Homework 6: Getting started with CVX

Kevin J. Kircher, Purdue ME 597

Directions:

- Students may work individually or in groups, but each student must upload their own solutions to Gradescope by **11:59 PM ET on Sunday, March 24**.
- Use any outside resources you want, but **cite your sources**. (If you really want to learn the material, I recommend seriously attempting the problems yourself before looking for outside help.)
- The TA will grade each problem quickly on a three-tier scale:
  - Zero points for a solution that's mostly unreadable or missing.
  - One point for a serious attempt that's not easy to read or is substantially incorrect.
  - Two points for a solution that's clearly readable and nearly or completely correct.

Problems:

1. Listen to the episode "Virtual power plants: the 'sandwich' for the grid" on The Carbon Copy podcast. Then, read pages 1–12 of the Department of Energy's Pathways to Commercial Liftoff: Virtual Power Plants report. (Jennifer Downing, the podcast guest, led authorship of the report.) As you listen and read, note in your response to this question any terms that you don't recognize or fully understand. Do your best to find the meaning of each of these terms through Internet searches. For each term, write down and turn in a definition or description in your own words.
2. Form your team for the final project. (Students can work alone or in teams of two or three. Teams of four may be acceptable in some cases.) Turn in your team members' names, if applicable, as well as a few sentences describing the topic you plan to work on.
3. Download and install the CVX toolbox for Matlab. Use CVX to find a battery power profile that maximizes 'buy low, sell high' revenue with an electricity price that is 0.25 \$/kWh between 2 PM and 9 PM and 0.15 \$/kWh otherwise. Use the following input data: One-day planning horizon, fifteen-minute time steps, 1600 hour self-dissipation time constant, 95% charging and discharging efficiencies, 13.5 kWh of energy capacity, minimum charge state of 20%, initial charge state of 50%, charging and discharging power capacities of 5 kW. Constrain the final charge state to equal the initial charge state. Turn in your code, the total revenue earned by the battery over the day, and a figure containing three vertical subplots: (1) electricity price vs. time, (2) electrical charging/discharging power vs. time, (3) stored chemical energy vs. time.