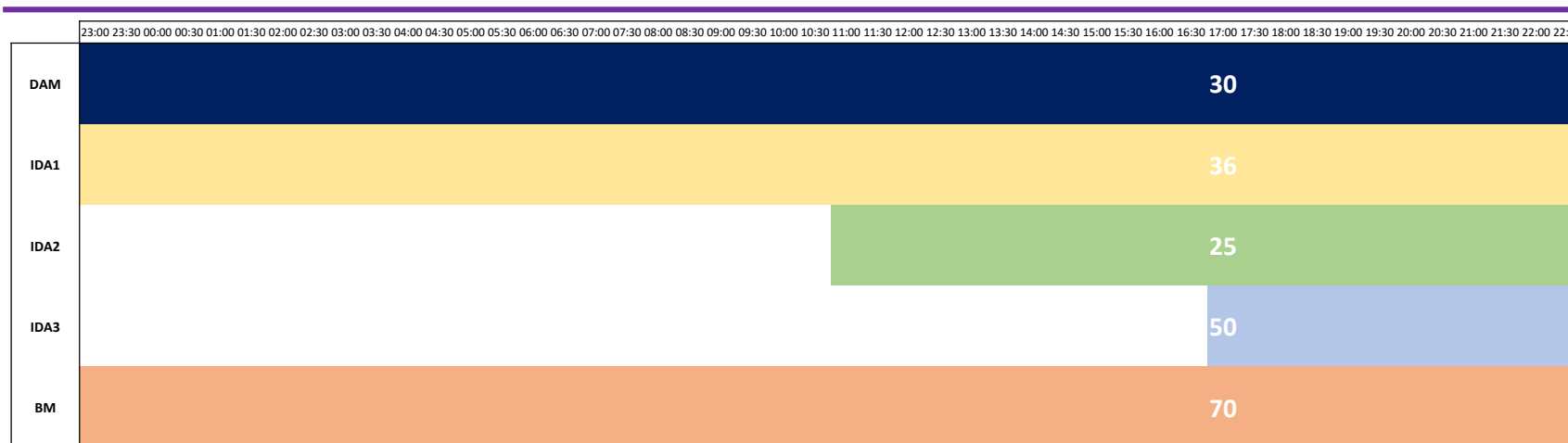| Name	Short Name	Control
Day Ahead	DAM	Market Participants
Intra Day 1	IDA1	Market Participants
Intra Day 2	IDA2	Market Participants
Intra Day 3	IDA3	Market Participants
Balancing Market	BM	TSO

A price is produced in each of the above markets for each time period across the day.

Active trading wants to generate profit between the spreads, so this means:
• Long Exposure: Buy in a cheap market, sell in a more expensive market. Done successfully = Profit
• Short Exposure: Sell in an expensive market, buy back in a cheaper market. Done successfully = Profit

P&L = (Market 1 Price – Market 2 Price) * Volume

Examples of trades: note you have to trade within the same period

	23:00 23:30 00:00 00:30 01:00 01:30 02:00 02:30 03:00 03:30 04:00 04:30 05:00 05:30 06:00 06:30 07:00 07:30 08:00 08:30 09:00 09:30 10:00 10:30 11:00 11:30 12:00 12:30 13:00 13:30 14:00 14:30 15:00 15:30 16:00 16:30 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30 21:00 21:30 22:00 22:30
DAM	30
IDA1	36
IDA2	25
IDA3	50
BM	70

If we consider the period 17:00-17:30, you can see there are prices produced for each market (DAM-IDA1-IDA2-IDA3-BM).

Long Trade examples
Buy 50MW in DAM @ €30. If we sell this 50MW in IDA1 @ €36. We profit (€36-€30=€6)*50MW= €300
Buy 50MW in DAM @ €30. If we sell this 50MW in BM @ €70. We profit (€70-€30=€40)*50MW= €2,000

Short Trade example
Sell 50MW in DAM @ €30. If we buy this 50MW in IDA1 @ €36. We lose (€30-€36=€-6)*50MWh= €-300
Sell 50MW in DAM @ €30. If we buy this 50MW in BM @ €70. We lose (€30-€70=€-40)*50MWh= €-2,000
Sell 50MW in DAM @ €30. If we buy this 50MW in IDA2 @ €25. We profit (€30-€25=€5)*50MWh= €250

These actions are available in each market timeframe across each trading day, but you have to be netural in any period you trade. i.e. you can't buy in 17:00-17:30, and sell it in 19:00-19:30. You need an equal and opposite action in each half hour period you decide to trade

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Project – Part 2, Developing trading strategies

Financial/Active Trading in I-SEM can make a company Profit & loss (P&L), if executed effectively. The concept is: Buy low, sell high or sell high, buy low.

-Can you develop multiple successful trading strategies for the period Jan 2021-Jul 2021? Use 1MW for simplicity, i.e. the difference between the prices is equal to the P&L. (In reality we could be trading up to 50MW..)

-To gain confidence in a trading strategy, you want to understand if they've worked over time or perhaps the most recent data is the most important only as the market evolves? Did these trading strategies work in 2019 and 2020 too?

Seasonality

Any data/findings from Part 1 can be used too e.g. generator

Net Demand

Price

Time of day

Wind Forecast

Relevant Pointers

You have been provided with price and wind, demand & net demand data. This is only a subsection of the data a trader has access to, but its all that is provided for this project.

- Is there a trend across different times of the day?

- Is there a weekday/weekend trend?

- Different levels of wind, have different trading opportunities

- Sometimes a higher win ratio can be achieved by trading DAM,IDA1, IDA2 & IDA3 and not going near BM

- BM is very volatile, the Net Imbalance Volume (NIV) helps you understand why the BM is high or low in certain periods…but you don't know the NIV ahead of time, each market participant can forecast it but you may be wrong (no data provided in this aspect, but raising for awareness)

- To help get confidence in your strategy, you want it to work over different time horizons e.g. if it was profitable in 01/01/2021 to 20/07/2021, was it also profitable in 2020 and 2019? You also want to understand what is driving the spread, so you can develop warning signals to your trade i.e. to avoid your winning trade going through 'downturn/negative periods'

Examples

- Sell DAM Price when wind is above forecast 3000MW, and buy back in BM
  - We can add further dimensions/logic to this trade
    - Only trade between the times of 23:00-07:00
    - Only if DAM Price was > €10/MWh
    - Only on weekdays

- Buy IDA1 Price, when wind is <300MW, and sell in BM
  - Only over the winter months from Oct to Mar
  - Only if IDA1 price was <€300

…Could explore: certain times of day (e.g. 23:00-00:00), different months etc

Risk/reward (expected value) is very important—so even though a trade might lose €10 4 times, when it does win it makes €200…

(Quick Sample) Trade Strategy Evaluation

Trade Strategy: Buy I-SEM DAM, and Sell I-SEM BM when Wind is Forecast Below 500MW.

2021	Total P&L	6,516	% of periods traded	28%	Win Ratio	43%
2020	Total P&L	21,272	% of periods traded	22%	Win Ratio	42%
2019	Total P&L	-3,995	% of periods traded	23%	Win Ratio	31%

Comments: Even though the win ratio is low, the P& of the strategies is profitable over 2021 and 2020. 2019 is loss making, but this could be linked to a change in the market dynamics.

Strategy Evaluation: Cum.P&L

Thank You for your time

Q&A

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