

## APPLICATION ID #9088 (Grade Band 6-8)

### Step 1: Choose It!

#### TASK

Which environmental topic did your team select? How does this topic affect your local community? Explain how this topic is important or meaningful to your team.

Limit your response to 250 words.

#### TEAM RESPONSE:

The focus of our project is to reduce phantom load in our community. **Phantom load** is the energy wasted when an electronic device is in standby mode, or "off", but still plugged into the outlet and consuming power. Although phantom load may seem insubstantial, it can add up to approximately **10% of household power consumption**.

When it comes to saving energy and reducing resource consumption, everyone knows about turning appliances off when not using them. But phantom load, or **standby power**, is hidden. Few people know that even when the TV is "off," it still draws power as it waits to receive the signal of the remote to turn it back on. The same is true for many other **vampire electronics**, as devices with phantom load are called.

The number of electronic devices in every household is growing exponentially. In addition, manufacturers are offering products with advanced features such as remote control, wireless connectivity, chargers and digital clocks, which consume more phantom load. Clearly, this is a rapidly growing problem, and it needs to be addressed. Therefore, we have decided to work on reducing the amount of phantom load in homes as well as schools. We will be working to educate our school and community about this subtle yet significant energy drain as well as urge our community leaders to institute policies that can reduce phantom load.

#### CITATION:

[http://www.economist.com/node/5571582?story\\_id=5571582](http://www.economist.com/node/5571582?story_id=5571582)

[http://www.energystar.gov/index.cfm?c=products.pr\\_save\\_energy\\_at\\_home](http://www.energystar.gov/index.cfm?c=products.pr_save_energy_at_home)

### Step 2: Research It!

#### TASK

Describe the inquiry-based research your team did to identify the focus of your project. Include below a clearly defined problem statement that defines the issue and shows evidence of how it is a problem in your community. The problem statement should be developed using both personal observations and collected data. Be sure to include citations for researched data.

Limit your response to 800 words.

#### TEAM RESPONSE:

Before launching our project and starting to raise awareness, we needed to better inform ourselves about phantom load and gather data that demonstrated that phantom load is a growing problem that needs to be addressed.

The **US Department of Energy** website (<http://www.energy.gov/energyefficiency/index.htm>) and **Energy Star** website (<http://www.energystar.gov/>) gave us lots of background information about phantom load. Another extremely informative article was the IEA's publication, *Things That Go Blip in The Night: Standby Power and How to Limit it*. This article contains information about what phantom load is, why it exists in household devices, technical solutions for reducing phantom load, and what policies had been issued to stop phantom load at the time of this article's publication (2001).

We found that, on average, phantom load costs about \$100 per household annually. A study, conducted in 2000 by Dr. Alan Meier from the Lawrence Berkeley National Laboratory (LBNL) in Berkeley, California, showed that phantom load contributed to around 10% of total household power consumption in the United States. This is equivalent to the energy output of 18 power stations! In France, phantom load is 7% of total power consumption. Other countries that have conducted these studies have found even higher numbers, some reaching around 13%. Phantom load adds up to around 1% of the world's total CO2 emissions. To help put this number in perspective, less than 3% of our total greenhouse gas emissions come from air travel, which is an obvious resource consumer. So phantom load is a huge energy drainer that cannot be ignored!

Though this certainly showed how substantial and urgent a problem phantom load is globally, we wanted to gather data on the amount of

phantom load in our households and schools. We did this by measuring the phantom load of various devices in our homes using a **Kill-A-Watt**. The Kill-A-Watt was plugged into the outlet, and then the device was plugged into the Kill-A-Watt. The Kill-A-Watt showed how many watts the device was consuming, which we could easily use to determine how much energy the device used when turned off. We learned that between the 3 households of our team members, we consumed **1.1 kWh** of phantom load per day!

In addition, we performed an inventory of electronic devices at our Middle School (R.J. Grey Junior High School). Results showed that **3.43 kWh** of phantom load were consumed at our school per day.

With the newfound information about phantom load consumption in our own households and schools, we wanted to understand why phantom load exists in the first place. Many devices, such as game consoles and TVs, have remote control capabilities. Devices stay in standby mode and wait for the signal of the remote, thereby consuming energy and causing phantom load. Also, devices with lights and digital clock displays that are on even while not in use, have phantom load because they need energy 24/7 to power lights and clocks. The same applies to appliances like microwaves, ovens, and iHomes.

We also researched what has already been done, in the US and in other countries, to reduce phantom load. In 1999, the **International Energy Association (IEA)** proposed a plan, called the **One-Watt Initiative**. The plan was to urge countries to reduce phantom load in devices to 1 watt by 2010. As of 2007, Australia, New Zealand, Canada, the European Union, Japan, Korea, the US, and China have taken steps to reduce phantom load. One country that has shown outstanding progress in reducing phantom load is South Korea. In South Korea, all appliances are forced to have a phantom load of 1 Watt or less. If a device fails to comply with this measure, the manufacturer must put a warning label on it stating that the device does not meet energy efficiency requirements, as well as pay a fine of up to \$5,000 per model that has over one watt phantom load. Australia has implemented a similar plan to reduce phantom load.

In the United States, President George Bush issued an **Executive Order** in 2001 which states that every government agency purchase devices that use no more than one watt in standby mode. Also, in July 2007, appliance standards that California had set in 2005 finally came into effect, limiting phantom load to 0.5 watts for certain devices. However, the state of Massachusetts has not taken any significant measure to reduce phantom load. We wish to change this by either setting standby power standards for devices in Massachusetts, or by making sure that each device in the market has a **conspicuous label** on it that states how much standby power it consumes. Along with awareness-raising campaigns, requiring products to include this label would help consumers make the right choice about which electronics they purchase. This would also spur competition amongst manufacturers as they strive to make their devices "greener" than the rest. With these measures in place, the amount of phantom load in devices will become an important selling point in products, which will reduce standby power considerably.

## CITATION:

US Department of Energy

<http://www.energy.gov/energyefficiency/index.htm>

Energy Star USA

<http://www.energystar.gov/>

IEA (International Energy Agency)

<http://www.iea.org/>

Standby Power - Lawrence Berkeley National Laboratory

<http://www.standby.lbl.gov/standby.html>

South Korea Program

<http://www.energyrating.gov.au/pubs/2010-loadaddown-ed7.pdf>

## Step 3: Plan It!

### TASK

Share your team's action plan, including project steps, timeline for completion, necessary resources, and how your team planned to measure whether your potential solution is working to impact or fix the problem. Tell how all members contributed, and share any necessary modifications to the plan that were made along the way.

Limit your response to 450 words.

### TEAM RESPONSE:

We came up with the following action plan:

- Determine phantom load consumption in households and schools (Sep 2010 - Oct 2010)
- Raise awareness of phantom load and its solution in our community (Oct 2010 – March 2010)
- Propose phantom load reduction ideas to our community leaders (Dec 2010 – March 2010)

We plan to conduct door-to-door surveys and create an online survey to gather data about phantom load consumption in our community. Our goal is to survey at least 100 households. We also plan to include a pledge to reduce phantom load. This will help us calculate phantom load in our community and build awareness at the same time.

We plan to meet with the school district's facility manager to discuss how phantom load can be reduced in schools. We plan to participate in our school's Climate Club activities to address this environmental issue within our school. Finally, to reach out to the school community about Phantom load reduction, we plan to read morning announcements and post blurbs in our school's email newsletter.

We setup a Google group for team communication ([acton-see-team@googlegroups.com](mailto:acton-see-team@googlegroups.com)) and our team had weekly meetings to share notes and findings, review our plan, and document progress.

We plan to educate the community about how reducing phantom load in our homes will reduce our carbon footprint. We plan to create a poster board of interesting facts about phantom load which we will display at public events and meetings. We will distribute brochures and paper surveys to people to raise awareness about phantom load. We also plan to send out a follow-up survey to evaluate the effectiveness of our awareness campaign. We will create a video to educate people on phantom load and to raise awareness over the Internet. In addition, we plan to create a website and a Facebook page.

Another measure to increase community awareness of Phantom load will be to publish articles about our project in the local newspapers.

The awareness campaign measures will continue throughout the duration of our project and beyond. We plan to check the effectiveness of our awareness campaign at the end of February. The success of the awareness campaign will be evaluated by:

1. Number of completed surveys
2. Number of people who reduced phantom load in their homes
3. Number of signed pledges

We plan to attend public events like the Harvest Energy Fair, Special Town meeting, and Acton's Diwali celebration to educate, generate, and exchange energy conservation ideas with our community.

We plan to present our ideas to various organizations such as Green Acton, the Acton Board of Selectmen, and Massachusetts State Senator Jamie Eldridge and take their help in spreading the word and making policy changes to reduce phantom load in Massachusetts.

## **CITATION:**

## **Step 4: Do It!**

### **TASK**

Share how your team went about collecting data, keeping thorough and accurate records, testing their ideas and hypotheses and making systematic observations about whether or not their solution is working. Share descriptions of any written notes, data tables, sketches, photographs or video captured during the data collection step.

Limit your response to 650 words.

### **TEAM RESPONSE:**

Armed with a Kill-A-Watt, each of us headed towards the wall sockets of our homes to tackle the energy-sucking vampires. We recorded the wattage of all the devices we could find. The numbers we found were surprisingly high, like the 23W wasting cable box and the computer Router/Modem, which silently drains about 78W.

After recording the data, we conducted door-to-door surveys. We explained what phantom load is, how it is a problem, and that they can reduce it by simply unplugging vampire electronics. In a few survey visits, we gave live demonstrations of phantom load using the Kill-A-Watt. Along with the survey, we asked everyone to pledge to reduce phantom load. We also sent an online version of the survey to friends (<http://sites.google.com/site/phantomloadfighters/phantom-load-survey>). We took 110 surveys in total, achieving our goal of 100 household surveys.

Using the information from the survey, and the measurements we took with the Kill-A-Watt, we calculated the average savings in kilowatt hours if phantom load was eliminated in households:

**(average phantom load of households\*hours in standby mode\*days)/1000**

**(110W \*10 hrs/day\*365 days)/1000 =400kWh**

We assumed each device was in standby mode for 10 hours daily.

To determine the average CO<sub>2</sub> emissions from phantom load:

**400 kWh \* 1.29 lbs of CO<sub>2</sub> per kWh = 516 CO<sub>2</sub> emissions from phantom load**

To raise awareness of phantom load, we attended public events and set up a booth to talk about phantom load. Events included the Harvest Energy Fair, a special town meeting, and Acton's Diwali celebration. In our booths, we conducted live demos of Phantom load using Kill-A-Watt on devices such as Wii console and DVR. Through these events, we educated and distributed brochures about phantom load to over 100 people.

We also made a short, entertaining video about phantom load. The video explains what phantom load is and how to prevent it. We posted this on Youtube and shared with friends and family. We created a website and also a Facebook page to raise awareness over the internet. Through these, we educated more people than we could in surveys, informing well over 100 people about phantom load.

We worked on ways to reduce phantom load in schools. In November, we met with our school district's facilities manager JD Head and his assistant Kate Crosby to talk about extending our project to the schools. In November and December, we worked with Mrs. Crosby to take an inventory of vampire electronics in our school. We approached the IT department of RJ Grey to determine if we could change the screen saver settings on computers so that the monitors power down quickly.

We've been working with our school's Climate Club to launch the "Power Down" program. The program involves placing a door knob hanger at each door. Once the devices in the room are powered down, the hanger is flipped to say "I am powered down". We will launch the "Power Down" program in conjunction with the National Green Week (week of April 11<sup>th</sup>).

We also met with our principal, who gave us permission to talk about phantom load in the daily announcements, and use the school's mailing list to reach out to the parents of our school community.

We presented to Green Acton, an organization that strives to make Acton greener, the EPA, and the Board of Selectmen at one of their televised meetings. After hearing about our project, everyone agreed to help spread the word about phantom load.

Raising awareness was only part of our efforts to reduce phantom load. On February 4th, we met with state senator Jamie Eldridge. After listening to our presentation, Senator Eldridge agreed to file a bill stating that all devices need to have a conspicuous label stating the amount of phantom load it consumes. On February 28th, we received communication from Senator Eldridge's office that the bill had been filed and that we would be called to testify before the legislative committee. This was a major breakthrough for us in our fight against phantom load.

## **CITATION:**

Formula for calculating carbon footprint

[http://www.carbonfund.org/site/pages/carbon\\_calculators/category/Assumptions](http://www.carbonfund.org/site/pages/carbon_calculators/category/Assumptions)

## **Step 5: Analyze It!**

### **TASK**

How did it go? What did your team's testing reveal? Did your solution impact the problem it identified? Share what made your plan work (if appropriate); any challenges met along the way; how you overcame those challenges; and what adjustments were necessary. Would your team have done things differently if given the opportunity? If testing is still ongoing, share any results gathered so far.

Limit your response to 400 words.

### **TEAM RESPONSE:**

When we first began collecting data, our goal was to survey 100 households. Through online and door-to-door to surveys, we collected 110 surveys, thereby achieving our goal. Many people asked us questions through the surveys, which showed their interest in reducing their electricity bill and carbon footprint.

We found that the main cause of phantom load is ignorance. Only 5% of those surveyed knew about phantom load before we talked to them, and no one knew that phantom load had a substantial contribution to energy wastage.

Our first booth at Harvest Energy Fair was a great success. Teachers and community leaders stopped by our booth. They were impressed by our efforts. We found that events focused on making the community greener attracted more people than general public events. Also, attending events was more effective than door-to-door surveys.

Taking an inventory of vampire electronics at our school revealed how much energy is wasted. We wanted to determine if the screen saver settings on computers could be changed so that the monitors power down quickly. We learned that this wasn't a quick fix, and we are still working with IT to solve this problem.

We discussed the launching of the "Power Down" program at our school with Mrs. Crosby. She had carried out this plan in the high school and met with great success. Electricity use over vacation in December dropped 10% from last year! We are now working to launch the "Power Down" program in conjunction with the National Green Week and hope to achieve similarly enthusiastic results.

Behavioral change is difficult to measure. Conducting a follow-up survey was unsuccessful because we did not receive responses. Though we don't know how many people reduced phantom load in their homes, we calculated that **if just 50% of those surveyed eliminate phantom load, 30,000 kWh of energy would be saved!**

Since behavioral change is also difficult to sustain, policy changes will be more effective to ensure phantom load reduction. The bill Senator Eldridge filed has met with success so far. We will testify for the bill in front of the legislative committee when it is scheduled for a hearing.

A few more policy change measures are being worked on. We want to contact Energy Star and ask them to add phantom load as a requirement for devices that strive to earn the Energy Star label. In addition, we would like to explore building code changes as a method to reduce phantom load at the source.

#### **CITATION:**

## **Step 6: Share It!**

### **TASK**

Now it's time to spread the word! Tell us what impact your project had on the local community, and how your team's newfound knowledge can be shared with others who want to make their communities a better place to live. What other kinds of communities might benefit from the team's conclusions? Be sure to explain how much time is recommended to complete the project, and what resources and materials are required.

Limit your response to 450 words.

#### **CITATION:**

### **TEAM RESPONSE:**

The two main themes in our 6-month project were to raise awareness and convince leaders to institute policy changes to reduce phantom load. Throughout our project, we presented our work and findings to several groups in our community. When we shared our project with Green Acton and at the Board of Selectmen's televised meeting, they were impressed and told us they would help spread the word about phantom load in the community. Our meeting with EPA's Cynthia Greene helped us obtain Energy Star contacts to request expansion of the Energy Star label to include phantom load. Finally, our presentation to Senator Jamie Eldridge caused the filing of a bill stating that all devices sold in Massachusetts need to have a conspicuous label of consumed phantom load.

Results from the inventory of electronic devices at the school were an eye-opener. We were able to convince our school's principal to read interesting facts about Phantom load and how it can be reduced through daily morning announcements and blurbs in the school's email newsletter. The National Green Week and the "Power Down" program had never been implemented in our school before. The principal agreed to launch this program during the week of April 11<sup>th</sup>.

We feel that any type of community would benefit from a project like ours, especially in upper middle class communities where the number of vampire electronics is high. Educating people is necessary because so much energy is wasted due to ignorance about phantom load in our community.

If this project is extended to a larger city, we suggest more effort be placed into demonstrations and announcements at public events, where more people are likely to attend. We educated many residents through public events, and if given the chance to redo this project, we would have attended many more events.

We have a few more policy change measures that we will like to see implemented in order to make reducing phantom load more convenient. First, we will see the bill through, and work to make it a law in Massachusetts. Next, we will explore making building code changes so that each room in every new home has at least one switch that connects to an outlet. This will enable phantom load reduction at the source with a flip of a switch, thereby increasing convenience. As convenience increases, more people will be willing to turn off their vampire electronics. Finally, we want to convince Energy Star to add limits on phantom load as part of their criteria for the Energy Star label.

We will continue to work on the project as we march towards our goal to reduce phantom load in Massachusetts and beyond. So stay tuned for more developments!

## Step 7: Attachments

### TASK

- You may include attachments to provide more information.
  - Up to 5 images (.jpg, .gif, or .png) or pdf or ppt
    - [Final PPT2.pdf](#)
  - 1 video - 1 minute or less (Videos will be reviewed for content, not the aesthetic quality of the video (.wmv, .mov, .flv))
    - [Phantom Slayers Video of Events Final V. 2.wmv](#)
  - Website links - up to 5 links
    - <http://sites.google.com/site/phantomloadfighters/home>
    - <http://www.facebook.com/pages/Turning-off-phantom-electronics/125567397495096?ref=ts>
    - <http://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxwaGFudG9tbG9hZGZpZ2h0ZXJzGd4OjEyYjZkN2Q0ODliYTU1YTU>
    - <http://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxwaGFudG9tbG9hZGZpZ2h0ZXJzGd4OjU3OTNiMmM4YmYyOWQ2YjA>
    - <http://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxwaGFudG9tbG9hZGZpZ2h0ZXJzGd4OjM5YTMxNzQyZDE0NzEwZTQ>