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Go Green, Go Home

"Make America Green Again"

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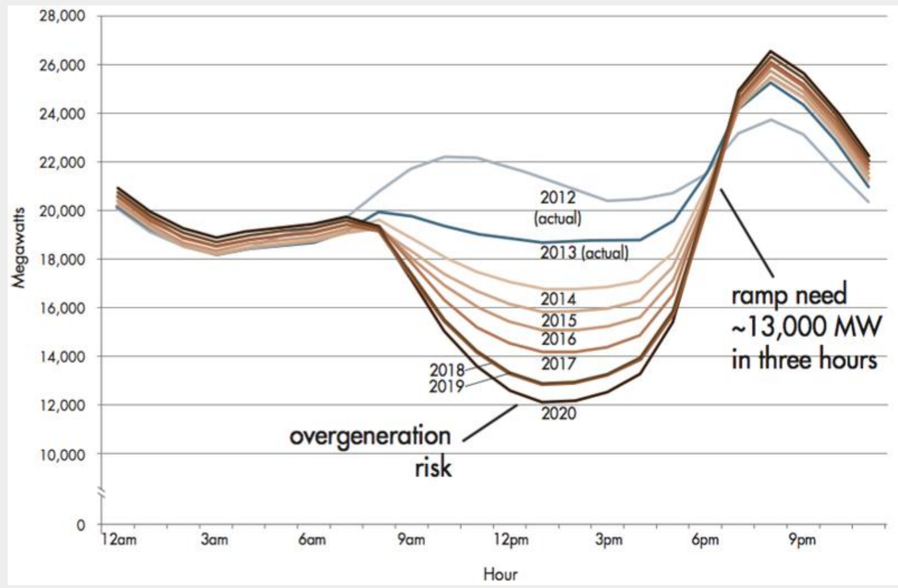
Objective

GGGH aligns energy use with renewable energy generation.
Take energy demands from users and execute them based on when energy generation is cleanest and most readily available

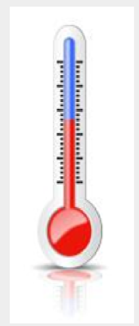
A Tremendous Problem



Renewable energy and EV's can cause logistical problems for utilities which require expensive solutions such as peaker plants, storage, and additional distribution maintenance.

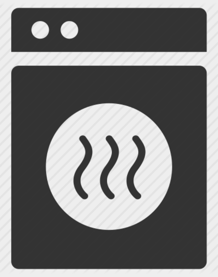
WattTime and Deployable Loads

Python pulls data from the WattTime API (wattime.org), which provides the carbon intensity of electricity coming from the grid on a given day. By controlling shapeable and deferrable loads, energy demands can be met with cleaner energy sources.



Shapeable loads can receive a variable amount of power delivered within a flexible timeframe as long as the energy requirement is met by the end of the time frame.

Deferrable loads can be scheduled to run at any time within the user defined time frame, but once they begin, they have specific power requirements for a set time.



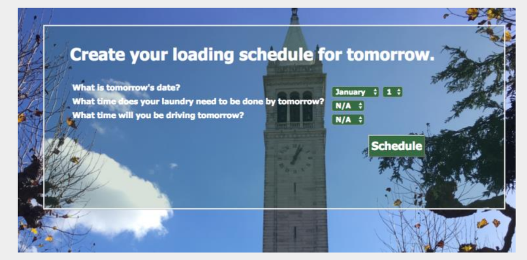
Optimization

We used a mixed integer linear program (MILP) to perform the optimization. The cost function is the carbon intensity of the grid (pulled from WattTime); the decision variables are the time and power consumption of the loads; the constraints include car and laundry deadlines, the energy-power relationship, and other appliance-specific constraints.

211 Decision Variables **633** Constraints

The Cyber Physical System

User input: User limits time frame in which loads should be complete.



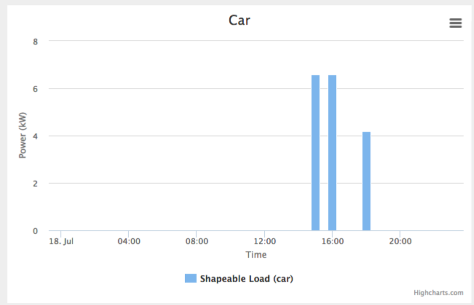
WattTime: provides real time and predicted data about the carbon footprint of electricity coming from the grid

Wallflower: Stores and retrieves time series data

Python: Provides a central hub for receiving, analyzing, and distributing data.

Optimization: Optimization problem that creates load schedules to minimize carbon emissions of electricity use

Visualization: Charts to summarize load schedules and emissions from energy use.



Arduino: Simulated scenario where loads are actuated for a single day in a model home.

Results

20%

Reduction in CO_2 emissions

Equivalent to 100 gallons of gasoline or 3,000 miles traveled

1,825 lbs

Potential yearly CO_2-e saved by using optimization

Implementation in 160,000 homes would prevent the need for construction of a $600 million Natural Gas power plant

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