UBC Social, Ecological Economic Development Studies (SEEDS) Student Reports

An Investigation into the Laundry Services Project

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APSC 261

November 2009

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Date of Submission: November 19, 2009

Course Name and Number: APSC 201 Tutorial 1E

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Abstract

To encourage students to bike more often to UBC, the UBC Design Team has come up with the Laundry Services Project. The Project consists of the New SUB providing the service of showers for bike riders to clean up before class. To further promote bicycling as a viable transportation alternative to cars, the Design Team will accommodate the bikers with towels and cleaning products. However, there are two main problems with this project- laundry machines and the cleaning products used. In order for the service to be sustainable, the group has to evaluate various machines and products and conclude with recommendations of both.

The team has divided the research into two parts- the laundry machines and the cleaning products. In order to decide on which washing and drying machines are most energy efficient, the group has picked top few choices and compared them in depth. Transportation is taken into account first, and it is concluded that buying these machines from a retailer store- more specifically, Sears- will reduce the environmental impact per unit. After selecting a probable place to purchase these machines, the group has looked at various elements such as, for washing machines, the water factor, modified energy factor…etc, to help them on deciding the final choices of products. The team then has visited the websites of the manufacturers to gather more information on the chosen machines, as well as the Sears website to ensure that the chosen machines are available. For the cleaning products, the group has researched various types of detergents and towels for comparison. Most products researched are from the United States, so the shipping fee is a concern. The group has chosen products with free shipping for further research.

While comparing the washing machines, the group has learnt that the higher the modified energy factor and the lower the water factor are, the more efficient the machine is. From comparing the MEF, WF, the price, and the volume of three chosen washing machines, the group has decided to recommend the LG WM2150H. In addition, the team has learnt that dryers are not Energy Star approved because the energy consumption is relatively constant. From comparing the price and the drum life, the group has decided to

recommend the LG DLEV833W. As for the type of towel and the cleaning product, the group has chosen the microfiber towel and the LEGACY OF CLEAN SA8+BIOQUEST Refill powdered detergent respectively.

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Glossary

Hard water: is water that has high mineral content (mainly calcium and magnesium ions) (in contrast with soft water). Hard water minerals primarily consist of calcium (Ca^{2+}), and magnesium (Mg^{2+}) metal cations, and sometimes other dissolved compounds such as bicarbonates and sulfates. Calcium usually enters the water as either calcium carbonate ($CaCO_3$), in the form of limestone and chalk, or calcium sulfate ($CaSO_4$), in the form of other mineral deposits. The predominant source of magnesium is dolomite ($CaMg(CO_3)_2$). Hard water is generally not harmful to one's health.

Greenhouse gases: Greenhouse gases are gases in an atmosphere that absorb and emit radiation within the thermal infrared range. This process is the fundamental cause of the

greenhouse effect. The main greenhouse gases in the Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.
Algal bloom: a rapid increase in the population of algae in an aquatic system.

Eutrophication: is an increase in the concentration of chemical nutrients in an ecosystem to an extent that increases the primary productivity of the ecosystem. Depending on the degree of eutrophication, subsequent negative environmental effects such as anoxia and severe reductions in water quality, fish, and other animal populations may occur.

List of Abbreviations

Modified energy factor = MEF
Water factor = WF
Machine electrical consumption = MEEC
Hot water energy consumption =HWEC
Removal of remaining moisture in wash load = RRM
Miles per Gallon = MPG
Operating expenditures = OPEX
Carbon Dioxide = CO_2
The United States Environmental Protection Agency = EPA
High Efficiency = HE

1. Introduction

The New SUB plans to provide the service of showers for bikers to encourage the UBC student body to bike more. In order for the service to be ecologically-friendly, the group has to take into consideration the types of laundry machines and cleaning products used. This report is divided into four parts- laundry machines, dryers, towels and cleaning products, and concerns. In the sections of laundry and drying machines, the group has included the approach of research and important findings and calculations which have helped them in determining the final choice of product. The group has researched various brands and types of both kinds of machines and has compared them via different factors to reach their recommendation. The section of towels and cleaning products includes two parts- description and comparison of different types of detergents and towels. By taking into account factors such as the price or the delivery expense, it can be easily decided which detergent is the most compatible for the Project. Similarly, by comparing factors such as the size, the price, or the durability, the group can easily determine what type of towel is most ecologically-friendly. The last section of the report emphasizes on four areas of concerns that the group has regarding the Laundry Services Project- economical, environmental, social, and political or regulatory.

2. Laundry Machines

2.1 Washing Machine

This section discusses a choice for the washing machine for the laundry services. This appliance is for washing the towels used by the showing commuters. The scope of this research focuses on the electrical washers, and not the natural gas washers, as they currently have no EnerGuide ratings.

Energy-efficiency can be based upon usage of hot water. Front-loading washing machines generally use less hot water than top-loading washing machines, so they are more efficient. Machines with water-level control can also be more efficient since one can limit water based on load size. However, these efficient machines are more expensive because they are widely available. All these factors have been taken into consideration.

2.1.1 Approach

There are three main versions of washing machines, residential, commercial, and industrial. Residential washing machines which have a low EnerGuide rating were compared. Commercial machines are more energy efficient; however, this is based on a higher volume of laundry. These machines were investigated for comparison purposes and were concluded to be ineffective for the scale of the project. Industrial machines were not compared in this project.

It was decided to buy a washing machine from a retailer since they import many machines in large quantities, so environmental impact per machine is less. Also, many of the manufacturers are international, meaning that buying their products through a company is easier. The manufacturers have already organized the money conversion ratios, shipping, and physical labour of packing and installing. Sears was chosen because it is one of the closest retailers to UBC. It also has a wide selection of energy efficient machines with prices included.

The factors considered consist of washer size, modified energy factor (MEF), and water factor (WF). MEF is an equation which takes into account washer capacity, washer electrical energy consumption, as well as energy taken to remove moisture. The higher the MEF, the more efficient the clothes washer is. WF represents the gallons per cycle per cubic food that the clothes washer uses. The lower the WF, the more efficient it is.

$$\text{MEF} = \frac{capacity}{MEEC + HWEC + RRM}$$, where MEEC= machine electrical consumption,
HWEC= hot water energy consumption,
RRM= removal of remaining moisture in wash load

$$\text{WF} = \frac{Q}{C}$$, where Q= total weighted per –cycle water consumption
C= clothes washer capacity

2.1.2 Findings and Recommendations

The following table details the third, second, and first choices of washing machines that Sears offer. All the machines compared in this study were ENERGY STAR® approved, so these are indeed the *most* efficient machines. Out of these three, in comparison to the Sears averages, all use less energy per year, have a lower WF, have less annual water use, and are less than average price.

Table One: Top Three Choices of Washing Machines

Brand	**Model**	**Volume (cubic feet)**	**kWh/year**	**MEF**	**WF**	**Annual Water Use (gallons/year)**	**Price (Sears website)**
General Electric	WBVH5300K	3.53	131	2.32	3.8	5183	799.99
Maytag	MHWZ600T	3.26	153	2.48	3.9	5009	949.99
LG	**WM2150H**	**3.52**	**117**	**2.77**	**3.4**	**4747**	**999.99**
Sears averages		*3.466*	*170*	*2.3812*	*4.006*	*5344.5*	*1269.99*

Based on this table, LG is the best choice from Sears. Further research into this product from the manufacturer's website provides more detail and how its use can be the most sustainable. The water level automatically adjusts to the size of the load, meaning that machine is designed to have a good WF regardless of level of usage. This model also has noise reduction, the 'Quiet DD system'. On the Energy Star website, it states that one should avoid the sanitary cycle since it is very hot and uses much energy. This model does not have the steam feature so there is no accident of inadvertently using it. Finally, LG provides a reasonable warranty- 1 year parts and labour, 3 years parts on the controller, 5 years parts on the liner and tub, and 7 years parts on the DirectDrive™.

Figure One: LG WM2150H

Just for comparison, the commercial washing machines are more efficient with water and energy but only if used on a scale larger than what is feasible for the SUB. They are also much more expensive when considering initial cost, parts and maintenance. The LG Electronics CW2079, which would be the first commercial washing machine choice, has a WF of 3.7 and a MEF of 2.45. However, the cost of the parts alone is over $2500 so the manufactured product itself is probably around $3000 to $4000. The Electrolux W4105H, the second choice, costs over $6000, probably out of the budget. The third choice is the Maytag MAH22P, but it only costs a bit over $1500 so quality might be compromised and warranty might not last as long – more money may be spend on maintenance and replacing parts.

2.2 Dryers

This section discusses a choice for the dryer for the laundry services. This part is an essential component to compliment the washing machine in the previous section, as each bath towel to be washed needs to be dried.

The new dryers in the market today utilize approximately 4% less energy than the average existing dryers in homes. This is mainly attributed to the improvement in automatic controls which use moisture sensors to prevent excessive drying.

The scope of this research will only focus on the electrical dryers, and not the natural gas dryers, as they currently have no EnerGuide ratings.

2.2.1 Approach

A similar approach was taken compared to the previous section, in terms of calculating transportation in the environmental footprint. Buying from a manufacturer would entail a specific order being filled to transport a single item across a distance. Purchasing from a retailer, however, streamlines this process, as the retailers buy in bulk, so environmental impact per unit is greatly reduced.

It is found that Energy Star does not have evaluations on dryers, because the energy consumption is relatively constant across the board of models available in the market today. It is more important to consider the lowest EnerGuide ratings (kWh/yr) in selecting a dryer. Added features for moisture and temperature control also add to energy savings to prevent overheating.

2.2.2 Findings and Recommendations

It is imperative that in order to be the most efficient, we run the dryer as close as possible to its capacity. This puts a constraint in our selection of a dryer, as being of equal or close capacity to the washer.

Using a similar approach, we have come to narrow down a dryer to two options:

Table Two: Top Two Choices of Dryers

	kWh/year (465 cycles/year)	**Air Drying System**	**Drum Life**	**Price**
MayTag MDE2400AZW	424	Moisture Sensor	1 year	$549.99
LG DLEV833W	945	Moisture Sensor with Thermister control	5 years	$749.99

Clearly, the MayTag Dryer wins in kWh/year rating. However, further research in consumer reviews reveal that MayTag does not perform efficiently as a Dryer. Furthermore, the added feature of the LG dryer of a Thermister provides more control over the drying of a load. Moreover, the LG drum is stated to last 5 years, compared to the MayTag drum of 1 year, which saves cost in the long run. It is for these reasons that the LG DLEV833W is recommended. Furthermore, utilizing the same brand of LG for both the dryer and washer aids in making future problems for maintenance easier, compared to utilizing a variety of companies.

Figure Two: LG DLEV833W

3. Cleaning Products and Towels

3.1 Cleaning Products

Detergent (washing powder) is a substance that is added to laundry in order to make the laundry cleaner. Laundry detergent generally consists of ionic and anionic surfactants which can assist on removing dirt from the clothes. Laundry detergents usually have two forms, powder and liquid. Traditionally, laundry detergent is powdered, but the use of liquid detergent has increased annually. For powdered detergents, anticaking agents are required to prevent the powder from turning into a big lump in moist environment. For liquid detergents, because the product is mostly water, larger amount of detergents is required for every laundry. The other newer kind is biological laundry detergents which contain enzymes that can "eat" the dirt off of the laundry; however, since the enzymes function best at the temperature of 30°C to 50°C, warm water is required. Because Vancouver water temperature is relatively low, around 10°C in average, heating up water results additional energy consumption; therefore, biological detergents are not considered.

3.1.1 Comparison Between Powder and Liquid Detergents

Comparing with liquid detergent, powder detergent has the advantage of cheaper price, smaller packaging, lighter weight and less significant eutrophication affect, meaning that liquid detergents release a higher amount of organic chemicals into the aquatic environment.

Powdered detergent is more economic to use. For any given brand of detergent, the powdered detergent has cheaper cost per load than liquid detergent. Also, it is easier to control the dosage per use to reduce the amount of chemical goes into aquatic system. Powdered detergent seems to rinse better than liquid detergent, which can significantly decrease the water needed. Since powdered detergent is more concentrated, it always comes in smaller packages, and usually packed up with paper cardboard. However, package of liquid detergent is usually plastic bottle which is difficult to recycle and extremely harmful to our environment. Moreover, liquid is always heavier than powder, so the transportation cost, as well as the pollution due to transportation, for liquid is

higher than powder products. In contrast, liquid detergent is more dissolvable in cold water. Since average water temperature of Vancouver is relatively cold, when choosing appropriate product for New SUB laundry service, highly dissolvable product should be considered.

3.1.1.1 Environmental Impact of Liquid Laundry Detergent

The CO_2 (Carbon Dioxide) emission from liquid laundry detergent is one of the major impact to our ecological system. CO_2, known as "greenhouse gas", keeps thermal energy in air and causes the phenomenon called "global warming". The CO_2 emissions from laundry detergent used for an average load of laundry is approximately 0.7 kg which occupants about 0.5 square metres of space for natural habitat potential.

3.1.2 Introduction to EPA

Many of the laundry detergents displayed on store shelves laboured as "green", "organic" and "natural", but how can consumers know if they are really good for the environment? EPA (The United States Environmental Protection Agency) has a system to test these cleaning products by analyzing the ingredients of the products, if the chemical used is safe, a logo will be given and if opposite, the manufacture will be asked to reformulate. EPA is good for both environment and business, because less harmful chemical will flow into environment and the business with better products can be profited more.

3.1.3 Different Types of Laundry Detergents

Different brands of detergents have different advantages. The price, weight, package size, transportation cost and cleaning ability will be focused.

Table Three: Comparing Laundry Detergents

Type of Detergent	# of Loads	$/load	Details	Delivery Expense
 (Figure Three) LEGACY OF CLEAN™ SA8®+BIOQUEST® Refill	150	$0.264	- can be used for cleaning tough stains like blood, grass and food - recognized by EPA - no phosphates, chlorine or other unpleasant ingredients - good to use with various skin types	This product is shipped for free from Michigan, United States.
 (Figure Four) Gain HE 2x Concentrated Liquid Detergent, Original Fresh Scent, 64-Load Bottle	N/A	$0.749	- 2x formula, so smaller bottle, and less plastic used - Traditional detergent in a High Efficiency (HE) washer produces excess suds which could lead to washer problems. Only the use of a HE detergent ensures the proper performance of the washers. - special dirt capturing ingredients	This product is also shipped from United States with some areas restricted.
 (Figure Five) Mrs. Meyer's Clean Day Basil Laundry Detergent	N/A	$0.271	- concentrated, safe, gentle on clothes and powerful on removing dirt and grime - contains anionic surfactants from plant-derived sources, cotton extract, borax, dirt and stain-removing enzymes.	N/A

			-provides garden-fresh fragrance to laundry and HE compatible	
 (Figure Six) Purex classic Powder Detergent, Original Fresh	/A	$0.36	- environmental friendly packaging - recognized by EPA - has strong cleaning power and at same time, it is hypoallergenic.	This product is shipped from Florida, United States.

3.1.4 Recommendation

Compared with these four kinds of laundry detergents, the LEGACY OF CLEAN SA8+BIOQUEST Refill powdered detergent is the most compatible for the SUB Laundry Service. This product functions properly in cold water and HE machines which can save energy required for heating up water and the amount of water used. Also, its concentrated formula requires less packaging and is recognized by EPA as environmental friendly detergent. The package is re-sealable, so it can be recycled for refilling easily. Since the product is powdered, it is much lighter than the similar liquid products which can save considerable amount of energy during transportation. Its price is reasonable and shipment is free. All of these properties are fulfilled the requirements listed in the beginning, which are cheap price, minimum weight, small reusable and recyclable package, low transportation cost and efficient cleaning ability.

3.2 Towels

For New SUB Laundry Service, the towels used have to be durable because they will likely be washed frequently. Using durable towels means fewer towels are needed, thus, reducing the cost and waste. Also, organic towels are required to prevent environmental harmful substances damaging the aquatic system. White towels are preferred to decrease the pollution caused by dying.

3.2.1 Types of Towels

3.2.1.1 Microfiber Bath/Swimming Towels (20 x 40)

Microfiber towels are super absorbent, durable and drying fast which are composed of 80% of polyester for the purpose of softness and durable. The other 20% is polyamide which enhances the absorbency of microfiber towels. Because of the incredible absorbency (holds more than seven times liquid than the towel's original weight), people are not required to rub the skin constantly to get dried; as a result, it is comfortable for the people with sensitive

skin. Moreover, the durability of the microfiber towels reduces the replacement frequency and packaging. At same time, these towels require less energy for drying and do not require bleach or fabric softeners, minimizing the impact to our environment. Each towel costs $9.02 and free shipping is provided.

Figure Seven

3.2.1.2 Bamboo Towel Sets – Eco-Friendly Towels (30" x 56")

Bamboo towels are made from 100% bamboo yarn which makes the towels extremely soft and durable. They have better absorbability than cotton towels. These towels are naturally hypo-allergenic and anti-microbial. The three pieces set costs $42.50 ($14.2 for each).

Figure Eight

3.2.1.3 Organic Cotton Towel Set (28"x55")

These organic cotton towels are made from 100% organic cotton, which supports the organic cotton movement. Also, the multiple colours of towels are produced with low ecological impact dyes. Additional chlorine and softener are not necessary to preserve the purity and softness of the cotton. For each set of four, it costs $32 ($8.00 for each).

Figure Nine

3.2.2 Recommendations

Comparing the three bath towels, the microfiber bath towels are the most sustainable option for SUB laundry service. First, they are comfortable for people with different skin types because of the high absorbency. Second, the microfiber towels are durable and can be easily dried, meaning reduction in the amount of waste and energy consumption. Also, the price is acceptable and transportation fee can be neglected.

4.1 Concerns

In terms of studying the feasibility of this project, one has to consider various elements: economical, environmental, social, and political/regulatory.

4.1.1 Economical

If this project is to exist, it would require continuous funding from UBC, as there are continual OPEX (Operating expenditures) attributed to electricity, water consumption, maintenance, detergent, as well as labor, assuming that customers are not charged for this service. It is important to note that this project will only be in full operation for 9-10 months out of the year, as during winter, biking to UBC is not a feasible option. This implies that the spaces used for the laundry service will not be used throughout the year, and will serve as an unused investment.

Charging students for this service may damper the popularity of this service, so we are assuming that this service is to be provided free of charge at the moment. Going on the assumption that there is no charge for the customer to use this service, the payback period of 20 years is not to be calculated in an economical perspective, as there is no revenue being generated.

Using an economic perspective, an advantage for the user of this feature can be seen. If the assumption is that on average, people are willing to bike around 20 minutes to UBC, then it can concluded, after a quick calculation, that they are willing to travel 10km to UBC on average. It is researched that the average miles per gallon (MPG) of cars in the market today is 17MPG, meaning that each student saves 0.365 gallons of gas per person

each time he chooses biking instead of driving. The final dollar amount the student saves then, is equivalent to the gallons saved multiplied by the gas price added to the price of parking at UBC.

Note that this calculation is in no way comprehensive, but is a quick evaluation on its initial feasibility. But this dollar value can then be compared to the OPEX in order to find a best efficiency point, in which to answer the question: how many people does the SUB require to use this service in order to justify these expenses? These curves and graphs may be calculated in further studies. Another note to this, however, that the payback period here is then purely on the side of the students (saving on gas), and a loss of revenue is to UBC (parking fees are lost).

4.1.2 Environmental

Using the same calculation above, the gas consumption of each person who chooses to ride a car, who is statistically viable to bike to UBC can be attained. Using this gas consumption, we can then calculate the amount of pollution averted by biking.

This will be then compared to the environmental impact of the energy and water consumption added to the SUB, taking into account the fact that the currently sized washers/dryers and towels are capable of washing around 20 bath towels per cycle.

This analysis then reveals again, that there will be two graphs involved, one representing the environmental "help" per person who uses the bike, and the environmental "detriment" per person. It is then possible that this service would cause more detriment to the environment than it can help, if not enough people are stopping to drive, and biking due to this service. Graphing these two figures will reveal a point in which the most effective operation is reached, also answering the question, how many people will need to use this service, to make it environmentally feasible? Using this graph then reveals an estimated time horizon in which this project starts to become positively feasible in an economic sense. Without extensive study, it is difficult to predict its payback period as

there are many social considerations to consider that require more data and statistics to predict behavior.

4.1.3 Social

The first issue to take into consideration is, if funding is not available from UBC for this project, whether it will be necessary to charge users for this service. If this charge is included, will people be willing to use the facilities involved?

Another issue to be studied, is will people be willing to use towels washed by SUB services? Would the psychological view on hygiene affect their reactions to this service? This is a more sensitive arena, depending on psychological reactions, but is significant to consider, as its effects may invalidate the entire project. One would have to maintain a clean image of the SUB, to maintain the trust of people who utilize this service.

4.1.4 Political/Regulatory

Going forward with this project, one would have to consider regulatory issues that involve laundry services. One would have to follow strictly these specifications in order to be continually and legally in operation.

Opening the Student Union and UBC to these regulations may or may not be politically sensitive, as the failure to follow these regulations may open the campus to public scrutiny; which is another way to state: if towels are not cleaned well, hygienic issues may arise that can affect UBC's public image.

5. Conclusion and Recommendations

For the Laundry Services Project to be sustainable, the cleaning of the towels needs to be evaluated to determine its effect. The group has researched on available options, evaluated them by comparison, and have recommended one washing machine, drying machine, type of towel, and cleaning product as the most sustainable laundry machines and cleaning products. After comparing the MEF, WF, and the price, the LG WM2150H is decided to be the most energy efficient washing machine. This LG machine has an

MEF of 2.77 and WF of 3.4. In addition, LG is chosen as the brand for the most sustainable dryer, more specifically, the LG DLEV833W. Moreover, the microfiber towels are chosen as the most sustainable type of towel. Not only are microfiber towels highly absorbent, but they are also fairly durable. Like the shipping fee of the towels, the delivery expense of the picked detergent, LEGACY OF CLEAN™ SA8®+BIOQUEST® Refill, is free. This type of detergent is recognized by EPA.

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7. Appendices

Appendix A: Comparing Different Models

Brand	Model	Volume (cubic feet)	kWh/year	MEF	WF	Annual water use (gallons/year)	Price
Bosch	WAS20160UC	2.2	125	2.14	4.5	3907	1399.99
Bosch	WAS24460UC	2.2	130	2.22	4.5	3907	1499.99
Bosch	WFL2090UC	1.85	121	2.03	6.5	4692	1099.99
Bosch	WFVC3300UC	3.31	130	2.55	3.5	4541	1199.99
Bosch	WFVC5400UC	3.31	130	2.55	3.5	4541	1299.99
Bosch	WFVC540SUC	3.31	130	2.55	3.5	4541	1299.99
Bosch	WFVC5440UC	3.31	130	2.55	3.5	4541	1399.99
Bosch	WFVC8440UC	3.31	130	2.55	3.5	4541	1699.99
Electrolux	EIFLW55H	4.05	243	2.23	3.6	5731	1299.99
Electrolux	EIFLW55I	4.05	243	2.23	3.6	5731	1499.99
Electrolux	EWFLW65H	4.05	256	2.31	3.8	5985	1499.99
Electrolux	EWFLW65I	4.05	256	2.31	3.8	5985	1599.99
Frigidaire	FAFW3514K**	3	171	2.21	4.3	5045	999.99
Frigidaire	FAFW3517K**	3	182	2.26	3.7	4398	949.99
Frigidaire	FAFW3577K**	3	175	2.31	3.8	4481	1049.99
Frigidaire	FTF2140F	3	202	2.01	4.1	4845	749.99
Frigidaire	FTF530F	2.65	126	1.97	7	7272	649.99
Frigidaire	GLTF2940F	3	196	2.22	4.2	4951	799.99
General Electric	WCVH6800J	3.51	142	2.2	4	5496	1099.99
General Electric	WPDH8800J	3.61	191	2.23	4	5665	1399.99
General Electric	WPDH8900J	3.61	191	2.23	4	5665	1649.99
LG Electronics	WM2301H*	3.63	119	2.89	3.4	4781	1199.99
LG Electronics	WM2701H*	3.87	141	2.57	3.4	5158	1399.99
LG Electronics	WM2901H***	3.87	141	2.87	3.4	5128	1599.99
LG Electronics	WM3001H***	3.87	139	2.71	3.4	5082	1899.99
Maytag	MAH2400***	2.15	191	1.8	5.9	4964	849.99
Maytag	MHWE300W#**	3.51	161	2.31	4.1	5696	1149.99
Maytag	MHWE400W#**	3.86	165	2.59	3.8	5765	1399.99
Maytag	MHWE450W#**	3.86	165	2.59	3.8	5765	1499.99
Maytag	MHWE500V*+	3.47	138	2.35	3.8	5210	1499.99
Maytag	MHWE550W#**	3.86	147	2.66	3.6	5462	1699.99
Maytag	MHWE950W#**	3.86	141	2.58	3.5	5251	1699.99
Maytag	MHWZ400T*+	3.26	183	2.31	4.3	5444	849.99
Maytag	MVWB450W#**	4.31	282	2.21	4.2	7062	899.99
Maytag	MVWB850W#**	4.34	277	2.25	4.3	7384	1099.99
Samsung	WF203***	3.11	216	2.04	4	4876	949.99
Samsung	WF218***	3.43	130	2.65	3.2	4329	1199.99
Samsung	WF337***	3.43	210	2.4	3.6	4840	1599.99
Samsung	WF428***	3.86	162	2.7	3.4	5145	1799.99
Samsung	WF448***	3.86	162	2.7	3.4	5145	2099.99

Whirlpool	WFW9250W#**	3.46	139	2.45	3.9	5222	1249.99
Whirlpool	WFW9400V*+	3.51	186	2.29	3.9	5325	949.99
Whirlpool	WFW9450W*+	3.79	150	2.46	3.8	5675	1349.99
Whirlpool	WFW9550W*+	3.79	138	2.52	3.5	5259	1449.99
Whirlpool	WFW9750W#**	3.86	136	2.63	3.4	5190	1599.99
Whirlpool	WTW58ESVW1	3.46	224	1.81	7.1	9589	649.99
Whirlpool	WTW6500W*+	4.31	252	2.29	4.2	7079	949.99
Averages		**3.4656**	**169.92**	**2.3812**	**4.006**	**5344.52**	**1269.99**
General Electric	WBVH5300K	3.53	131	2.32	3.8	5183	799.99
Maytag	MHWZ600T*+	3.26	153	2.48	3.9	5009	949.99
LG	WM2150H**	3.52	117	2.77	3.4	4747	999.99