

Congratulations on being invited to the second round! Ahead of this interview, we would like you to complete a technical exercise that will form the basis for a discussion in the second-round interview. We will be looking for the following:

- Ability to process a problem and come up with a sensible and practical design
- Clear and structured communication of the development process and model outcomes
- A focus on quality, with a codebase that is easy to understand and review

We expect this challenge to take 2 to 4 hours. We do not expect you to source any additional data than that provided, and you are not required to use all the data provided. There are many ways in which this problem can be approached - we are not looking for a “correct answer”. You are free to use the internet and any freely available libraries. **If it looks like you will need more than 4 hours, please consider simplifying the specification to reduce the amount of time you need.**

Please send us your deliverables at least 24 hours before your second interview.

Context

Batteries make money by buying electricity when prices are low and selling it when prices are high. Electricity prices go up and down throughout the day because supply and demand change. For example, people use more power in the evening or when it's cold. There are multiple electricity markets, each with their own prices that can change at different times. Batteries can take part in more than one market, letting them find the best times and places to buy or sell electricity and earn a profit.

Task

- Build a Python package that models a battery charging and discharging to maximise profits, using the data provided
- You may assume the battery is a price taker (i.e. the actions of the battery have no impact on the market prices)
- In this exercise, there are 2 wholesale electricity markets, with prices included in the attached files
- The units of the market prices are £/MWh (money per unit energy), Market 1 has half-hourly prices, and Market 2 has hourly prices
- When the battery chooses to use some portion of its capacity to charge or discharge from one of the markets, it must commit that capacity for the entire time interval of that market
- For example, if the battery chose to commit 5 MW of discharging into Market 1 when the market price is 50 £/MWh, it would be paid £125 ($5 \text{ MW} * 0.5\text{h} * 50 \text{ £/MWh}$)
- The battery can export any amount of power up to its maximum discharge rate for any duration of time, so long as it has sufficient energy stored to do so
- Likewise, the battery can import any power up to its maximum charge rate for any duration of time, so long as it has sufficient remaining storage capacity to do so
- The battery cannot sell the same unit of energy into both markets, but it can divide its power across both markets
- For example, a battery with a 5 MW maximum discharge rate and 5 MWh of energy stored could commit 2 MW of discharge into Market 1 for two half-hour intervals, and 3 MW of discharge into Market 2 for its 1 hour interval, but it could not commit 5 MW to both markets at the same time, and could not discharge more than 5 MWh of energy over that interval
- The battery cannot charge and discharge at the same time
- This exercise is not designed to mimic realistic battery trading to keep the scope of the exercise as small as possible
- You are free to decide whether to include or exclude and of your own knowledge about electricity markets and/or batteries that is beyond the specifications of this exercise

This exercise is simplified and does not fully reflect real-world battery trading, so keep your focus on the rules and data provided. You do not need to use any data beyond what has been given. You are free to take any approach to determining the batteries decisions in each time interval.

To simplify the problem, consider focussing on a solution that runs and is structured well, but compromises in any of the following ways:

- Ignoring some of the market rules or battery behaviours
- Focussing on one market
- Focussing on a subset of time periods
- Simple decision logic for battery decisions, that do not need to be optimal

Deliverables

Please send the following at least a day before your second interview:

- A way to access the source code for your Python package (e.g. a link to a GitHub repository or similar)
- Instructions for how to set up and run your battery dispatch model
- Reproducible results from your model
- A brief (no more than 1 paragraph) summary of your approach to the challenge

We are looking forward to hearing your response and please let me know if you have any questions.