Practical Web Based Visualization for Comparative Energy Usage Analysis

Citizen Engagement for Energy Efficient Communities (CoNNECT)

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The Goal:

The goal of the CoNNECT dashboard is to enable consumers to easily visualize their power consumption with respect to climate, their neighbors, and their own past usage. With this data the consumers will be more likely to make better decisions about their own energy efficiency thereby reducing their usage as well as their carbon footprint.

The Data:

- Three years of usage data for about 180,000 users was obtained in an Excel Spreadsheet.
- The data was then broken apart into customer data and their usage data and inserted into a MySQL database. This is to ensure that when new data is introduced the tables would not have to be rebuilt or modified.
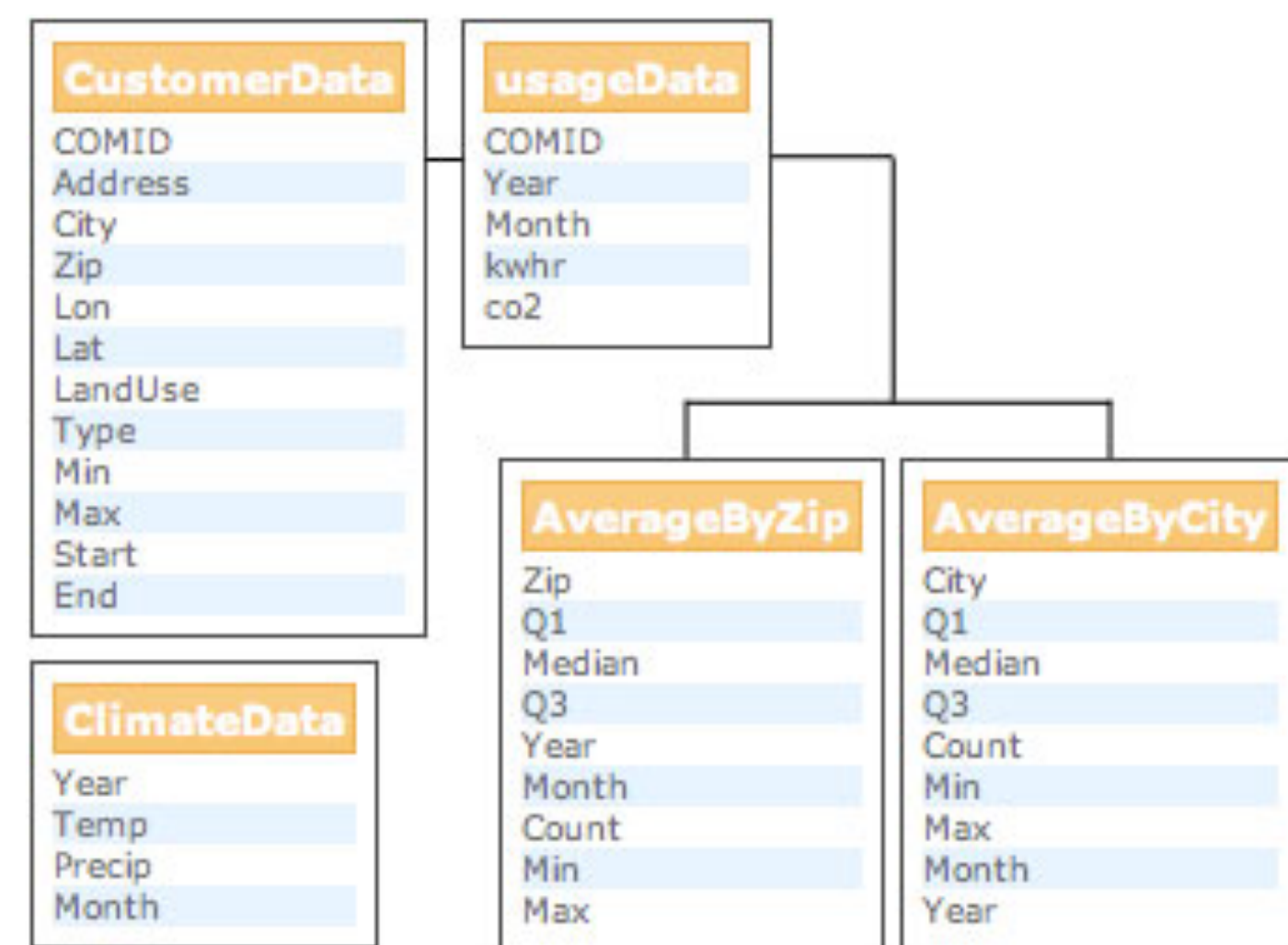
- This was accomplished by writing a custom program in Java that imports the data and breaks it apart into the appropriate pieces.
- As program breaks apart the data it also calculates the statistics for each city and zip code on a monthly basis. It then inserts these in a separate table.

The Back End:

- PHP is connects to the database and retrieves the usage records based on customer COMID.
- PHP also retrieves all of the statistics and climate data.
- When the results are retrieved from the database they are already in order.
- The data is then reformatted into a Javascript array

Interactive User Interface:

- HTML5 and the Protovis[1] Javascript visualization library were used rather than Flash or Flex.
- Support for these technologies is built in to all modern web browsers making them quicker to load and render.
- The user doesn't have to install any additional software or plugins in order to use the application.
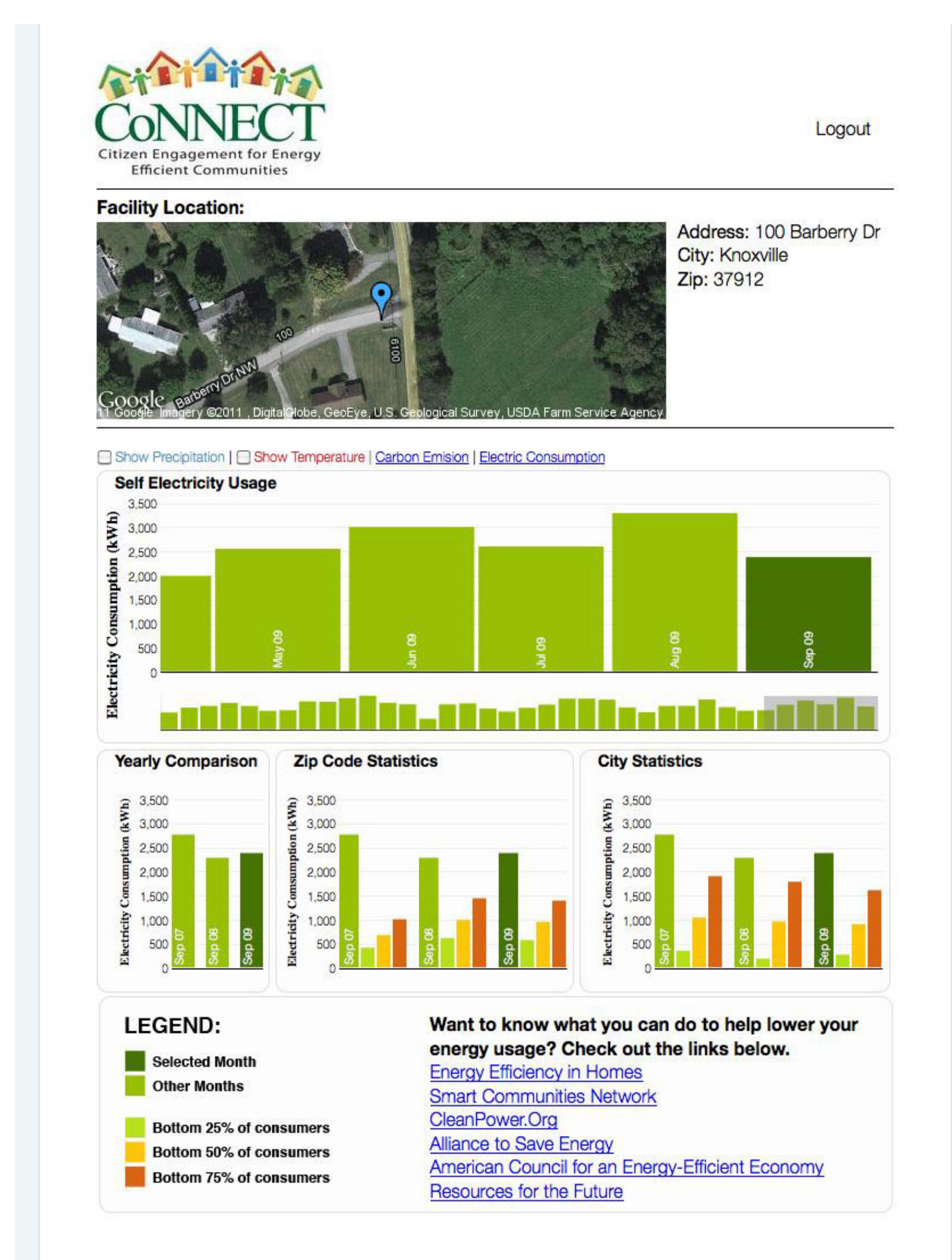

The focused area of the visualization allows the user to easily focus in on a few months of interest or expand their view to a large range of dates. The yearly comparison area also helps the user to be able to more easily see any benefit of improvements made to their home in previous years.
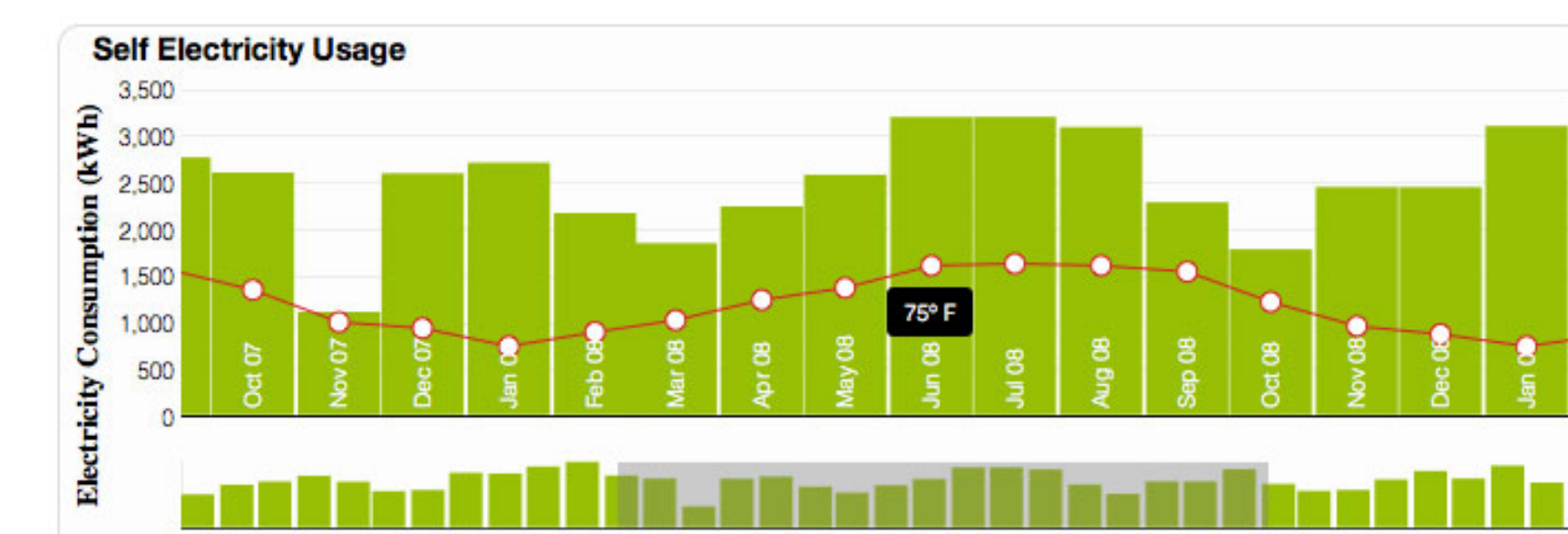
When the user hovers over a specific temperature or precipitation node it displays the information for that month. This allows the user to see more detailed information about that month.

When the user selects a large range of dates the columns scale down to the appropriate size. Also when the user chooses to show the temperature and precipitation that it is also displayed in the bottom panels. This allows the user to see variances from year to year.
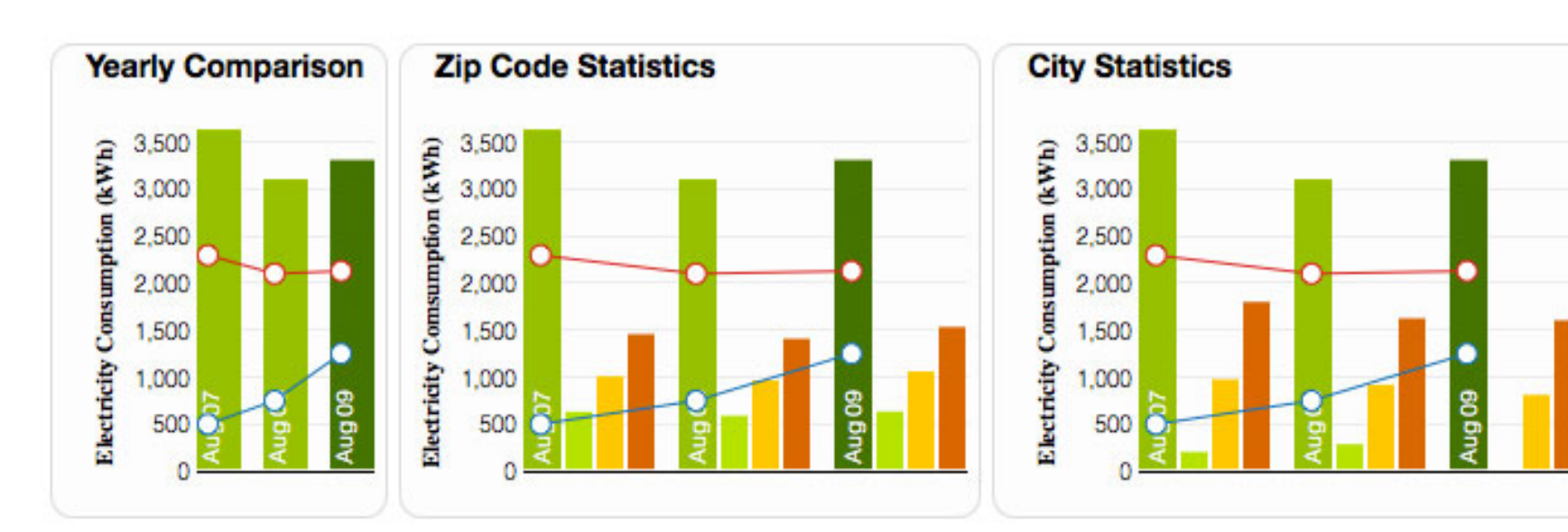
When the user chooses a month the comparisons are updated. Each of the nodes are for a specific year/month combination. This helps the user see if their power usage is due to improved efficiency or if it's due to changes in climate from year to year.

Design and Interaction Considerations:

- Users have the ability to easily select a custom range of dates. This was accomplished by giving the user an area at the bottom where they can select a range of dates by clicking and dragging.
- When a user clicks a month in the overview they are shown a yearly comparison and statistics of that month. This make allows them to see any benefits of improvements in hardware or habit.

- Bar graphs were used to represent the data that the users had some control over, while line graphs where used to represent day that the users had no control over.
- The focus area and statistics are highlighted by size and color respectively. This is to give the user a clear indication of which areas are the most important[3].

Mobile Device Support:

- In July 2010 mobile devices accounted for 11% of all web traffic worldwide[2]. With millions of mobile devices being created since then.
- By using HTML5 and Javascript this application will render correctly on a mobile browser. The screen shot to the right was taken from Xcode's iPhone simulator.

Observations:

- It is possible to see when a user has been on vacation by looking at months where usage is abnormally low compared to others. Notice in the graph below, how in August even though it's warmer, the user managed to use less power than in June or July.
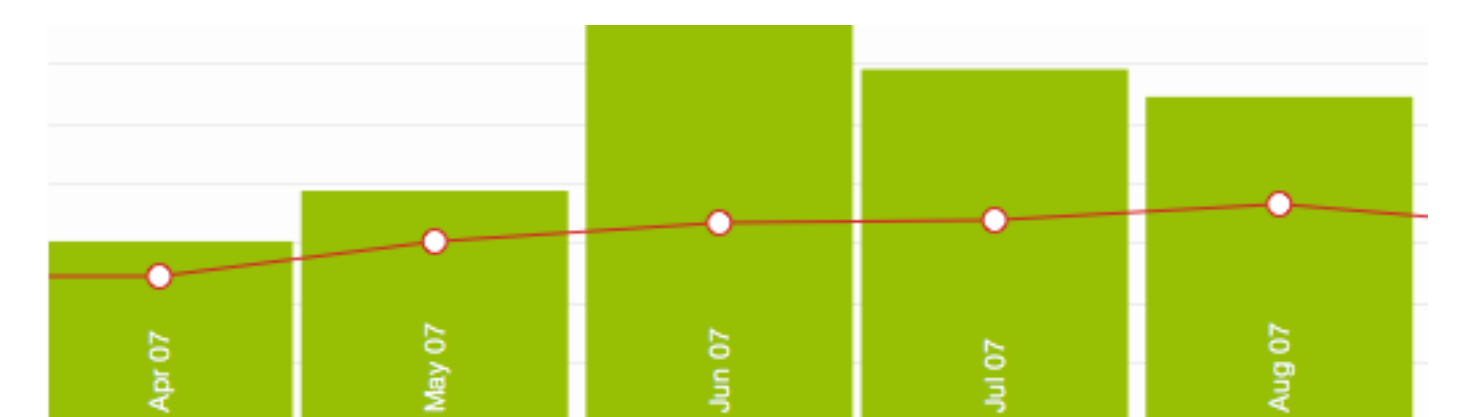
- Peek power usage most often occurs when the temperature reaches the maximum or minimum for the year. Notice in the graph below that usage is at it's least during the transition from winter to summer.

- Improvements in habit or hardware a easily detectable with the yearly comparison pane. As shown below these users have all made significant reductions in their usage over the past three years.

References:

1. http://mbostock.github.com/protovis/
2. http://mobileanalyticssimplified.com/post/790212999/11-of-web-traffic-worldwide-is-now-mobile
3. Few, Stephen. *Information Dashboard Design*, page 71, 2006