Assignment: BESS Dimensioning for Industrial Peak Shaving

Context:

A manufacturing facility ("The Fabric") has recently installed a **5 MWp** (peak) onsite Photovoltaic (PV) plant to reduce its reliance on the grid. However, the facility still faces high electricity costs due to "Peak Demand Charges," (charges based on the maximum power (MW) drawn from the grid at any single moment).

Obs: The meter does not record just a one-second demand peak. Instead, it calculates the average power consumption over 15-minute intervals and register each of this throughout the month. The utility then identifies the highest of these 15-minute averages, which is defined as the “measured demand”.

To mitigate these costs, the facility manager wants to install a **Battery Energy Storage System (BESS)** to perform **Peak Shaving**.

Objective:

Based on the provided 24-hour time-series profiles of load demand (Demand_MW) and photovoltaic generation (PV_Gen_MW) at 15 min intervals, determine the specifications of a BESS (power rating (MW) and energy capacity (MWh)),such that the net power imported from the utility grid is constrained to a maximum of **2.2 MW** at all time steps, while not exporting at any time surplus power to the grid (zero grid).

1. **Efficiency:** Assume an ideal system (100% round-trip efficiency) for the base case.

Calculate:

1. Power Rating:

Calculate the minimum required power rating of the BESS in **MW**. This is the maximum instantaneous power the battery must either provide or absorb.

2. Energy Capacity:

Calculate the minimum required energy capacity in **MWh**.