Project SunDial

Ruchi Kwatra
Vardhman Mehta
Casey Pham
Michael Stepanovic
Ryan Stoddard

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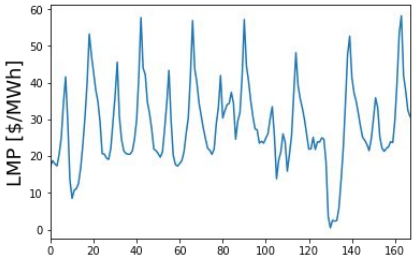
Background

Operating a solar battery installation is complicated!

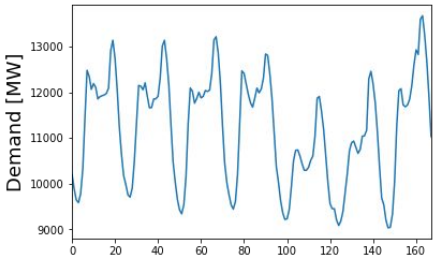
Should solar power be stored or sold back into to the grid?

Will I make the most money selling power now or later?

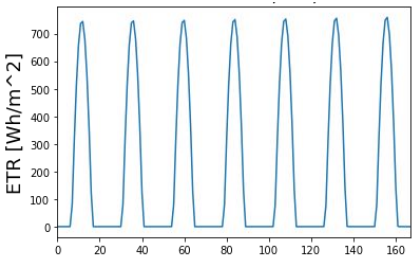
Does the weather suggest the battery should be charged or discharged?



Energy price model



Energy demand model



Solar output model

Maximize $$$

Data Sources

Powered by Dark Sky

Weather forecasts (predicted)

California ISO

Shaping a Renewed Future

Energy price data

Battery cycle data

Weather observations (actual)

Solar output data

Energy demand data

Use Cases

1. Visualize Energy Plan Impact

Interpret fluctuations in energy prices, demand, PV output, and battery health by entering the date and hours

2. Cost Analysis

Maximize cost savings of a solar installation, based on:
(1) energy costs, (2) demand, (3) sunlight availability and (4) battery health

Design Components

Based on 2016 energy demand seasonality and a given weather forecast...

1. How much are utilities charging? (Energy Price Model)
2. How much sunlight is available? (Solar Cell Output Model)
3. What are my charge/discharge capabilities? (Battery Degradation Model)
4. How much energy will the grid demand? (Energy Demand Model)
5. How should I use my battery? (Dashboard)

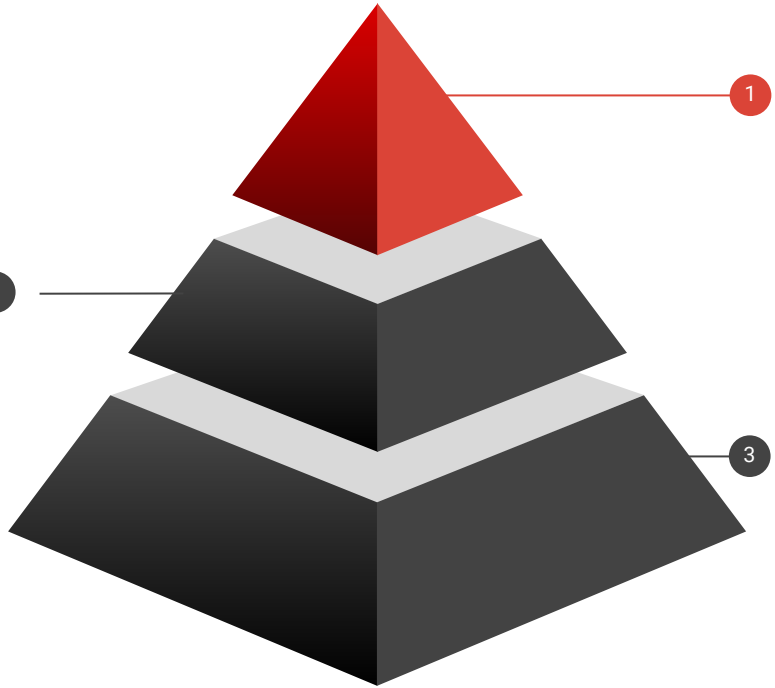
Integrating Components

Visualize cost savings in an interactive dashboard

1 Provide information and controls for developing an energy utilization plan.

Predict cost savings and compare energy plans

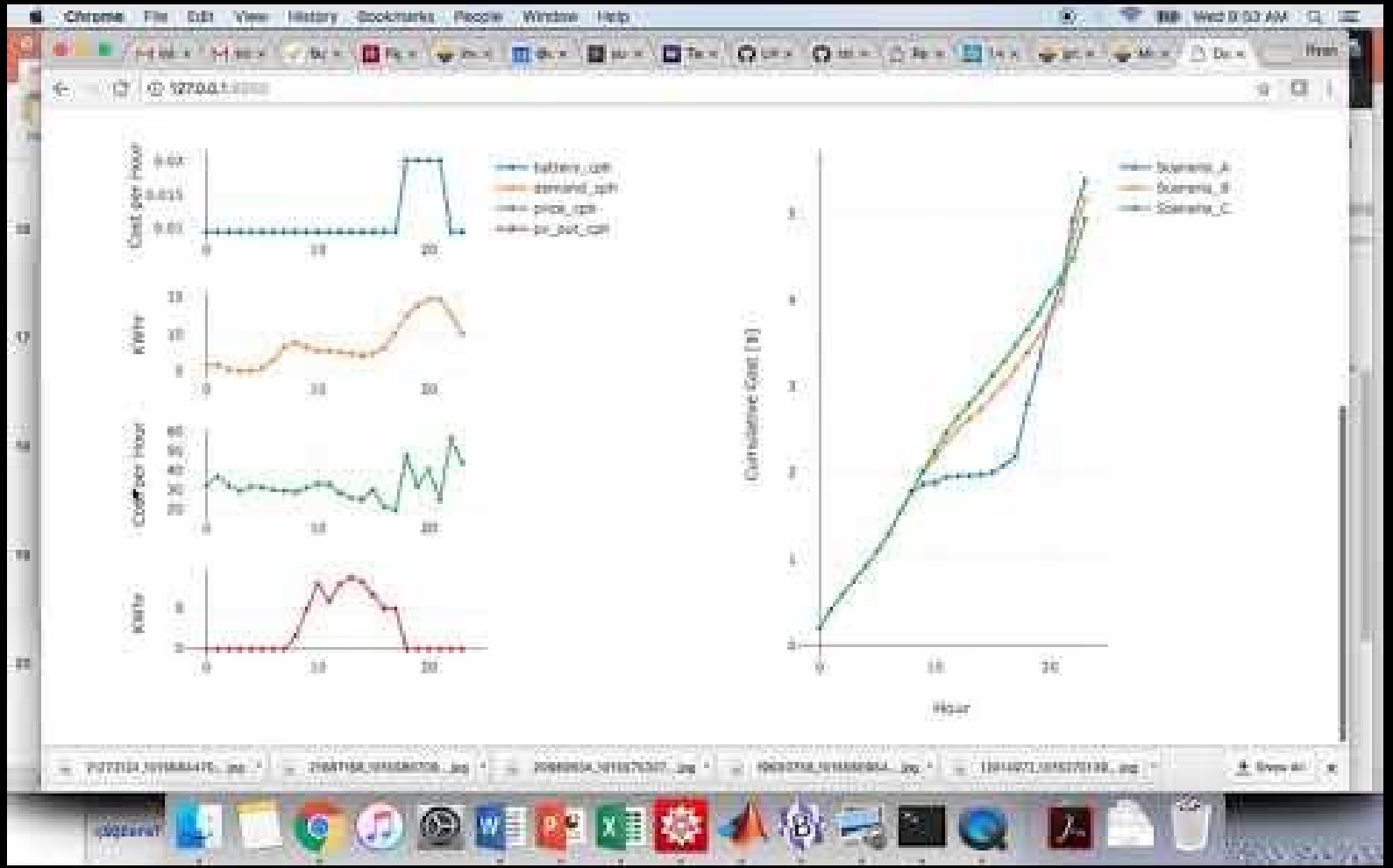
2 Given a user-specified date, time window, and cost threshold, calculate total daily costs under different utilization scenarios.



Combine data sources and fit predictive models

3 Energy prices, demand, sunlight and battery degeneration modeled for a specified location (Santa Maria, CA) over 2016.

Demo


Chrome File Edit View History Bookmarks People Window Help
Cost per Hour
battery_cph
demand_cph
price_cph
pv_pick_cph
KWHr
Cost per Hour
KWHr
Cumulative Cost ($)
Scenario_A
Scenario_B
Scenario_C
Hour

Project Structure

```
SunDial/
  |- app.py
  |- LICENSE
  |- README.md
  |- requirements.txt
  |- setup.py
  |- doc/
     |- components.md
     |- data.md
     |- functionalspecs.md
     |- ...
  |- examples/
     |- model_usage_example.py
     |- ipynb/
        |- ...
  |- img/
     |- ...
  |- sundial/
     |- __init__.py
     |- data/
        |- ...
     |- battery_model/
        |- ...
     |- demand_model/
        |- ...
     |- price_model/
        |- ...
     |- pv_model/
        |- ...
     |- tests/
        |- ...
```

https://github.com/UWSEDS-aut17/SunDial

Lessons Learned & Future Work

Lessons Learned

- Programming styles
- Unit tests
- Version control
- Machine Learning models

Future Work

- Add capabilities to auto-download datasets based on lat-long
- Further explore various models to make more accurate
- Add “auto-optimizer” tool that searches every possible scenario and finds the cheapest solutions