Optimisation of battery charging and discharging

Here, we formulate a model that optimises an agent’s market strategy for a given portfolio of storage devices and known market prices.

# Definition of sets, parameters, and decision variables

## Sets

## Parameters

## Decision variables

# Problem Formulation

## Objective: Profit maximisation over optimisation horizon

There are two aspects of the agent’s objective value. First, we have the total revenue earned minus the amount spent on the electricity market. Second, we include any penalty from deviating from the end-of-horizon energy state.

## Constraints

### (2a) Definition of the state of the energy storage state

The energy stored depends on three things in our formulation: The energy retained from the previous time-step, the energy used to charge the device, and the energy discharged from the device. Mathematically this gives:

### (2b) End-of-horizon conditions

Here we define some end of horizon constraints on the storage devices, ensuring the end-of-horizon is within a particular range, and defining the shortage or excess if the EOH storage is not at the ideal level, .

#### (2b.i) Defines end of horizon storage excess or shortage from ideal

#### (2b.ii) Limit on end-of-horizon storage excess from ideal

#### (2b.iii) Limit on end-of-horizon storage shortage from ideal

### (2c) Limits on charging and discharging of storage devices

Here we limit the power charging and output capabilities of each storage unit

#### (2c.i) Charging Limit

#### (2c.ii) Discharging Limit

### (3) Non-negativity constraints

Finally, we constrain the energy stored, power consumed/discharged, and energy shortage/excess decision variables to be non-negative.