**Memo**

To: Professor Pisano

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Team: Sweet City: Team 20

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Subject: Sweet City Second Deliverable Test Plan



1. **Energy Efficiency Module**

**Description and Goal:**

The energy efficiency module is composed of a switching circuit. Two push button switches toggle between incandescent and LED lights. The module now fulfills project requirements of interaction and a visual load.

The overall goal of this module is to demonstrate differences in power consumption for the two bulb types. The end result will show National Grid customers the major impact of using LEDs instead of incandescent lights. Switching to LEDs not only helps the environment by significantly reducing power consumption, but can also lower a customer’s monthly electricity bill.

Completion of this energy efficiency module is another major milestone in the overall project. It is one fourth of the project circuitry. Since we can accurately depict having a button triggered and a corresponding light turn on, we can expand the circuit to potential add ons in the final product. The difference in power by using LEDs over incandescents may be used to power a model Green Line train. In addition to the circuitry, a raspberry pi code can measure and display the power consumption of the two light types.

**Procedure:**

To achieve the desired brightnesses and switching mechanisms, apply an 8V DC source to the circuit. There are two push button switches that control separate transistors and the lights themselves. The first switch is a universal on-off switch. To turn on either light set, button 1 must be pushed. When pressing button 1, a voltage is applied to an incandescent bulb as well as one side of the second switch. Pressing button 2 shuts off the incandescent bulb and turns on a white LED. Releasing the second button will turn the incandescent bulb back on, while shutting off the LED. Releasing the first button will stop the current flow to the entire circuit, which shuts off the light that was on at the time.

**Verifiable Result:**

The energy efficiency module will be considered successful if:

* Pressing button 1 lights the incandescent bulb
* Pressing buttons 1 and 2 switches from incandescent to LED
* Not pressing a button keeps both lights off
* Only one set of lights is on at a time

The button press switching mechanism achieves the “interactive” requirement for the module while also having a visual load of either an incandescent or LED. This circuit and the supplementing LCD displays help show National Grid customers the effectiveness of using LED light bulbs in their homes.

**2.0 Simulation and Display**

**Description and Goal:**

The Energy Efficiency module requires a simulation of power consumption by the LED and incandescent light bulbs. Although the data could be read directly from the circuit itself, a simulation has been made in order to show customers consistently the effect of using LEDs over incandescent light bulbs.

The overall goal of the simulation is to display power generated by the LED or incandescent when a button is pushed. By finishing the simulation for this module, this module will almost be complete. The only tasks left will be to build Fenway and add the finishing touches.

Every module requires a display showing power generated, consumed, or other data about the Smart Grid. Since the LCDs on the Wind, Solar, and Energy Efficiency Module are the same, figuring out how to display data for one module makes it easy to display data for the others. Since the Smart Grid display is much more difficult, knowing the basics will help with displaying more data on a larger screen.

**Procedure:**

The display code of the raspberry pi runs on a continuous loop waiting for a change in input. Applying to the energy efficiency module, a “button press” triggers the display of power consumption. Pressing another button, which switches bulb types, triggers a change in display to account for the new power consumption. Release of button 1 results in a display of 0W.

Press button 1: Display power consumption of incandescent bulbs

Press buttons 1 and 2: Display power consumption of LED

Release button 1/No button pressed: 0 W

**Verifiable Result:**

The simulation and display will be deemed successful if the LCD displays the correct corresponding values when the buttons on the Energy Efficiency circuit are pressed.

The display portion will be considered successful if:

* Pressing button 1 displays the power consumption of the incandescent bulb
* Pressing buttons 1 and 2 displays power consumption of the LED
* Not pressing a button displays “no button pressed”

These values can later be verified by measuring voltage and current with a multimeter and calculating power by hand.