Main ideas: (1) Explore dependency of charging rate on SOE while objective is to energy arbitrage in day-ahead market, price-taker

(2) WF and PHSP optimize to maximize output- operation cost-deviation cost in presence of uncertainty

(3) Battery as price taker with objective to energy arbitrage in day-ahead market, spinning reserve, regulation markets – cost operation

(4) Battery for peak shaving: consumer bill has two parts (i) total kWh plus max kW(peak).

(ii) participate in (fast) frequency regulation with operation cost and mismatch penalty (iii) degradation

Objective is to minimize all 3.Some sensitivity analysis. Different peaks / penalty

(5) Like(3) Energy arbitrage in day-ahead and real-time markets. Failed bids in day-ahead markets can be considered towards real-time markets.

(6) Consider energy arbitrage in a grid system while providing ancillary services such as balancing grid.

(7) Now, battery as price taker on RT and DA models, price maker on ancillary services above

(9) Cooperation of wind and energy system: wind for frequency regulation, participate in real time and day-ahead and regulation markets, but wind has uncertainity, so battery come in maximize them minus operation and mismatch penalty

(Price maker on ancillary)

\*\*\* Peak shaving not interesting\*\*\*

Ancillary market: frequency regulation (How u will bid accept )   
what happens if u will get cold.

\*\* Wind and PV \*\* variance minimization.

Limitations: capacity to inject disinject, charging/discharging rate. Do not immediately charge /discharge. May be some threshold and wait for bigger peak.

Firming or hybridizing variables.

Tasks (1) Find distribution cov function of soc, max soc distribution for c bar, soc (t+delta)- soc(t) for delta c, graph of variation of mean reversion and volatility vs c bar, graph of Y\_t

OU has only one parameter: mean reversion ratio to sigma (Look at jp volatility)

(3) convert to python.

California ISO. (hybrids trend that is our objective).

Data for price maker / price taker??