



Roles

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Overview of Problem and Solution

Many consumers are not against reducing their home energy usage, since it both helps the environment and saves them money at the same time; however, the main obstacle they face is apathy. Other than monthly utility bills, there isn't an easy way for homeowners to monitor their energy usage and see where or how they could save money, and as a result, most people only have a broad sense of what their home energy usage is like.

We at JuiceBox intend to develop an application that monitors, tracks, and displays a user's home energy usage, so that users can not only see more specifically how they currently use energy, but also see how they can reduce their energy bills through purchasing more energy efficient appliances and by changing specific lifestyle behaviors. By providing users with more information about their home energy usage, we hope to both help users reduce their energy bills as well as help our society as a whole collectively reduce our environmental footprint.

Task Analysis Questions

Who is going to use this system?

Cost conscious and/or environmentally conscious people who pay their household's energy bills are likely to use our system to monitor and reduce their home energy usage. These people are more tech-savvy, since they want more information about their home energy usage than what's provided through their utility company.

What tasks do they now perform?

People currently have to replace old light bulbs and appliances, and they go through their own personal decision process in order to choose which product to buy. For instance, Eve and Mike were looking for a new oven since theirs had burned out earlier in the week. People also have to pay for utility usage, so many look over their utility bills and monthly statements to see how much they're being charged for different utilities before they pay it off. Steve looks at his monthly utility bills just to check it over before filing them away in a file cabinet. People also have to make sure that all of their heating, plumbing, and

electricity systems work, which means that they need to detect and fix any leaks or breakdowns that happen in their home. Eve and Mike ended up finding out that they had a water leak through seeing their monthly bill, which showed an abnormal increase in water usage that month.

What tasks are desired?

People would like to have more specific information about how their energy bill is broken up. Eve and Mike thought that they were doing a good job about electricity and heating usage, but knew that they could improve water usage. More information about how their water usage is broken up could help them reduce their water usage. People would also like to know right away when a leak or otherwise abnormal usage is detected. Eve and Mike would have had an easier time hunting down the leak if there was more information about where the leak seems to be coming from. People would like to know how much they can save by buying more energy efficient products. None of the people we talked to said that they knew how much they'd be saving by buying a specific appliance.

How are tasks learned?

People don't currently have any special training on monitoring their home energy usage. People like Steve pay the utility bill every month, see a report, and make individual purchases that affect the utility bill. There are also a lot of other personal informatics applications such as FitBit and Mint.com where people become familiar with reading and analyzing personal data shown to them in pie charts, graphs, and other visual representations. In order to learn how to manage home energy usage, people have to know how the data shown them (like usage over time) represents the choices that they make, and they have to be able to make lifestyle and appliance decisions based on whether or not they're satisfied with their current bill or if they want to reduce their energy usage. People may also go online to find out how they can fix certain problems in their home that arise.

Where are tasks performed?

As demonstrated by Steve and Mike, people usually check their utility bills at home. They either make purchases over the internet or they drive out to a store like Eve and Mike and buy it there. People find and fix leaks and other abnormal energy usage at home.

What is the relationship between customers and data?

People get their energy bills sent to them every month, so all of their personal usage is most likely accessed at home and stays private between them and the utility company. Some utility companies also reports out comparison statistics between a user and neighbors, so the utility companies in effect take all the personal data they collect, holistically analyze and process that data, and report back their findings in monthly statements. Steve talked about how he sees each month how he stacks up in comparison to neighbors, but he's not sure how accurate that is since it doesn't take into account house size.

What other tools does the customer have?

Utility companies send out monthly bills which include usage reports. At Home Depot, we also saw that lightbulbs have an estimated electricity cost on the box itself, and the packaging also tells you how long the bulb is expected to last. Refrigerators and other appliances on display in the store have similar tags with those kinds of statistics.

How do customers communicate with each other?

Most people do not talk about their energy usage with other people, but for those that do, they probably communicate orally or through text messaging or email. Steve didn't really talk about his energy bill with friends or family, but there were times when he's shared about his new appliances, what he thought of them, and whether or not there had been a difference in energy savings.

How often do customers perform the tasks?

Customers like Steve and Mike mainly check their energy usage monthly when the statements and bills get sent out. Customer purchases also vary by the type of product and by the individual person's spending habits. Many people buy new gadgets or small appliances frequently, but lightbulbs can last years, and many big ticket items such as refrigerators, washers, and dryers last a long time.

What are the time constraints on the task?

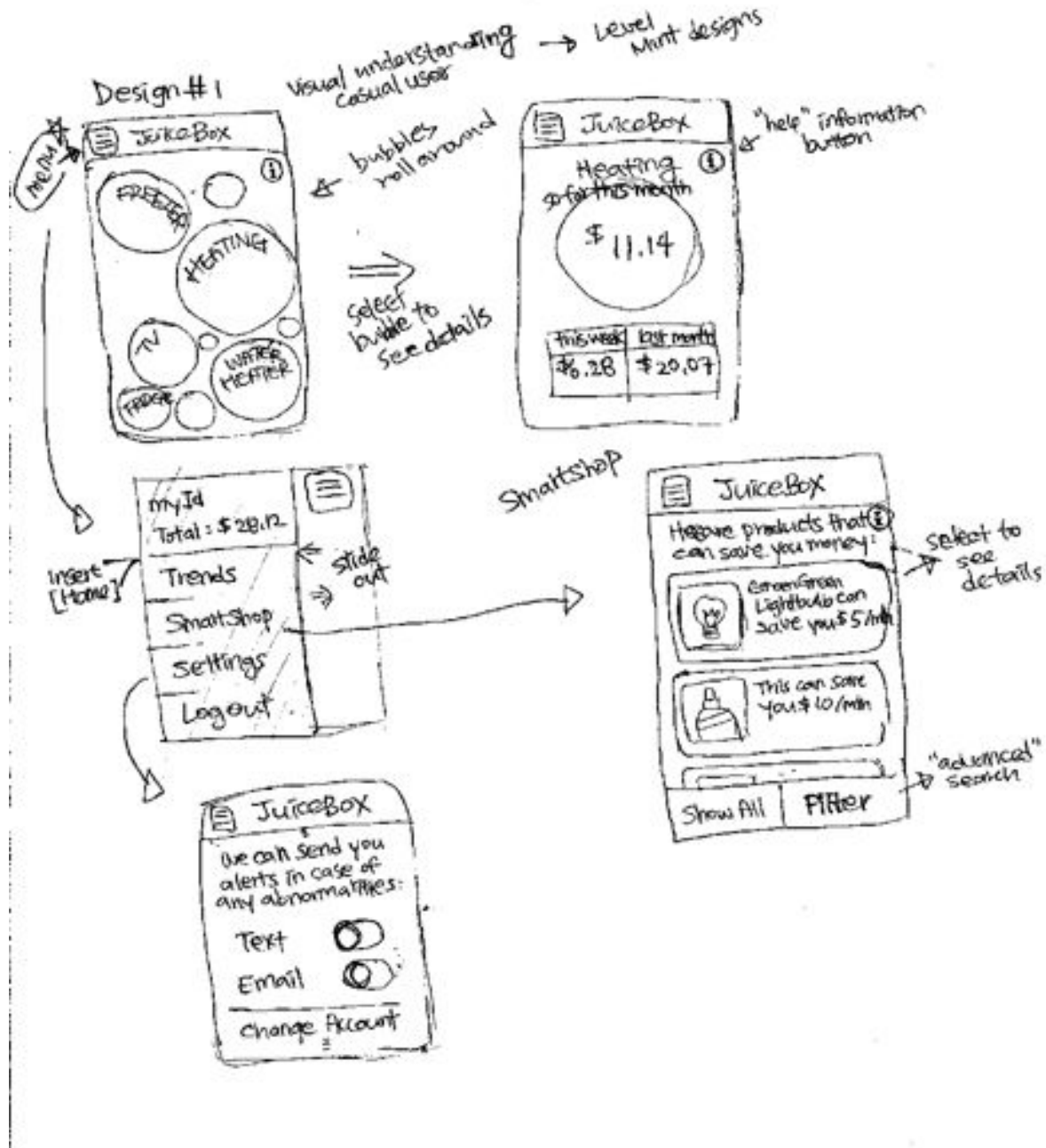
Currently, there is a small time window every month that a user spends looking at their utility bill. As time goes on, however, people usually spend less and less time looking at how their energy bill is broken up, since habits become formed and there isn't much variance for energy usage, except for seasonal temperature changes.

The time spent deciding and making a purchase also depends on the user. Some people such as Steve spend days or weeks thinking about and researching appliances to buy, whereas some people make impulse buys at the store, or in Eve and Mike's case, an appliance breaks down and they immediately have to replace it.

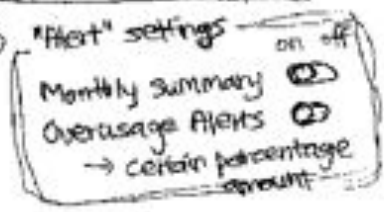
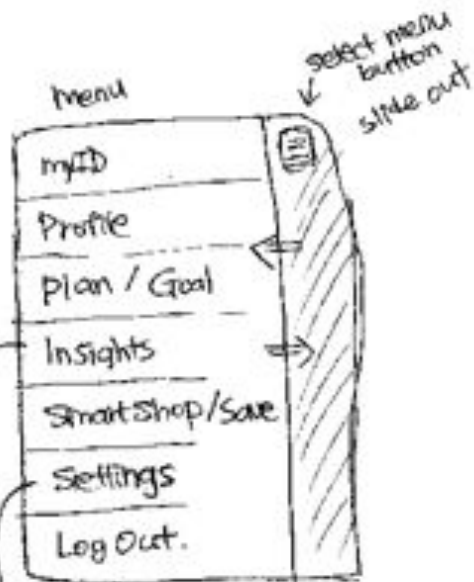
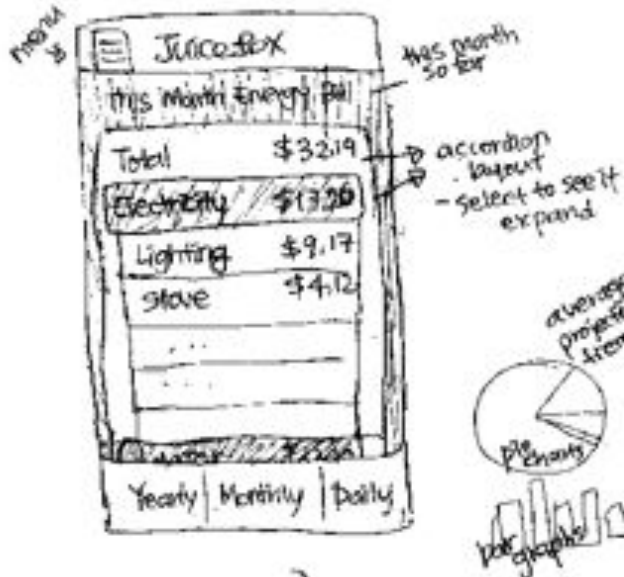
What happens when things go wrong?

When there's a leak, usually people have to call a plumber, or when an appliance breaks down, people like Eve and Mike have to go to the store and buy a replacement. For leaks and important appliances, people usually try to fix those problems as soon as they can. If people somehow don't get an energy bill, their only real backup plan to measure their energy usage is to manually record their water and electric meter readings.

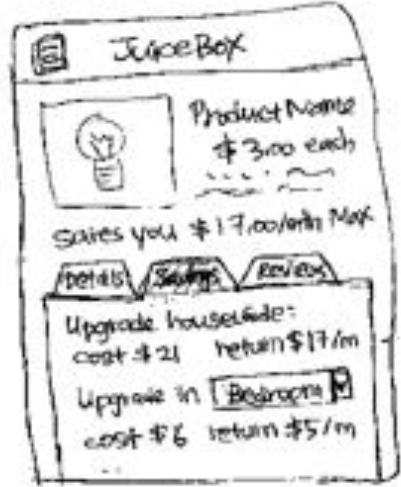
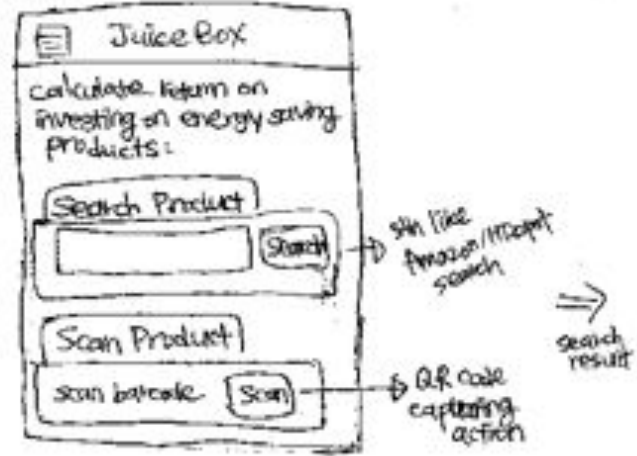
Storyboards



Design # 2 Power user!
 detail oriented
 motivated to save graphs



Save (smartshop)

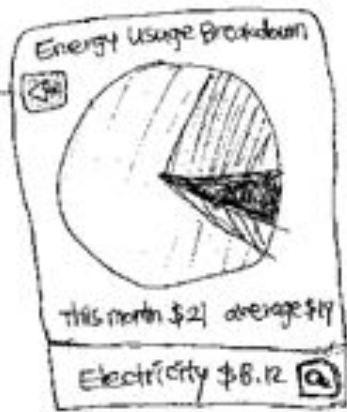


Design #3

task oriented



back button



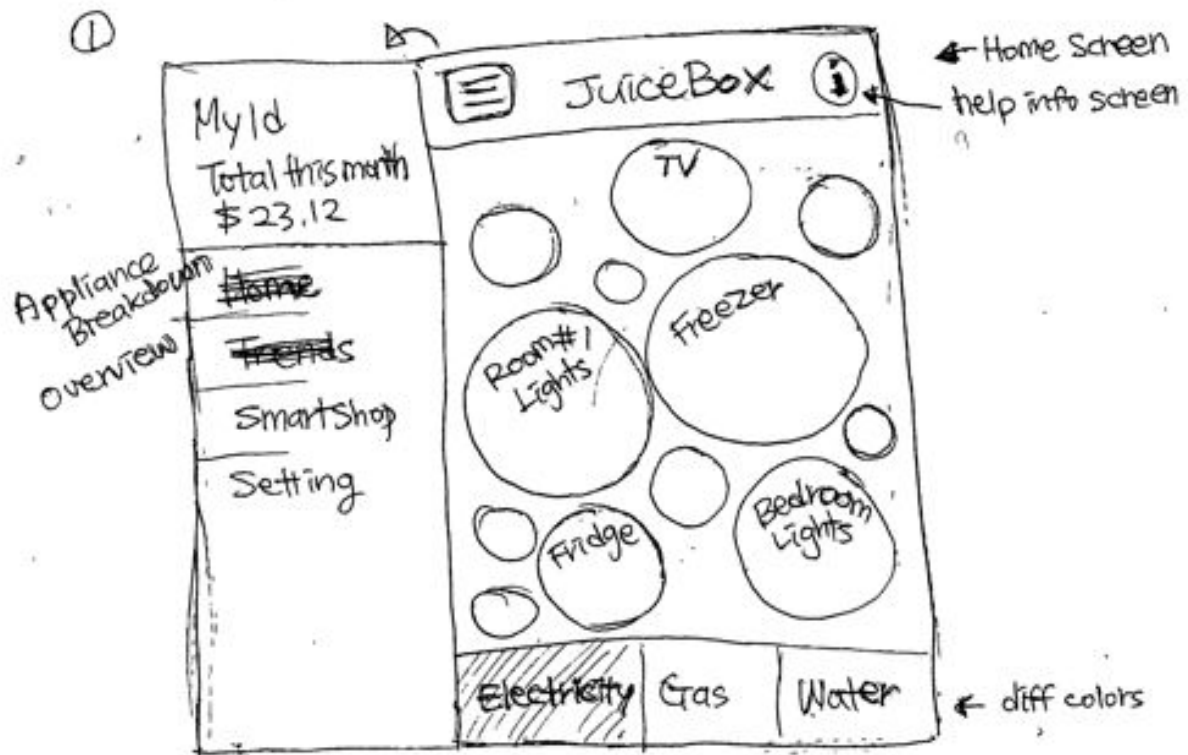
selecting on pie piece displays information on that piece

here

magnifying to see more details to another pie chart




Design of Selected Interface



②



pie
"trends" 

3



main Trends screen is (default) Monthly & total.

diff. colors.

select tab to see line graph overlay over the total graph



JuiceBox



shop to save

We recommend



Greengreen bulb
saves you \$ 7.12/mth

Details

Search Product




Scan Product

scan barcode

Go

5.

 Juice Box
Account
Edit Account >
Edit Appliances >
Notifications >
Sign out >
Help
About >
FAQs >
Feedback >

We combined concepts from two of our initial sketches into a fourth design that we chose to move forward with. Designs 1 and 3 appealed to us more than design 2 because of their visual layouts. Design 2 was task-oriented and had an appropriately bland menu structure to match. Design 1 was intended to be very visual and easy to understand, while design 3 tried to show the user as much information as possible. In the end we decided that each one was missing out on strengths of the other and moved towards an interface that conveyed a lot of information but in a visual way.

Our chosen design allows users to see detailed information about their utility use in real time, analyze their utility use retrospectively, search for products that reduce their energy bills, scan products found in-store to see detailed information on how they would affect their bills, and set up email or text alerts for unusual utility use. The major feature that does not appear in full in this design compared to others is a product recommendation system. A light version of the feature appears under the product search and scan page for the sake of monetization potential but the detailed recommendations page was removed for the sake of simplicity; having three independent ways to interpret new appliances may have overwhelmed new users.

Every screen has a menu button that looks and behaves like the standardized Android menu button. This could be adapted for other mobile devices. The idea here is to use symbolic recognition of a well-known usage pattern to make learning the interface easier. Most Android apps use this menu representation so users are very familiar with it already, requiring no new knowledge. Having the menu button present on every screen also prevents users from getting deep into the interface hierarchy and having to retreat all the way back out to access other features. The options on the menu bar represent all the major functions of the application.

Selecting Appliance Breakdown from the menu pane takes the user to screen one and is listed first to put emphasis on what we see as the most visually appealing and unique screen of the interface. This is the screen users will see first whenever they open the app. It features “bubble clouds” similar to the popular word cloud visualization technique. Each appliance in the user’s home is represented by a labeled circle whose area is proportional to that appliance’s utility use so far in the current month. Three tabs contain different bubble clouds for electricity, gas, and water usage to avoid arbitrary comparisons between different units. Money is the key focus of the home screen, with the total utility bill so far this month displayed in the top-left corner of the app. Based on contextual research users relate more to costs than other units like kWh and care more about saving money than going green. Putting a dollar amount prominently on the screen directs users to see the relative bubble sizes as monetary comparisons. Clicking on a bubble takes users to a page presenting more detailed information about the appliance, which is an intuitive and guessable interaction.

The appliance information page prominently shows the appliance’s bubble, visually connecting the screen to the one from which the user just came; it reminds the user that they just clicked on a bubble. The reminder makes it easier to think about the hierarchy of the app’s screens and makes it obvious to the user what selecting the back button at the bottom left will do: take them back to the bubble cloud. Selecting Appliance Breakdown from the menu button available on this screen can also return the user to the bubble cloud, but accessing hierarchal screens only from a central menu makes screens seem arbitrarily arranged. Being able to go back to where you just came from makes the hierarchy easier to think about. The appliance information screen also prominently features costs to appeal to the real concerns of users. It elaborates on the size of the bubble by putting a definitive value on its cost so far in

the current month. The cost so far in the current week and the total cost from the previous month are also presented to provide slightly more detailed information. The Details button at the bottom right is not elaborated on but would probably show a use-over-time graph and a pie-chart comparison of this appliance's cost so far to the total utility bill so far.

Selecting Overview from the menu pane takes the user to screen 3, which features a graph with variable granularity showing utility bills over time categorized by resource (electricity, gas, or water). We have concerns that users will expect to be able to see the energy use over time of specific appliances from this screen. In reality users must select an appliance from the Appliance Breakdown screen and select details to get this information. User testing will reveal if this is indeed a problem.

The SmartShop page, screen 4, accessible from the menu pane, allows users to either search online for products by keyword or scan product barcodes. It also advertises a single suggested product, a reduced version of a product suggestion screen present in other designs. Users would search for products to explore and compare many available options online or use the scanning feature in-store when they want to see how a particular item would affect their utility bills. The purpose of the suggested item is to show the users options they might not have thought about that dramatically affect their monthly bills. It also serves to advertise the app's monetization potential. The SmartShop page is simple, and we continue to debate whether it is too simple. For this design we chose not to clutter the space and stick to the core functions of the SmartShop feature.

The final option on the menu opens the Settings page, page 5. This page allows users to tell the app what their current appliances are, sync with the hardware which collects usage data, and set alerts for abnormal utility usage, among more standard tasks like signing in or out and learning more about the app. These options are categorized under settings because they relate to neither information presentation, which the Overview and Appliance Breakdown buttons fall under, nor shopping, which is represented by the SmartShop feature. During user testing we will pay close attention to whether users expect to find these options under Settings. The screen is laid out as a simple list categorized into account options and app help. Arrows on the right side of each button are well-known affordances that indicate to the user that pressing within the rectangle will transition to a screen that details the selected option. List titles lack that affordance and differ in color from the selectable options to visually indicate that they are not interactive.

Scenarios

**These scenarios assume that the user has already installed the appropriate sensors in order to collect the data needed to run the application*

Catalina is a junior undergrad at the University of Washington's College of the Environment, and lately she's been really interested in ways to reduce her carbon footprint. She lives by herself in a Wallingford apartment, and wants to figure out what most of her electricity usage goes towards, empowering her to take steps towards becoming meaningfully greener.

In order to see how her energy bill is broken up, she opens up the JuiceBox application, where she's greeted by the main screen, which shows her different bubbles of different sizes that indicate the relative energy breakdown. She can switch tabs to switch between looking at heating, water, and electricity usage. When she clicks on individual bubbles, she is shown more specific data about how much she has spent in the last month on different areas. If she slides open the menu and selects

"Trends", she can see her energy usage broken up into different pie charts and graphs where she can more specifically see how individual appliances or groups of appliances' energy usage has changed over time.

Sunil is a single father to twins Kumar and Sruthi, aged 11, and works as a biology teacher at a local middle school. The family lives in a spacious split-level house that is an hour's drive from Sunil's job. The twins are both rambunctious and forgetful, and Sunil is often worried that they will play with some appliance and cause damage. This worry is not unfounded, as he remembers getting a water bill once that was at least twice what he usually pays, and after searching high and low discovered that his children had played with the hose in the backyard near the start of the 2-month billing period, but had forgotten to shut it off. The water, aside from being quite expensive, also caused some structural damage to his house, and Sunil is not eager to repeat the experience or have another one like it.

In order to catch any abnormal behavior or leaks, Sunil opens up the JuiceBox application and goes to the menu, selects the Settings tab, and then can opt in for different kinds of alerts. He can receive a monthly summary about his energy usage, and text or email alerts if he wants to know when leaks are detected in specific appliances or systems, or if specific appliances are using an abnormally high amount of energy. With these alerts, Sunil will be able to catch and prevent any leaks or problems before they become more costly than they have to be.

Later that month, Kumar and Sruthi forgot to shut off the sink all the way after they washed their hands, and after about 10 minutes, Sunil received a text alert saying that the faucet was dripping. He then made sure to shut it off. That specific incident wouldn't have been that big of a deal, but Sunil appreciated the peace of mind in not having to worry about things like that since JuiceBox was on top of things.

Aisha is 43 years old and lives by herself in a small villa in Bel Air. In the past year, she has received many flyers from the LA Department of Water and Power encouraging her to switch to energy-efficient light bulbs such as CFLs and LEDs. She wants to switch to the cheaper of the two options, since her house has so many light sources. Aisha knows that while LEDs cost more, they also last longer and use less power than CFLs, so she isn't quite sure which choice is the better one, fiscally speaking.

Aisha goes to her local Home Depot and walks over to the light bulb section. She opens up the JuiceBox application, goes to the "SmartShop" tab in the menu, and then scans the barcode of a couple LEDs and CFLs. She is then able to see that the longer lifespan of the LEDs make up for the extra cost in the living room and a couple other more highly trafficked areas, and that CFLs are still the better option for the majority of her lights. She also sees that even though a couple of her incandescent light bulbs are still working, that it will save her \$7.00 a year to switch immediately to CFLs, so she decided to buy a couple LEDs and CFLs to install immediately when she gets home.