Objective:
- This work presents a probabilistic-based sizing tool for residential home owners, load serving entities, and utilities to select energy storage (ES) and photovoltaic (PV) based on historical load characteristics and load management options.
- Inputs: historical load profiles and solar radiation data.
- Outputs: home energy consumptions, monthly energy payment, self-consumed solar and backfeeding energy, etc.
- Demand-side Energy Management (DSM) is also involved.

Technical Approach:

- Data Description
  Various patterns of house load models and solar power output models could be extracted from this data set.

Accomplishments:

- Sizing PV and ESD at the Home Level
  As shown in Fig. 7, Reverse power is not an issue in the winter load group This shows that it is not wise to just use one size of ES for the whole year because of the seasonal load differences. Also, the users can run different ES and PV combinations to find the optimal one that meets the power limits of backfeeding.

- Sizing PV and ESD at the Transformer Level
  Assume that a transformer supplies three homes, each of which has a 5-kW rooftop PV. As shown in Fig.8, installing a 2kW/2kWh battery at the transformer level will receive the same result as installing one 1kW/1kWh battery at each home.

- Sizing PV and ESD at the Feeder Level
  Fig.9 shows the reverse power for penetration level of 50%, 70% and 90% respectively, also shows the trend of the maximum reverse power on the 80%-line of various penetration levels. To give a comparison, the red line in the trend figure is obtained using a 10kW/3kWh ESD at the feeder head.

Next Step:
- In the future, sizing analysis involving DSM will be studied in detail, to see to what extent DSM will benefit the residential loads with renewable energy.

Potential Impact:
- This method can give the users a clear comparison of the tradeoffs among different PV and ES options and assist them make more informed decisions.