2016

Electronic Waste

HP 4675

Electronic waste at the University of Wyoming is an area for improvement. This project is an overview of methods other universities and countries utilize in terms of electronic waste and how we can follow steps to improve our systems at the University of Wyoming.

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Introduction

The issue I wish to address with this research involves the knowledge of electronic waste. "E-waste (also known as electronic waste or e-scrap) is defined as all obsolete or outdated computers, televisions, cell phones, printers, PDAs, and thousands of other devices commonly used in offices, homes, and by people on the go." (Laramie Wyoming, 2016). Millions of consumers dispose of e-waste on a regular basis. In the US, cell phone use has surged from 340,000 subscribers in 1985 to over 215 million in June, 2006 according to cellphonebank.org. The average American cell phone user owns 2 or more cell phones and the average wireless user upgrades their cell phone every 18 months. It is estimated that more than 140 million cell phones are retired each year and over 500 million cell phones are currently stockpiled in US homes. It is estimated that up to 75 percent of obsolete cell phones are stockpiled in drawers by people who don't know what else to do with them (cellphonebank.org, 2016). Some people may take these old used cell phones back to their distributor, while others will throw them away. "Did you know that cell phones, on average, are used for less than 18 months before being replaced? In America alone, more than 140 million cell phones will end up in a landfill this year" (SC Johnson, 2012). There are thousands of chemicals used to construct any type of electronic device. "Cell phones contain toxic materials such as lead, cadmium, nickel, and/or lithium. When placed in a landfill, these toxins will leak out and can contaminate the soil as well as the drinking water. Choosing to recycle cell phones will keep these toxins out of our landfills" (SC Johnson, 2012). These chemicals leak into the ground and are absorbed into the soil which inevitably will result in soil that cannot support living organisms as well as contaminated drinking water for the community.

It takes a cell phone an average of 1,000 years to decompose. "Cell phones are made from several valuable materials, such as gold, silver, and copper, and from several slow-to-

decompose and potentially toxic materials, such as plastic and lead, used in the casing.

According to Earth911.com, plastic casings can take hundreds, if not 1,000 years, to start

breaking down in landfills." (Echannel News, 2016). Because of the duration it takes for a cell

phone to decompose, disposing of e-waste responsibly becomes a huge issue. In society today,

we are slowly becoming more conscious of the Earth and the deterioration we are causing.

However, we are also a technology-driven society.

> "The demand to effectively and safely recycle the obsolete electronics is pushed by the same
>
> demands our society imposes to manufacture the new, smaller, faster, and more efficient
>
> software. For this reason, the environmentally safe disposal of e-waste has rampantly become a
>
> problematic issue over the past decade, and technological advances and legislation on all levels
>
> has vaulted e-waste recycling into an evolving multi-billion dollar a year industry." (Laramie
>
> Wyoming, 2016).

Due to the lack of knowledge of these devices' harmful features, and ways to remedy the

situation, thousands of consumers will dispose of their electronic devices irresponsibly. I will

first discuss the options available in Albany County and what we offer (or do not offer) at the

University of Wyoming. Then I will discuss what other universities and communities are doing

in the surrounding areas and in the U.S. as a whole. Finally I will discuss global options. What

are other countries doing to help reduce the amount of e-waste on Earth? We will be discussing

what Laramie does in order to dispose of e-waste, what other campuses and countries are doing

in terms of proper e-waste disposal, and finally, what we as a campus can do to provide these

services to our students and the steps to implement a process.

Part 1: University of Wyoming and Albany County

To begin, I wanted to look into e-waste in the Laramie community. Specifically, I wanted to see what we offer to the community members, and what areas of opportunity were available for improvement. First I looked into companies that provide the proper disposal of e-waste. As of now, there are no organizations on campus that provide these types of services. I found out that the University of Wyoming campus currently does not provide any service like this yet. I had the privilege of talking with the recycling plant here on campus my junior year in my Campus Sustainability class. We discussed the processes that they currently have in place. When I asked them if they provide any services like this they mentioned that they do not, however the Laramie dump does. Based on this information, we were able to contact the dump and ask them questions about their e-waste services they currently provide.

The next step was to call the Laramie waste facility. I called and talked with the supervisor, JR Slingerland, and was able to ask him a few questions about the e-waste service they have in place for the Laramie residents.

> "In April of 2007, the City of Laramie established the first e-waste collection and recycling program in the state of Wyoming. Since the program's inception, the City has diverted over 600,000 pounds of e-waste from the landfill. Residential customers may drop off e-waste at the landfill free of charge during all operating hours. Commercial customers must pay for disposal of e-waste depending on the size and weight of the electronic item being disposed" (Laramie Wyoming, 2016).

The landfill allows for community members to drop off their e-waste for free during their business hours which are Monday through Saturday, from 8:00am until 4:30pm.

Businesses/Commercial use is charged a fee to dispose of the waste based on weight of the items being thrown out. The types of e-waste items that are accepted at the Laramie Landfill include: "Televisions, Computers and Monitors, Printers and Scanners, Keyboards and Mice, Cell Phones, Game Consoles, Personal Electronic Devices (MP3, PDA, Tablets, Etc.), Audio/Visual equipment (DVD players, VCR, Etc.)" (Laramie Wyoming, 2016). It is helpful that the landfill accepts so many different types of e-waste materials. All of the electronic devices contain harmful chemical materials that will ruin the soil they seep into. It is important to dispose of electronic waste carefully and responsibly.

Mr. Slingerland mentioned that they do not dispose of the waste themselves; Laramie Landfill goes through a company that provides bins for the facility and collects the bins when they are full. Most communities do not have the operating capacity to dispose of the e-waste efficiently themselves. Because of this, in order to have the waste correctly disposed of, they must go through a third party. I asked the supervisor and he gave me the name of the company they go through that actually disposes of the waste for them, which I will discuss more in detail below. I learned that once the bins are collected, the third party company disposes of the materials themselves. Laramie does not actually have an e-waste recycling center or anything of that sort; they must go through a third party.

There are two companies the Laramie landfill goes through and they are called I.T. Refresh and Electronic Recyclers Incorporated; both of these companies are based in Colorado. I did more research into I.T Refresh and found additional information. I.T. Refresh ensures that they do not send their e-waste across seas to provide a peace of mind to the consumers who utilize their services.

"The Responsible Electronics Recycling Act was reintroduced to Congress in 2013 after failing to make progress in 2011. The act prohibits sending e-waste to developing countries. The act has support of major electronics manufacturers such as HP and Apple. The act would also create new jobs in the recycling industry in the United States." (I.T Refresh, 2016).

They ensure to their consumers that they follow the national laws. Because they offer pick-up services, I have researched how to go about acquiring these services for the university. The pricing options for I.T Refresh can be found in Figure 1. This service company provides individual service pick up. They offer large volume pricing individually through the company; pricing for that can be seen again in Figure 1. I attempted to contact IT Refresh and received no contact in return. While there is a list of prices in figure 1, I was aiming for a personal phone call to discuss what it would cost to have bins here on campus instead of individually priced items. Because I was unable to contact IT Refresh, we only have individual data. For this project to be implemented through the Certified Energy Revolving Fund (CERF) program, a budget for the proposed project is required. As seen in Appendix A, there is a list of requirements in order to be considered for CERF funding. Appendix B is the actual application used for the CERF funding program. If we could partner with this company to provide a pick-up service for the University of Wyoming, we would be able to provide an e-waste service to the students of the university.

As for the Electronic Recyclers Incorporated, I was unable to find any information online about this company. Due to this, I assume they are private and have no further information to pursue. However, I will continue to pursue I.T. Refresh to further the potential for a partnership. Like other colleges and campuses around the United States, our university would be able to offer an e-waste recycling service to the students and community members as well.

Part 2: Other States and Universities

Currently, there are several universities around the country that are engaging in e-waste efforts. Three prominent universities engaging in e-waste are Yale University, University of Florida, and Northwestern University. Yale University's Environmental Health and Safety department is currently partnered with a local recycler called Take2. Take2—a certified sustainable recycler—and Yale have an extremely efficient recycling program for all goods; however, their e-waste program is particularly impressive. According to Yale University's Environmental Health and Safety website, "On average, [Yale] recycles approximately 200,000 lbs. of used electronics each year." Students, faculty, and community members who would like to have any form of electronics recycled at Yale, are asked to fill out an online form and allow one to two weeks for pickup. This approach is fairly popular because it reduces problems of batteries leaking toxins into public areas.

The website also notes that, "unwanted computers in good condition are rebuilt each month and donated to two local charity groups." This is a wonderful way to reduce the amount of material that needs to be disposed of. By not only recycling the old material that is no longer of use, they also refurbish used computers to recreate a working device. Not only do they refurbish, Yale University also contributes to the community by giving back to local charities. This act displays the philanthropy of Yale and the e-waste recycling facilities that are associated as well. Yale University's e-waste recycling program is similar to the University of Florida's program.

Much like Yale, the University of Florida offers pick-up services for various kinds of electronic waste. In order to efficiently recycle its waste, the University of Florida is partnered

with a local recycling company named Creative Recycling. The main distinction between these

two schools is that the University of Florida has extremely rigid guidelines in terms of data being

recycled. Any students, faculty, or community members who wish to recycle their electronic

waste are required to wipe all of the information on the device and run a data destruction

program on the device. Unlike I.T. Refresh, where the company is the one that actually wipes the

hard drives, Creative Recycling requires the users to dispose of the old data themselves. This is a

way to avoid any liabilities that could follow on accidental deletion of consumer information.

For example, if a consumer forgot to save any data on their old computer and took it into

Creative Recycling to recycle or refurbish the item, the company could be responsible for the lost

data. This is a smart and safe way for the company to attain the same end results of a clean hard

drive, without the added risk. The University of Florida requires this as a means of self-

protection as well as individual protection. The list of items the University of Florida allows can

be found in Figure 2.

Finally, Northwestern University in Evanston, Illinois, has a highly efficient electronic

waste recycling program as well. Based on the different types of electronics, Northwestern

University offers several different options for students, faculty, and community members to

recycle their e-waste. For the cases of working computers, cell phones, and Apple products, the

Northwestern sustainability website suggests donating the devices to people in need of the

technology; however, if the devices do not work, the university offers a location that individuals

are able to drop off their personal electronics for appropriate disposal. The recycling office is

open weekdays from 9:00 am-5:00 pm. They offer assistance to anyone who is unsure how to

recycle their materials. Again, this university encourages individuals to recycle their used

materials and products amongst each other first. This is wise because most individuals who

utilize their 18-month updates every time they are eligible for an update have many used phones

that are in perfect condition sitting around the house. As mentioned earlier, the amounts of

devices that are found in our homes are approximately around 500 million and possess harmful

toxins. By educating the individuals of this university and community, the University is

providing the knowledge and the power to change how we recycle our electronics.

Other universities across the country are making similar efforts to responsibly take care

of their electronic waste. Some universities have bins throughout their campus that are emptied

daily. Some go through various other third party entities that pick up and dispose of the e-waste

themselves. While others have a special event every semester--much like the University of

Wyoming's glass recycling events--that allow students, faculty, and community members to

bring in their e-waste and have it taken to a recycling facility in one large load. Whatever the

route may be, the important fact of the matter is that the majority of campuses in the U.S.

recycles electronic waste and are educating their community members on the importance of

responsibly and properly disposing of their devices.

Part 3: Global Scale Sustainable E-waste Recycling

As of now, Norway is the leading country globally, in terms of electronic waste. As seen

in the graph in Figure 3, Scandinavian countries produce the most electronic waste

internationally, with the U.S. coming in 9th place. Because individuals discard enormous

amounts of electronic waste, Norway has to be top notch when it comes to sustainability efforts

and recycling methods.

"2014 saw a record amount of electronic waste discarded across the globe, according to a report

compiled by the United Nations University. 41.8 million tons of refrigerators, televisions,

washing machines, vacuum cleaners and other electrical appliances were thrown away last year,

up from 39.8 million in 2013. Last year's mountain of e-waste is equivalent to 1.15 million heavy

trucks forming a line 14,300 miles long, according to the report" (Forbes, 2015)

Norway has various methods which they use to responsibly handle the amount of waste they

produce. One method they use is incineration. Norwegians have decreased their landfill

contributions down to 6 percent according to Forbes. They have been able to do this by using a

multitude of methods by which to dispose of their trash. Incinerating the garbage allows for the

country to reduce the amount of garbage that sits in the landfills. Unlike the United States, they

have various other methods by which they responsibly dispose of the waste they create. While

they are the largest contributor of waste and electronics, Norwegians make the largest effort to

remain sustainable and responsible when disposing of their excess waste.

Switzerland is the second leading contributor of electronic waste in the world. Again, as

with Norway, Switzerland has to combat the large amounts of waste they produce. Switzerland

has been a top waste management country since 1998 according to the Swiss E-Waste

Programme as of 2011. While this example is somewhat dated, it still displays the longevity and

commitment Switzerland has as a country to the betterment of their society and community

members as a whole.

"Switzerland has been a pioneer in legislating e-waste management. Legally, e-waste

management was introduced in 1998 by the Swiss Federal Office for the Environment (FOEN),

by way of the ordinance on 'The Return, the Taking Back and the Disposal of Electrical and

Electronic Equipment (ORDEE)'. However, the formal collection and management of e-waste

started before the legislation came into force, driven by voluntary initiatives of the producer

responsibility organizations (PROs) SWICO and S.EN.S. As an external technical advisor to both

Swiss PRO's, Empa regularly audits the recycling processes" (Swiss E-Waste Programme, 2011).

By regulating waste management, Switzerland has been able to branch out. Not only does

Switzerland do the best in order to mitigate their own waste, they also reach out to other

countries in order to assist them with responsible waste management as well. For example,

"With its e-Waste Programme, Swiss State Secretariat for Economic Affairs (SECO), supports

initiatives to assess and improve the handling of e-waste in developing and transition countries

and facilitates the global exchange of gained experiences. Empa, commissioned to implement the

programme, currently focuses on five countries – China, India, South Africa, Colombia and

Peru" (Swiss E-Waste Programme, 2011). Switzerland is assisting other countries to maintain a

responsible e-waste management program. They are attempting to implement new processes for

these countries that would otherwise have no other immediate option. "This aims to identify

possibilities to mitigate the risks without reducing the attractiveness of the e-waste recycling

business. Assessments and implementations are made in collaboration with local partners such as

government and non-government organizations, industries, universities and others" (Swiss E-

Waste Programme, 2011). Switzerland is going as far as partnering with the governments of

these countries in order to collaborate more fluidly. By partnering with the government,

Switzerland can ensure that all processes follow regulations and guidelines within these

countries, often an overlooked aspect of international projects.

Iceland is the third country on the list, contributing 57.3 pounds per capita of waste.

Similar to Switzerland and Norway, Iceland utilizes a few different methods in order to address

their waste contribution. Figure 4 displays a graph from Cornelis Aart Meyles, author of *Waste*

Management in Iceland (2004). From this graph, one can see Iceland utilizing incineration and

landfilling like Norway and Switzerland both use.

While Switzerland is not quite on the same level as Norway, with 6 percent in their

landfills, they are still attempting to reduce the amount of waste in their landfills altogether. The

Switzerland electronic waste management is called WEEE (Waste Electrical and Electronic

Equipment). "These standard plants are also the starting point when plants are tailored to suit

specific customer requirements. The flexibility of the modular approach means that a number of

combinations can be obtained, ranging from a single machine to complete systems. The Eldan

plants are designed for automatic processing, i.e. staff is required for surveillance only"

(Environmental Expert). WEEE is a company in charge of disposing of various types of

electronic waste such as:

> "Computer scraps containing main frame computers, personal computers, keyboards, and
>
> monitors without glass tubes, printers, and faxes. Small home appliances containing videos, TV
>
> sets without glass tubes, record players, CD players, hair dryers, toasters, vacuum cleaners, coffee
>
> makers, irons, and micro wave ovens. Handheld tools such as drilling machines, grinding
>
> machines etc. Electrical scrap such as contactors, relays, main breakers, fuses, contact bars,
>
> switches, and instruments. Electronic and telegraphic scrap such as electro mechanical
>
> switchboards/relays, computerized switchboards, and printed circuit boards. Small electrical
>
> motors up to approx. 1 – 1.5 HP" (Environmental Expert).

There are a multitude of items that are classified as electronic waste. As mentioned above, the majority of these items are everyday household amenities. For example, women go through many different types of hair accessories such as straighteners, hair dryers, and any type of curling iron. Even items like this, which individuals do not think twice about hesitating to throw in the trash, can be recycled responsibly instead of being discarded, just to sit in a landfill for decades.

Denmark is the fourth country on the list of global e-waste offenders, contributing 52.9 pounds (Forbes, 2014). Denmark follows a similar approach as that of Norway. The country is focused on reducing the amounts of waste they have sitting in the landfills, while increasing incineration and recycling efforts.

> "The overall treatment of MSW in Denmark is characterized by low amounts of landfilling (4 %) and high amounts for incineration (54 %) in 2010. Denmark was close to 50 % recycling of MSW in 2009. However, the recycling percentage decreased from 2009 to 2010. The main reason for this seems to be the change in the scope of municipal waste due to the new regulation on recyclable waste from enterprises. Therefore it will require an increased effort to reach a 50 % recycling level by 2020 based on 2010 data. The major initiatives to improve MSW in Denmark were taken before 2001, i.e. landfill ban, landfill and incineration tax, separate collection schemes" (Kjaer, B, 2013).

Denmark attempts to incentivize individuals to recycle and encourage incineration by using bans and taxes. Similar to Switzerland with the idea of "polluter penalties". The polluters are expected to pay for the damage they are causing. To incentivize citizens to recycle, Denmark charges a tax

on those who choose not to recycle. Because the country has 4 percent in the landfills as of 2013,

it seems as though the taxes and bans are most effective. While the United States does not

currently have legalities in place similar to these, we have a lot to learn from other countries. As

with the University of Wyoming, there are several key ideas from these countries and various

universities that we can learn from. The University of Wyoming would be able to offer students

a better, more responsible option for discarding their unwanted or old electronic waste if a couple

of these processes are implemented.

Recommendations for UW

Recycling at the University of Wyoming has improved; however, with the lack of e-waste

options in Laramie, something needs to be implemented. As I have learned in several

sustainability classes, Universities are typically a leader in sustainability efforts for a community.

As demonstrated with the Universities researched, small steps can make a great impact for e-

waste projects. The University of Wyoming could implement some of these ideas to grow

recycling efforts in the future.

By following an approach similar to Yale and the University of Florida, UW can offer an

e-waste pick-up service here on campus. The partnership with the third party will be beneficial

for faculty and staff at the University of Wyoming, as well as the students and community

members. At this point, with no program currently in place, it could be fairly difficult and

potentially not as cost effective when starting a new program. After visiting the University's

recycling department, it is noted, time and money are two big issues for the program to stay

alive. With this in mind, there are three steps the University can follow in order to implement an

electronic waste recycling program, as well as future steps to further develop the program.

The first step to take is the educational aspect. Education is one of the most important ways to promote action. Like anything, with some education most will agree to take the right steps to become more sustainable. As a group, most students probably do not know most electronics can be recycled instead of just thrown away. Even if students are aware that these materials can be recycled, they may not know how to go about recycling. With the help of the campus sustainability club, we would create various marketing displays and promotions to display the negative aspects of e-waste and encourage students to consider options before throwing them into the trash. If a device can be reused, we will encourage them to donate to someone in need or possibly to the Information Technology department on campus as well. Education is an important step because it encompasses the idea that students have the most power and influence with administrators on this campus. Without education, students are not going to take action and be responsible when disposing of their e-waste. If enough students learn about the program and show interest, the University will see the value in the program and help with implementation.

The second step in the program would be to seek funding. Like anything, volunteers can only do so much and money becomes a deciding factor. From the various guest speakers in Campus Sustainability, it is known that funding is typically the issue with products on campus. The Central Emergency Response Funding (CERF) program is a possibility to get startup funding; however, it is still a fairly new program, which could pose a potential challenge. The sustainability committee would play an important role here within the organization and also to begin seeking funding to start the program on campus. If no funding is available, the program would need to be adjusted in order to accommodate the circumstances at hand.

The third and final step would be to implement a grassroots program on the University campus with the help of the sustainability committee. The program would include several e-waste bins across campus in key locations. Before students discarded an item, there would again be recommendations to donate to IT or individual that could benefit from the use of this device. Some possible ideas for locations of e-waste bins would be the student union, Washakie dining center, the Classroom Building, and possibly the Business Building. Due to the program being new there would not be enough time or resources to have bins in many locations across campus at first. Because of this, the program is heavily reliant on the first step, education, for students to be aware of the program and to be able to locate the bins. Depending on how many items were discarded, the campus sustainability club could determine how regularly the bins would need to be emptied. The third party (IT Refresh) from Colorado would be in charge of emptying the bins monthly or bi-monthly based on the amount of usage within the bins. Once the program took off, a partnership with the University recycling center could be beneficial to ensure the maintenance of the e-waste bins and further development and incorporation of the program into the community.

Looking more into the future, further development will be important to ensure the program stays intact. Ultimately, it would be ideal for the University of Wyoming, similar to Yale, where students, staff and faculty fill out forms and the e-waste is then picked up at a later date. This would create more convenience and overall more participation. For example, students who do not have a vehicle may not be able to get out to the Laramie landfill to discard their electronic waste. This provides students with an alternative way to responsibly discard their e-waste. Another important part of the program's future will be funding. This will be highly

possible with enough student education and involvement; the administration will also have to

become involved.

Conclusion:

  The issue this paper addresses is the lack of electronic waste systems on the University of

Wyoming campus. In order to fix this situation, it is important to educate individuals and

promote action from the students, faculty/staff, and community members of Albany County.

Because it takes cell phones an average of 1,000 years to decompose, it is pertinent to the

environment to ensure these devices are disposed of responsibly. Throughout this paper, we have

analyzed the various methods other universities in the United States utilize, as well as global

countries efforts too. In our society today, individuals are gradually becoming more conscious of

the Earth and of the additional harm we are causing. However, we are also a highly

technologically driven society. Because of this, it is germane that we offer bins for students and

faculty/staff members at the University of Wyoming.

  First we looked at the options available in Albany County and the University of

Wyoming. While there are no current services on the University campus, there are services

offered for the community as a whole through the Laramie Landfill. Next we discussed what

other Universities and communities are doing in the surrounding areas and in the U.S. as a

whole. We reviewed processes through the University of Florida and their partnership with

Take2. Lastly we discussed options that are available in other countries such as Norway,

Switzerland, Iceland, and Denmark. Globally, incineration is a large portion of the waste

management processes. Unlike the United States, other countries attempt to reduce the amount

they have in landfills by incinerating the garbage. Currently, Norway is down to 6 percent of

their waste material sitting in a landfill versus Iceland who is still at 71 percent. In summary,

there are several steps the University of Wyoming can take in order to implement a process

similar to that of the University of Florida. By partnering with IT Refresh, the University of

Wyoming campus can provide these types of services to our students and be a role model for the

Wyoming community as a whole, leading sustainability efforts throughout the state.

Resources

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Figure 1:

I.T. REFRESH
RESPONSIBLE ELECTRONICS RECYCLING SOLUTIONS

WE'VE MOVED! 100 N. Link Lane, Unit 100
Fort Collins, CO 80524
recycling@itrefresh.org

Home   About Us   **Services**   Refurbishing   E-Waste Facts   Contact Us   Search

Price List

CRT TV <20 in. diagonal*	$15.00
CRT TV 20 to 29 in. diagonal*	$20.00
CRT TV ≥30 in. diagonal*	$35.00
Console TV	$35.00
Flatscreen TV (any size)	$10.00
Laptop	$10.00
Computer Tower	Free
Printers/Copiers	$10.00
Floor Model Printers/Copiers	$25.00
Computer Accessories, Cell Phones, MP3 Players	Free
VCRS, DVD Players, etc.	$2.00
Hard Drive Destructions	$10.00
Pickup from home or business	$20.00 - $35.00

*Price list subject to change
*TVs measured by screen size
Call us at (970) 797-2934 for large volume pricing.

e-Stewards CERTIFIED

the REAL recycler.™

ClimateWise
Business Smart.

Figure 2:

C. Examples of Electronic Equipment and Materials

Cables	Microfiche Readers
Calculators	Modems
Cameras	Moving Vehicles
Cell Phones	Optical Drives
Circuit Boards	PDAs
Computer Racks	POS Equipment
Connectors	Power backup
Converters	Printers
Copiers/UPS	Projectors
CPUs	Repeater Research and Testing Equipment Tracking Devices
Computers	Surge protectors
CRT Monitors	Splitter & Cluster Boxes
DVD Players	Tape Drives
Fax Machines	Telecom Equipment
Hard Drives	Televisions
Keyboards	Transceivers
Mice	VCR Players
Laptops	
Mainframes	
Medical Equipment	
Memory Devices	

Because electronic equipment contains a high level of lead and other hazardous materials, it has been deemed to be harmful to the environment. As such, the University of Florida has taken measures to minimize such environmental damage.
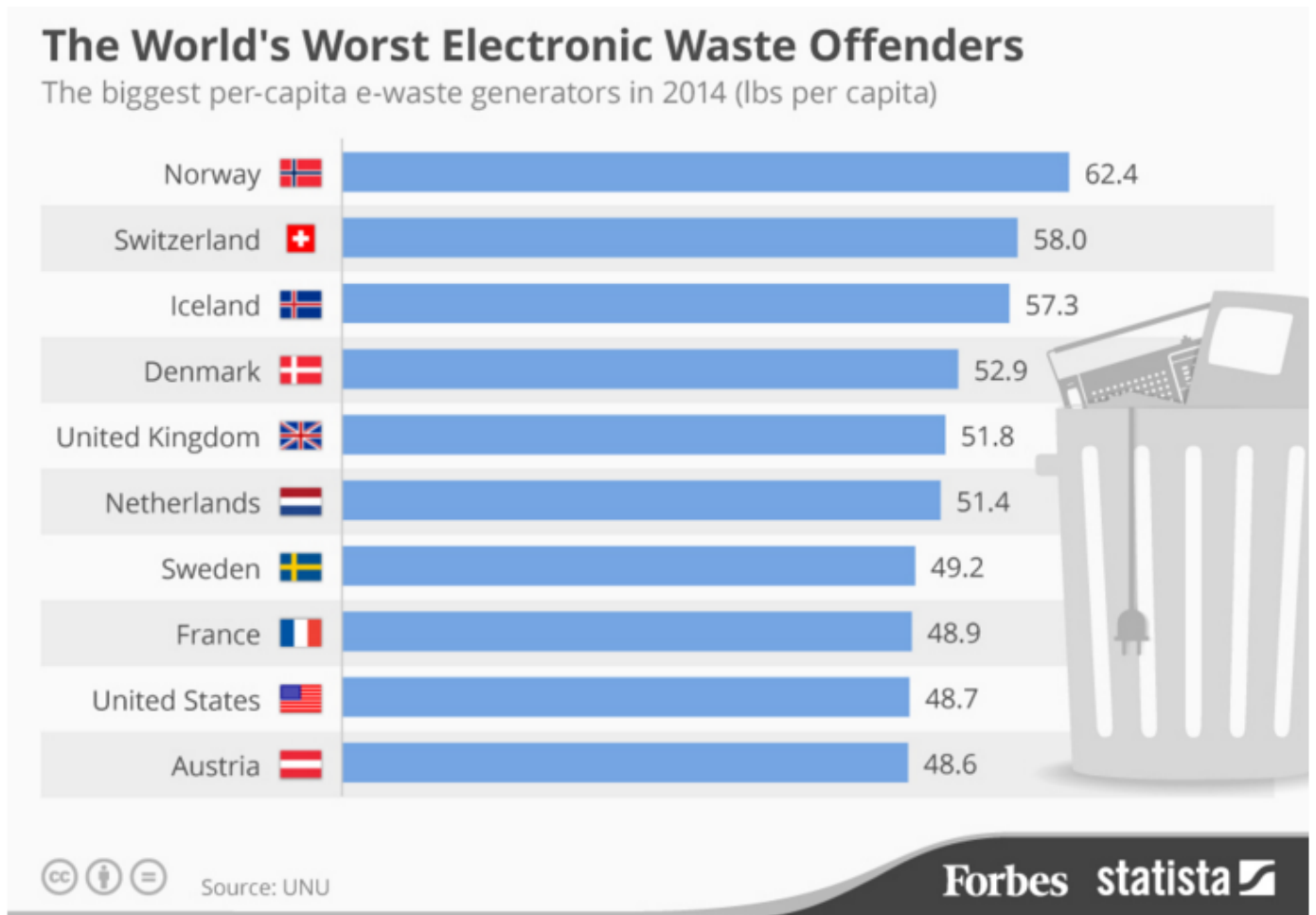
Figure 3:

The World's Worst Electronic Waste Offenders
The biggest per-capita e-waste generators in 2014 (lbs per capita)

Country	lbs per capita
Norway	62.4
Switzerland	58.0
Iceland	57.3
Denmark	52.9
United Kingdom	51.8
Netherlands	51.4
Sweden	49.2
France	48.9
United States	48.7
Austria	48.6

Source: UNU

Forbes statista

Figure 4:

Table 1 Generation and treatment of municipal and industrial waste in 1995 and 2004

Waste generation	1995	2004	Periodic change (% of total)
Number of inhabitants	267.806	299.404	+11,8
Total produced waste (kilotons)	391	488	+24,8
Produced waste in kg per capita	1.460	1.630	+11,6
Waste treatment methods			
Landfilling	80%	71%	
Incineration	1,2%	2,7%	
Recovery (other than by incineration with energy recovery)	12,5%	25,6%	
Other treatment methods	5,8%	0,8%	

Appendix A:

CERF PROJECT PROPOSAL: SUBMISSION COVER SHEET

PART 1: PROJECT DESCRIPTION AND AUTHORS (*Required***)**

Date:

Name(s):

Project Category (Energy, Water, Waste, Other):

Project Title:

***Proposal Narrative** (*Should not exceed 2 single-spaced pages, beginning on a separate page following cover sheet.)*

Biographical Sketches/Resumes (*Should not exceed 1 page per author, beginning on a separate page following proposal narrative.*)

PART 2: COST AND IMPACT ESTIMATES (*Not required but preferred if available*)

Estimated Cost:

Estimated Payback:

Estimated ROI:

Maintenance and Repair Improvements:

Student Engagement and Learning Opportunity:

Environmental Impact:

*(*Spreadsheets and other supporting documents may be included on a separate page, following biographical sketches/resumes.)*

PART 3: IMPLEMENTATION PLAN (*Not required but preferred if available*)

*(*Spreadsheets and other supporting documents may be included on a separate page, following cost/benefit documents.)*

Appendix B:

Conservation and Efficiency Revolving Fund (CERF)
2015-2016 REQUEST FOR PROPOSALS

Note: There is only one CERF solicitation for the 2015-2016 academic year.

PURPOSE

The Conservation & Efficiency Revolving Fund (CERF) subcommittee invites proposals from UW students, staff, and faculty for campus energy, waste, and water efficiency projects. As opposed to a traditional request for research or project funding, the subcommittee seeks effective project *ideas* to implement on campus for good stewardship of university resources. Proposals should aim to make UW a better place, and successful proposal participants are encouraged to involve students in project development, outreach, and related research.

Funding from the CERF supports campus sustainability projects typically administered by the UW Physical Plant or other administrative units. Although funding does not accrue directly to the applicants, the CERF is an opportunity for members of the campus community to drive and shape sustainability efforts at UW. The funding also connects curriculum to real world problem solving by funding student-initiated projects and allows faculty to use campus as a living laboratory for research. Successful proposals will be publically acknowledged and authors will be recognized as leaders in conservation, efficiency, and campus sustainability.

BACKGROUND

The CERF is a UW Campus Sustainability Committee initiative, successfully established in spring 2014 with seed capital provided by UW Physical Plant. Revolving funds such as the CERF are innovative funding mechanisms for campus efficiency, conservation, and sustainability projects that demonstrate an excellent return on investment. Savings from these projects are "revolved" back into the CERF to continually fund similar projects.
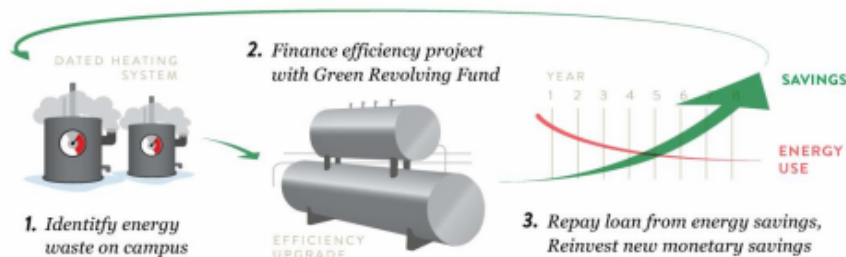

FIGURE 1: Green Revolving Fund Capital Cycle

Source: Sustainable Endowments Institute & Association for the Advancement of Sustainability in Higher Education, Green Revolving Funds: An Introductory Guide to Implementation & Management; p. 6.

Specifically, the CERF:

- Provides a formal mechanism for efficiency and conservation to serve as an investment in the university, rather than an expense, ensuring beneficial and profitable projects do not go unfunded due to capital constraints;

- Demonstrates good stewardship of state financial resources by reducing operating expenses;
- Creates a living laboratory for student engagement, applied research, and curriculum-based learning;
- Improves the UW built environment;
- Reduces exposure to energy price fluctuations;
- Reduces greenhouse gas emissions per UW's American College & University Presidents' Climate Commitment obligations; and
- Provides examples of innovative efficiency measures and processes for implementation throughout the state per UW's land grant mission.

PROJECT CRITERIA

Estimated proposal costs should not exceed the current fund amount of $350,000. For this RFP, the subcommittee highly encourages *smaller projects, no less than $1,000, to maximize student learning and engagement opportunities*. The subcommittee will evaluate projects based on financial return, ability to address deferred maintenance concerns and ongoing repair costs, student engagement and educational opportunity, overall environmental sustainability impact, and demonstration of clear financing, implementation, publicity, and maintenance plans. All CERF projects must make *measureable* energy, water, and/or waste efficiency or conservation impacts, including projects such as but not limited to:

- Energy – Lighting replacements, HVAC enhancements, weatherization and insulation, building controls, on-site renewable energy systems, renewable fuels (e.g. biodiesel) from agricultural or dining waste;
- Water – Low-flow appliances, systems to recover or reuse wastewater, irrigation enhancements;
- Waste – Increased composting, waste diversion through additional and/or improved recycling;
- Other campus sustainability projects that do not clearly fit into one of these categories, including behavior-based programs that demonstrate clear reductions in resource use and costs.

BUDGET

Proposed budgets are restricted solely to project implementation costs, including design, materials, labor, and measurement/verification. Other costs, such as research, publication, travel, salary, or student support, are not currently permissible.

As the CERF is funded through savings from previously funded projects, the entire $350,000 may not be available during each funding cycle. Based on available funding, selected projects may not be officially funded and implemented until the following fiscal year. Applicants are still encouraged to apply for larger-scale projects, as partial funding may be awarded or other funding sources may become available.

SUBMISSION GUIDELINES

Submit proposals a as a single Word or pdf document by email to mgeiger1@uwyo.edu *and* rbudowle@uwyo.edu by May 6, 2015. Applicants must complete Part 1 of the proposal and cover sheet. Proposal narratives should not exceed two single-spaced pages and should address the above criteria and CERF goals. Additionally, narratives should provide clear examples of similar efficiency and conservation projects successfully implemented in other university or commercial settings and/or from related literature. Finally, provide a biographical sketch or resume not exceeding one page for all authors.

Applicants should complete parts 2 and 3 of the proposal, relating to estimated costs, benefits, and project implementation, as fully as possible. Providing further information will increase the likelihood of

project selection. The subcommittee recognizes, however, that many applicants eager to contribute to efficiency and conservation measures at UW may not have the expertise to provide such information and encourages applicants to collaborate with subcommittee members on proposals. The subcommittee will also announce formal, open CERF brainstorming and collaboration sessions during the semester to facilitate this process. *Subcommittee members are available to provide CERF informational presentations and sessions for courses and student organizations upon request.*

The CERF subcommittee, which is comprised of students, staff, and faculty, will formally review proposals and publicly announce successful projects by June 15, 2016.

FURTHER INFORMATION AND CONTACTS
http://www.uwyo.edu/sustainability/cerf/

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