Idyll Energy Solutions

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The Problem

The problem our project addresses is the issue of energy loss due to idle power consumption. Idle power is defined as the power consumed by an electronic device when it is plugged in but not in use. Although the Green-Movement is picking up momentum, little attention has been placed on the mindless waste associated with idle energy consumption. However, it is our belief that every step taken to reduce energy consumption, especially when it serves no useful purpose, is a good step. That is why we designed the Switch Strip.

Though the issue of idle power is not widely known, its effects on the environment are significant. According to the Environmental Protection Agency and Energy Star, the average U.S. household spends $100 per year to power devices while they are off (or in standby mode). Nationally, standby power accounts for more than $10 billion in annual energy costs. The financial aspect of the problem alone is enough to demonstrate the need for a reduction in the energy waste. However, the environmental aspect is of even more concern. The US wastes 68 billion kilowatt-hours on standby power annually; all of this wasted energy sends more than 97 billion pounds of carbon dioxide into the atmosphere. To give an idea of scale, the carbon emissions from standby power in the United States accounts for one percent of the carbon emissions for the entire world. As you can see, the scale of the problem is substantial. It affects every individual, at the pocketbook level, and the entire globe environmentally.

The problem has a simple solution. Unplug devices when they are not in use and you will drastically reduce idle power. However, this is an example where knowing the solution only addresses half the problem. For most people, the only time they will ever hear about idle power is when someone warns them to unplug appliances to reduce “energy vampires” in their home. An environmentally conscious person might go about doing this for a few days after learning this information. However, it is a time consuming task to unplug and replug in a device every time you interact with it. The only realistic solution to the problem of idle power is a device that does this automatically for the user.

Vampire power is not a new threat to both the power grid and consumer’s wallets. Small companies have proposed modest solutions to the problem. All these solutions begin to address the issue, but fail to package a complete and attractive solution to the average consumer. The inexpensive solution by Smart Strip is a surge protector with a control outlet. When the device in the control outlet turns off, the power to the dependent outlets cease. Four other companies use sensors instead of a control outlet to cut off the flow of power. iGo proposed a surge protector that sensed when a device entered standby mode or turned off and then cut the power. The iGo Power Smart checks the devices every 30 minutes to determine whether or not to restore power. Alternatively, the user can press a button and instantly restore power. Bye Bye Standby’s power strip is controlled via a remote control wherefrom the user can cut off and restore power manually. HiSaver and Isole both use motion sensors to determine when to allow and when to withhold power from devices. All these power strip solutions begin to address part of the problem, but fail to adequately propose a neat solution.

In order to defeat vampire power, the solution must be simple, effective, and hassle free. Smart Strip continually allows power to the control port, which is usually the largest consumer of vampire power. For instance, in a home entertainment system, the TV usually will be the control device. iGo

requires user input in order to turn a device on or else you will have to catch it when it powers on in thirty minutes. Bye Bye standby requires an additional remote. Lastly, HiSaver and Isole both rely on unintelligent motion sensing that cannot tell the difference between an unoccupied room with the TV left on or a movie night with a family of couch potatoes. Any efforts to incite the masses to mobilize against vampire power must combine the elements of these solutions; together these solutions are effective, but separate they fall short.

The Solution

The solution to the problem is our idle power elimination system, called Switch Strip. Our automated power strip is unique and unlike any other power strip on the market. The solution we have come up with is a power strip with eight outlets, five of which are controlled and three that are uncontrolled. The three uncontrolled outlets will be normal outlets that are always connected. The five controlled outlets will be turned on and off automatically, as needed.

To determine when an appliance should be turned on or off, we look at load occupancy for each individual appliance (that is, if the appliance is being used or in active mode) and room occupancy (that is, if there is anyone in the room to use the appliance). The idea behind our algorithm is that if there is no load or room occupancy, then there is no need for an appliance to be draining power. Our design will physically disconnect individual appliances from power if they are not needed and a set amount of time has passed. To determine room occupancy, we use an infrared sensor to detect motion. Detecting load occupancy is somewhat complicated, and this feature sets our design apart: each individual appliance will have a power threshold programmed in. When the current power state of the appliance is greater than that threshold, that appliance is in active mode. If the power is less than the set threshold, the appliance is in standby or idle mode.

Each individual appliance will have its own power detection circuit, programmed power threshold, and timer to allow it to be turned on or off independently. Power is a function of current and voltage but because we are using wall power (120VAC, 60Hz), the voltage will remain relatively constant. Therefore, the power we are measuring becomes dependent on the change in current. To detect power, we look at each appliance's return or neutral path. We measure the current here using the Hall Effect, allowing for us to determine the power levels continuously without breaking the circuit. The thought behind this aspect of our design is that the current on the return path will be the same as the current on the hotline path but at a much lower voltage. This allows us to measure power without consuming more power than the appliance would be using under normal operation. Thus, each appliance has its own circuit that gets a signal from the Hall Effect device, which is then amplified, rectified, and sent to the microcontroller. The microcontroller receives this data and interprets it to determine if the appliance is in active or standby mode. In short, whenever the microcontroller chooses, it can look at the power being consumed by any of the five appliances.

To program each appliance's power threshold, the microcontroller needs to know the power levels associated with active and standby modes. The user will plug their appliance into one of the controlled outlets, hit the programming button for the appliance once (to set the standby mode), turn the appliance on and hit the programming button again (to set the active mode). The microcontroller keeps these settings permanently stored in memory unless the user chooses to reprogram the strip for a

different appliance to be used on that outlet. Once the threshold settings are initialized, the user will never need to consciously interact with the Switch Strip again – the appliance will turn itself on when someone is in the room and keep the appliance on when in use and the appliance will unplug itself when it has been in idle mode for a set amount of time with no one in the room.

Each appliance will have its own timer that will be counted down when there is no load and no room occupancy. The duration of the timer is variable, and the user may change it simply by turning a dial. All timers will be set to the user-defined value but each timer will count down individually. This is what allows for individual appliances to be shut off independently of the load on other devices. The thought behind this is that unlike automatic lights that shut off when there is no movement, our device will disconnect appliances when there is no movement and the appliance is not being used. This means that if the user is watching a movie our power strip will not disconnect the TV and DVD player even if there is no motion detected, or if a consumer is listening to a stereo from a different room. All other controlled appliances plugged into the power strip will disconnect after the set amount of time but the stereo will stay on.

Our solution to the problem of idle power waste is very practical and efficient. The largest area of idle power consumption in the average household is from computers and entertainment centers. Unlike other similar products, our device will consume very little power (less than one watt). Entertainment centers can easily consume up to 60 watts in standby mode. Using our product, the user could reduce that idle power from 60 watts down to 1! The best part about this design is that it will save the consumer substantial money over time. It can easily pay for itself in a few years and then it will effectively be putting money back into the consumer's pocket. This seems to us to be a very practical solution.

For our demonstration, we will be proving our ability to switch an appliance on and off using our prototype board. To do this we will have a television plugged into our board which will then be plugged into the wall through a Kill-a-Watt device. The Kill-a-Watt will show the instantaneous power consumption of the appliance. We will start by turning the television on, demonstrating the power sensing ability of our circuit. We will show that even if there is no motion (the sensor is covered), the TV will remain powered as long as it is in active mode. This will simulate the user sitting still on the couch watching television. We will then turn the television off and cover the motion sensor simulating that the user has turned off the television and left the room. We will show that there is still idle power being drawn by the television, even in standby mode, by showing the power being consumed on the Kill-a-Watt device. After a short period of time, our device will cut power completely to the appliance. This will be demonstrated by a corresponding drop in power consumption, shown with the Kill-a-Watt device. Finally, we will remove the cover on the motion sensor, simulating the user walking back into the room, and show that the television has returned to standby mode by a corresponding increase in power consumption. We will then return the television to full power, thus completing our proof of concept. In addition to the proof of basic functionality, we will also have sketches and models available of what our product will look like in its production ready state.

The Market

We believe that we can successfully enter the energy efficient market because of our unique, innovative design. As delineated earlier, the Switch Strip's configuration sets it apart from the existing competition. In sum, the Switch Strip: allows consistent power to the control port, uses intelligent

motion sensing capacity, automates powering on and off of individual devices, permits users to personalize timer settings, eliminates the need for active interaction by user, and only consumes 1 watt of power. These features outshine the current market offerings and position Switch Strip to be industry leader.

As it stands, our aim is to price the Switch Strip in a way which would allow it to pay for itself within the first year. Current statistics show that the average household spends at least one hundred dollars a year to power devices in standby mode. This may sound like a small figure, but if you add that up over the years, the average American will spend thousands of dollars on powering energy vampires throughout his or her lifetime. Either way you slice it – several exotic vacations or investment potential – the opportunity costs alone make idle power an obvious waste of money. By pricing the Switch Strip at fifty dollars or below, customers will re-gain their initial investment within the first six to nine months, as well as save on their energy bills for years to come.

Although customers are clear benefactors of the Switch Strip, we also hope to work with large utility companies. Such a partnership would endorse our product and further establish our niche within the industry. California is a prime example of a forerunner in energy-conservative practices. Due to their energy crisis, the California Energy Commission has begun setting standards on the acceptable energy usage of new television sets. This decision took place after studies revealed that more energy efficient televisions would save enough power to supply 864,000 single families. This example illustrates why the Switch Strip would be enticing to utility providers – who are facing a depleting energy supply – and consumers - who are required to cut back on energy consumption but do not want to sacrifice their flat screen TV in the process.

Working with home consulting firms, such as energysavvy.com, will help raise awareness about Switch Strip's attributes and aid us in gaining credible support. As the Green Trend has continued to expand, and the energy supply fails to replenish itself, an increasing number of customers will be relying on web-based information, energy star recommendations, and "green" labeled products to do their share. Not only will the "green" consumer desire this information, but also the cost-conscious customer once power prices continue to rise as a result of low supply. This is where strategic alliances with reputable consultants will be an important element in our success.

A future goal is to have our Switch Strip bundled with TV companies and other electronic makers. Several ways to package this to the consumer would be to bundle it directly into the TV package, or offer a discount on TV's grouped with the Switch Strip. This would ensure seamless adoption by TV purchasers and assist in establishing the Switch Strip as a household fixture.

Over the course of the last couple of months, Idyll Energy Solutions has spent tremendous amounts of time compiling a market research survey that will help us understand the consumer behavior of our ideal customer and our sales forecasting. This fifty-seven question survey includes: complex pricing models, branding, existing consumer awareness of idle power consumption, basic demographics, purchasing tendencies associated with electronic goods, and product messaging. To help create this survey, we informally consulted with Executive Vice President of GfK Global Custom Research, Jake Sedlock. Through these meeting, different marketing strategies and research methods were examined.

The Impact

Our potential for impact is large and multidimensional. First off, we are aiming to tackle the mindless 97 billion pound output of carbon dioxide annually. In our first year of sales, we aim to reduce carbon dioxide waste by 855 lbs., spanning to more than 20,000lbs reduction a year by our fifth year of sales and growth. Our impact wouldn't stop there. For each unit sold, a percentage would be donated towards sustainable energy development. In addition to saving energy, the consumer would also receive money saving benefits, allowing them to save more money for the things that they care about. The goal of Idyll Energy Solutions isn't based upon creating products that help save energy, but also to shift consumer mentality, both nationwide and globally, towards better environmental stewardship.

In addition to helping contribute the green movement and idle energy consumption reduction, our plan has another benefiting group. Because warehousing and distribution is such a capital intensive process, we have decided to outsource that to Pioneer Human Services in Seattle, WA. Pioneer Human Resources (PHS) is a non-profit company that manufactures products, packages, distributes, and catering services and improves the lives of those who have high barriers to employment by providing them with a job, housing, counseling, and treatment for their needs. By outsourcing this need to PHS, we are benefiting his legally discriminated group.

The Team

Idyll Energy Solutions has assembled a high-caliber team with a broad range of competencies in order to combat vampire power. The team consists of six senior students with majors covering Electrical Engineering, Business Administration, Business Finance, Economics, and Philosophy. All have previous work experience with companies ranging from startups to large international companies including Microsoft and Merrill Lynch.

Mark Cotton recently worked for Seattle City Light doing distribution engineering work where he managed and designed large-scale conversion projects, each ranging in cost from $56,000 to $130,000. From this experience, he witnessed the effects of standby power on the power grid and set out to solve the problem. He and Kathryn Imler, both electrical engineering students, embarked on designing an idle power elimination system that has since been presented at the Erickson Research Conference 2009 and received one of ten national grants from the American Public Power Association's Demonstration of Energy-Efficient Developments Program.

Mark partnered with a team of business majors with the business acumen to deliver the product to the masses. Allen Klein, Kevin McFarland, Jamie Durbin, and Winslow Moran-Hodge bring academic success and extensive experience. Between these students, they have started up an award-winning environmentally conscious ecommerce business, received multiple awards and a grand prize in business plan competitions, and bring extensive marketing experience. Also, all have received numerous academic and leadership scholarships. Through this partnership, Idyll is focusing on tailoring the product to meet the consumer's needs and expectations at an affordable price point.

The technical experience of the engineering students drives the product innovation of Idyll Energy Solutions. Mark Cotton started his college career at age 16 where he graduated from Green River Community College, receiving highest honors in his Associate in Arts degree before transferring to Seattle Pacific University. At SPU he received the Deffenbaugh Electrical Engineering Scholarship and Lee Engineering Scholarship along with making the Dean's List every quarter. Both he and Kathryn have received the Trustees' Scholar Award for four years. Further, Kathryn was published in a paper resulting from her work on projects for NATO and the Department of Defense with the Pacific Science and Engineering Group in San Diego. Together, Mark and Kathryn bring a background capable of powering Idyll Energy Solutions.

The Idyll Energy Solutions team combines electrical engineering know-how and business experience to create a consumer appealing product. A strong board of advisors and mentors empowers this team to build its solution. As part of the American Public Power grant, Seattle City Light is sponsoring Idyll Energy Solutions and Javad Maadanian, Senior Energy Management Engineer and Supervisor of the Conservation Resources Division, is advising the team in developing the device. Also advising the team, Dean A. Klein, Vice President at Micron Technology, Inc holds 190 patents in computer architecture and electrical engineering. Dean was formerly the Executive Vice President of Product Development at Micron Electronics, Inc. At SPU, the product design work is guided and advised by Professor Kevin Bolding. Professor Bolding is the department Chair of Electrical Engineering at SPU and holds a Ph.D. in Computer Science and Engineering from the University of Washington and 15 years of experience as a professor. Further, Idyll Energy Solutions is receiving marketing advice from Jake Sedlock, Executive Vice President and Global Key Account Manager at GfK Group, one of the largest market research companies; legal advice from Brian Howe, founder and principal attorney at VoxLegal, which specializes in early stage startups; business advice from Alex "Sandy" Gibb, Senior Vice President of Pioneer Human Services, a conglomerate of ten social enterprises including assembly and packaging operations. With strong community, business, and academic experts behind them, Idyll Energy Solutions is positioned to deliver a striking blow against vampire power.