Slicing Carbon Emissions with the Dyson Airblade

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Often, the environmentally conscious choice is also the most economically feasible choice. A pilot project of 4 Dyson Airblade hand dryers would create a savings of $36,000 over a 10 year period. In doing so, they would be saving roughly 40 tons of carbon emissions and preventing the loss of hundreds of trees. Through our research, we have found that a pilot installation of Dyson Airblades has a high chance of success in initiating a campus-wide installation, which will, in turn, have momentous positive implications for WWU, both economic and environmental.

1. Initial Steps

The goal for our project has always been to reduce the amount of waste that Western sends to the landfill. Our original idea was to acquire more garbage sorting stations on campus to increase the amount of waste being recycled. We wanted an idea of what part of Western's trash wasn't being recycled. So we obtained waste audit data, from the Air and Waste Management Association on campus, for different buildings. We quickly saw that paper towels make up one quarter of the waste volume produced by many of the buildings, most notably Wilson library and Haggard Hall. We decided eliminating this large amount of trash from our waste was an achievable goal and quickly began researching how to do so. Our two most feasible ideas were to compost the paper towels or get rid of them all together using energy efficient hand dryers. We found out composting was too expensive due to the need for costly compostable bags, also another group was already working on a pilot project to compost paper towels in select bathrooms. They were going to overcome the cost by using the Green Energy Fee to purchase the bags. So energy efficient hand dryers became our best option and we focused on the Airblade in particular because it's cost effective, environmentally friendly, and hygienic.

2. Hygiene

What sets the Airblade apart from other air hand dryers, in terms of hygiene, is the way it functions. First air is pulled through a two stage hospital grade HEPA filter where it filters out 99.97% of bacteria before it reaches your hands. The air is then sucked through the sealed motor, split between the two "horns" of the machine, and forced through an aperture the width of an eyelash. This creates two blades of air traveling at 400 mph that squeegee your hands dry as you pull them up. On average, after drying for 12 seconds, the Airblade leaves .1g of water on user's hands.

A conventional air hand dryer is much less hygienic due to its lack of air filtration and that it heats the air before it blows it on your hands. It pulls in unfiltered bathroom air that contains bacteria and viruses. Then it heats up the air, blows the bacteria and viruses onto your hands as it dries, and bakes them on with the heated air.

Other important hygienic aspects of the Airblade are its silver ion coating which restricts the growth of bacteria on the machine. It requires no touching to operate unlike most paper towel dispensers that require users to pull on a lever that has airborne pathogens on it. It's also the only hand dryer to be approved by the NSF (National Sanitation Foundation) and HACCP (Hazard Analysis and Critical Control Point) to respected organizations committed to public health and safety.

3. Stakeholders/Interviews

Gayle Shipley

We met with Gayle Shipley the head of Environmental Health and Safety to hear her opinion and concerns for installing the Airblade hand dryer. We were very happy to find out that she is actually in favor of the Airblade hand dryers over regular hand dryers and over paper towels in the long run. She was already very knowledgeable on the subject and knew most of our pros and cons.

The issue she had with conventional air hand dryers was that they spread germs back onto your hands. There are bacteria and viruses, such as E. coli and Staphylococcus, in the air of the bathrooms and hand dryers suck them up with the air and blow them right back onto your hands. Also they take an excessive amount of time to get your hands dry and according to her observations most people are not willing to spend that extra time drying their hands. She stated that she thought the Airblade performed well at fixing both of these complaints.

Her view on paper towels vs. the Airblade was that they were about equal when it came to drying and cleaning hands. She would prefer the Airblade in the long run because it would save a lot of trees and lower Western's carbon foot print but thought that paper towels still had a place in the bathroom when it came to opening the door to leave. When you grab the door handle with your hand you're transferring bacteria and viruses to your hands again and then you spread them around when you leave. Her preference would be to leave a dispenser so you could use a paper towel to grab and open the door.

Her only concern with the Airblade was the HEPA filter. She wanted to know how often the filter needed to be replaced and how often it gets clogged with the particles it sucks up. If it becomes clogged with particles then the amount of suction it has will be reduced and lower it's drying capability. She has also heard complaints that the HEPA filters have a plastic smell which could be detrimental for a user's health. Through our research, we did not find any documented instances of this problem, but we will include it as a piece of our follow up study.

Don Bakkensen

We talked to Don, the head of Building Services, over the phone about any problems he saw with installing Airblade hand dryers on campus. One obstacle he saw us having to deal with was that not all bathrooms are equipped to have electric hand dryers installed in them. Since most bathrooms use paper towels there are no electricity hook ups where the dispensers are located, so if you were going to replace a paper towel dispenser with a hand dryer you would have to route electricity to it. He estimated that it would cost about $1,000-$2,000 per bathroom to route an electrical hookup to where the Airblades would be installed in the bathroom.

We could replace just hand dryers with Airblades to save the cost of putting in an electrical hook up but, since warm-air hand dryers are moderately cheaper to use for drying than paper towels, it would hurt the cost effectiveness of the Airblades. Even with the additional cost of installation the Airblades pay themselves off faster when they replace paper towels, as described in "Data and Analysis".

Greg Hough

Greg Hough was key in providing us with some basic, preliminary estimates regarding the cost of

the installing the Airblade. He quoted us roughly $1000 to rewire a bathroom without hand dryers already installed. He also quoted us about $300 to install an Airblade into a previously existing dryer location. He also confirmed that most bathrooms are installed with half-inch sound insulation, though some older buildings may not have this. Furthermore, he pointed out that sound would not be an issue in Arntzen Concourse, as it is surrounded on all sides by thick concrete walls.

Rich Neyer

Initially, we contacted the Director of the AS Recycling Center Richard Neyer regarding the paper towel composting aspect of our project. Our communication with Mr. Neyer was somewhat limited as our project focused in on the Dyson pilot. He was implemental at first in supplying us with the information that ultimately lead to the realization that paper towel composting is not economically feasible at this time. He told us that the paper towels could be compacted to about 20% of their size at the Recycle Center, and he said that he could supply bins/dumpsters if need be. He also indicated the need for a follow up study to measure the actual amount of waste being diverted from the landfill. Mr. Neyer was more than enthusiastic towards the idea of paper towel composting and seemed like he would be very happy to be involved in creating the program in the future, were it to ever get off the ground. The information he provided us with, however, led us to the conclusion that the savings incurred by composting paper towels would be significantly less than the cost of compostable bags.

Michael Smith

One of our most prominent stakeholders is Michael Smith of WWU Custodial Services. In our meeting, he immediately launched into the superior nature of paper towels. He indicated one of their greatest features as the mechanical removal of pathogens, he claimed removes over 90% of pathogens. In our research, we found an independent French study by the Institut de Recherche Microbiologique which showed a 98.5% decrease in post-hand washing pathogens via mechanical action. When we mentioned that the Airblade has a HEPA filter, he reminded us that they only filter to one micron, which does not filter viruses. We have not unearthed any reputable research regarding viruses and hand-drying options, but it seems that most viruses should be removed upon washing. This is a point where further investigation is needed. Even though he had a few concerns, Mr. Smith concluded that people are moving away from paper towels and that hand dryers are the way of the future, of which the Airblade is the best out there. Consequently, he is in support of a pilot project. He didn't indicate any specific concerns as far as janitorial services go. In response to paper towel composting, he showed support but said that his budget was stretched thin and he couldn't do anything out of his way to support the project. He said that his employees would be able to take a bag of paper towels to a different (composting) bin if it were easily accessible. Mr. Smith also supplied us with very useful data on various janitorial related things, such as bathroom use and trash bag cost.

Bill Ciha

At the University of Iowa, Manager of Custodial Services Bill Ciha is working hard on installing over 400 new Dyson Airblades campus wide. We were lucky enough to get a brief interview with Mr. Ciha and some invaluable insight into what our project could look like in the future. Mr. Ciha said that, though the project was slow to take off and was met with skepticism on

many fronts, it gained a lot of momentum after the first pilot project was successful. Initially, he said education was an important aspect simply because people didn't know what the Dyson Airblade was and its benefits. Also, letting stakeholders know the purpose of the project was key. The pilot received a positive response from students and stakeholders alike, and now Facilities Management is beginning installation of Airblades campus-wide. Mr. Ciha wholeheartedly

supported the dryers thus far, though he conceded there were a couple of hurdles. One of the biggest is that the Airblade is fairly noisy, which is a problem in academic buildings. This has been remedied by blowing in extra insulation. Another problem was wiring in bathrooms without previously installed hand-dryers. He said that this was easily fixed, however, by simply pulling wiring down from the ceiling. Other minor problems included an attachment to some auxiliary uses of paper towels, such as their use in door opening and spill cleanup. None of these issues were major stumbling blocks for the project. Mr. Ciha suggested that our team implement an early education plan, telling both students and faculty about the proposed project. Now well into the project, Mr. Ciha had no complaints about the dryers thus far; he said they held up to all their claims and were easy to clean. The Dyson Airblade is now in the campus building code. Graciously, Mr. Ciha forwarded us a data sheet of cost comparisons for different hand-drying options.

4. Data and Analysis

Money is an issue and a major obstacle at this and many other public institutions. Facing budget problems currently and for the foreseeable future, Western has a responsibility to ensure that its' operations are carried out in a cost-effective manner. To this point, our group has researched the Dyson Airblade and their effectiveness in saving money.

Although their initial cost may be off-putting, the energy and cost saving that their daily use has over paper towels is a significant bonus that incorporating them into our campus infrastructure. The initial cost of the Dyson Airblade is $1,400. The cost of setting the Dyson Airblade up by installing it into an existing bathroom ranges from $170-200, which is equivalent to one hour of work by a certified electrician. In our chosen bathrooms for the product, we will need to install 2 dryers per bathroom, and may need to re-wire them.

The Airblade has a 5 year warrantly, which covers all defects and replacements resulting from normal daily use. The HEPA filter, which filters microbes out of the air that is used to dry hands, requires replacement every 5 to 7 years, and costs $40 per filter. An issue unique to our campus is that wiring needs to be run in each bathroom to support the electricity needs of the hand dryers. According to an estimate made for us by facilities management, this could cost around $1000 per bathroom

Airblade hand dryers require the energy use of 0.004667 kWh per 12-second cycle. One cycle is enough to dry a pair of wet hands. Western has a current approximated energy cost of $0.07 per kWh of renewable electricity. Doing the math, this means that the cost of one hand dry is equal to $0.0003, or .03 (three hundredths) of a cent.

The paper towels which WWU currently uses cost $4.86 for a roll that is 800 feet in length. The cost per inch of paper towel is $.00051, or .051 cents. On average, each paper towel pulled from the roll is approxamately 15 inches in length, and a complete dry of hands requires two of these 15 inch sheets. Doing the math, this means that cost of one hand dry is equal to $0.015, or 1.5 (one and one-half) cents.

The table below shows the cost benefit of using the Dyson Airblade hand dryer. The table shows a one-week time period with 400 uses per day (a high-flow restroom on campus)

One Week Cost Analysis

Drying Method	Cost per use ($)	Uses per week	Total Cost ($)

Paper Towel	0.015	2800	42
Dyson Airblade	0.0003	2800	0.84

As is shown, the cost of using the hand dryers is much less (precisely 2% of the cost) than the cost of using paper towels. To get a better picture of the usage over the long-term, the following tables show a one, five, and ten year cost projections. These projections are for one hand dryer replacing paper towel usage of 400 people.

One Year Cost Analysis[1]

Drying Method	Cost per week ($)	Weeks per year	Total Cost/year ($)
Paper Towel	42	52	2,184
Dyson Airblade	0.84	52	43.68

Five Year Cost Analysis

Drying Method	Cost per year ($)	5 year cost ($)
Paper Towel	2,184	10,920
Dyson Airblade	43.68	218.4

Ten Year Cost Analysis[2]

Drying Method	Cost per year ($)	10 year cost ($)
Paper Towel	2,184	21,840
Dyson Airblade	43.68	436.80

Based on these statistics, it is plain to see that the cost of operating an Airblade hand dryer saves more and more money as time goes on. But how much exactly?

Dyson claims that under normal circumstances, the investment of $2400 into the Airblade and its installation is paid off in just over a year. By assesing the cost of one year of paper towels and one year of the electricity that an Airblade uses, and adding in the initial cost, we can find the break even point.

To find the break even point, we can form two linear equations (y=mx+b) to asses the costs

The variables in these equations are:
Y is total cost
M is cost per week of usage
X is number of weeks
B is investment required

The equation for paper towels is y=42x+0
The Equation for the Airblade is y=.84x+2400

[1] We realize that the actual number of uses and cost savings over this time period will vary from these numbers. However, we are attempting to portray an accurate baseline to compare data that will be collected as our pilot project progresses.

[2] These numbers are impressive, but do not take into account the ever changing cost of resources. We could see a sharp rise or decline in the cost of electricity, paper products, landfilling costs, or other factors that would mean additional savings or costs to the pilot project or a more widespread installation.

With basic algebra, you can find that x, the number of weeks, where y would be equal. This number is 53 weeks. In other words, it would take 53 weeks before the initial investment into one hand dryer serving 400 people per day, its' installation costs, and energy costs to break even with the costs of paper towel usage. Any further usage would be considered cost saving, as paper towels cost significantly more to use per week than the Airblade.

With this in mind, we have come to the realization that each of the bathrooms we are installing in will need two dryers, so it is possible that our 4 dryer pilot project will, in fact, have savings of roughly half of what our projections show. Because each hand dryer will be handling 200-250 persons per day instead of 400, the savings will be slightly less, and the payoff time will be about doubled to take this into account. While this will seem a negative, this still puts the payoff time at 2 years per dryer, which is less than half of the warranty period.

These savings, while impressive in themselves, do not take into account the money that the school currently spends on bagging, transporting, and landfilling the paper towels after use. Each of these requires use of additional items, manpower, and/or resources. At a cost of $.14 per trash bag, the savings of bags alone would be in the hundreds of dollars per year, and the cost saving in landfilling still need further investagation by Facilities Management and our group.

Environmentally, the Airblade is a superior choice to paper towels. According to the manufacturer, each dry cycle of a Airblade produces 3.4 grams of CO_2. In comparison, the equivalent paper towel will produce 12.5 grams of CO_2 according to paper towel manufacturer Kimberly-Clark. While both of these numbers come from manufacturers of the respective products, they are the most accurate numbers we can find, though they were found through research that was funded by the manufacturers.

By multiplying these numbers by the amount of projected uses above, we found that using a single Airblade will prevent the responsibility of release of 5.25 tons of CO_2 over a 5 year period. This means about a ton per year per unit, a savings of 70% over paper towels' carbon footprint over the same amount of time.

Additionally, each unit saves around 10 (10.2 to be exact) trees from being harvested and made into paper towels. With a 4 dryer pilot project in high flow areas, around 40 trees would essentially be preserved each year. While this alone has many benefits, these trees have the ability to sequester 9.8 tons of CO_2 from the atmosphere each year. Not only are we leaving trees in place, which has a positive environmental impact, these trees are lessening the impact of other practices which release pollutants into the atmosphere.

5. Implementation and Follow Up

Possible Challenges/Solutions

1.) One challenge we foresee is getting student support for the hand dryers. Many people are against all hand dryers because they group them up with conventional hand dryers that are unhygienic.

Our solution to this will be to try and educate people on why the Airblade is more hygienic than other hand dryers, how energy efficient they are, and how many trees they save by cutting out paper towels. At this time we haven't come up with a definite way to educate the campus but are looking into signage, video displays, and tickers that count how many paper towels and trees the hand dryer has saved from being used.

2.) The bathrooms that the hand dryers will be most effective in are the ones with paper towel dispensers. Unfortunately these bathrooms don't have electrical outputs located where the Airblades will be hooked up. The solution is to do minor construction to run wires from the ceilings down to the walls. This will be somewhat expensive ($1,000-$2,000 per bathroom) but if we're replacing paper towels with the Airblade the cost will be mitigated in about a year.

3.) A project such as this will be quite expensive, with each Airblade costing $1,200 each, two per bathroom, construction and installation cost. The Airblade is so energy efficient that it will pay off these fees within 2 years of installation. To get the funding to put this project into action we are going to apply for funding through the Green Energy Fee.

4.) After the project has been in place we need to complete a follow up study to see how well the Dysons are actually working and how much energy they are saving. That way we can move from the pilot project and work towards getting them installed campus wide. The challenge is finding ways to record this information. We will need to get some sort of sensors to attach the Airblades to see how much energy they are using. Then we'll need to compare that information to how much energy it would have taken to operate the bathrooms on conventional hand dryers. Also how much energy and money it would cost to operate the bathroom with paper towels. We should be able to use our cost data from the pilot project to find these costs.

5.) The challenge that comes from doing the follow up is actually going through with the follow up research and data comparison. It will take dedication of time and effort by the group members to do this and at the same time there is no guarantee that any of us will be at Western when it's time for a follow up study. To prepare for this we can leave enough of our data, research, and findings behind that it could become a potential project for the campus sustainability planning studio to turn the pilot project into a campus wide project.

Post-Implementation Follow Up

The follow up may be one of the most important and most difficult aspects of our project. It is paramount that we collect hard data on the effectiveness of the Dyson Airblade, that we may present this data to Facilities Management (and others) so that they may make educated judgment of whether the Airblade will be effective across campus. We believe that the dryers will prove themselves and pay themselves off, but we need to collect the information so that their effectiveness is incontrovertible. First and foremost, we plan to meter energy usage by the dryers over the course of a few months and a year. With this data, we will be able to create a comparison between projected energy savings and actual energy savings. Also, education is a critical component of our project. We plan to create posters to go directly above the hand dryer that will accentuate positive characteristics of the Airblade and the nature of the project. We also hope to install a real-time energy savings meter alongside every dryer. This meter will put the energy savings into an accessible format so that students may witness their decreased impact as they dry their hands. As a supplement, one year after implementation we will survey faculty and students to get a snapshot of the user adoption patterns and user satisfaction by the dryers. Furthermore, we will survey the custodial team on the durability and ease in dealing with the dryers. Through these steps, we hope to create a comprehensive follow up presentation for Facilities Management.

6. The Future

It is our hope that the completion of this project will give Facilities Management a strong case in favor of the Dyson Airblade. If our projections hold, the Airblade will pay itself off in less than one year, after which time it will be generating generous savings for both the university and the environment. The driving force behind this small project is the hope that Facilities Management will see our follow up data, adopt a policy for phased replacement of existing air driers and paper towel dispensers, and include the Airblade in architectural specifications for future buildings. This installation will be influential in reducing carbon emissions, deforestation, and landfill usage.

In the event that Airblades aren't installed immediately, paper towel composting may become economically feasible in the future. If this is the case, this research may serve as a starting point for a paper towel composting pilot so that we may at least lessen the environmental impact of our paper towel usage.