Savings Found From Reforming Laundry Room Habits and Installing New Clothes Dryers At Rutgers New Brunswick

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This report was written by members of

Students for Environmental & Energy Development (SEED)

Proposal Summary

Students for Environmental & Energy Development (SEED) found that by modifying student habits in the laundry room, the university could save $88,500 per year and by installing all new dryers, could save $81,200 a year. Altogether, this proposal indicates $150,300 in possible savings per year if students were to modify their habits and use new dryers. If money saved from implementing new student habits went into purchasing new dryers, the university could be outfitted with new dryers after six years.

Introduction

With well over 20,000 students living on-campus, residence halls and apartment buildings at Rutgers University-New Brunswick (RU-NB) consume a significant amount of energy. Students make a direct impact on energy consumption within on-campus living spaces in three specific areas: dorm rooms, bathrooms, and laundry rooms. SEED chose to focus on improving energy efficiency in laundry rooms not only because there are fewer laundry rooms than there are dorm rooms or bathrooms (making implementation easier), but because laundry rooms account for 27.8% of total energy used by on-campus college students (Steingard, 2009) . The total energy used in the laundry room depends on how the machines operate, and how the students operate the machines. SEED assessed both changing machines and changing student habits for reducing electricity consumed in the laundry room for a complete analysis. In terms of students operating machines, most are not conscious of how their selected settings, or load of laundry mass, can be inefficient and costly to the university as well as the environment. In terms of the machines and how they operate, the university is leasing machines that are inefficient compared to newer machine models. This impacts both University's budget and carbon footprint.

Through rigorous data acquisition and calculations with the supervision of Francis Jordan, a knowledgeable graduate student whose area of expertise is laundry machines, SEED believes that changing student habits as well as the machines they use can save the university from unnecessary money spent and the environment from carbon emissions.

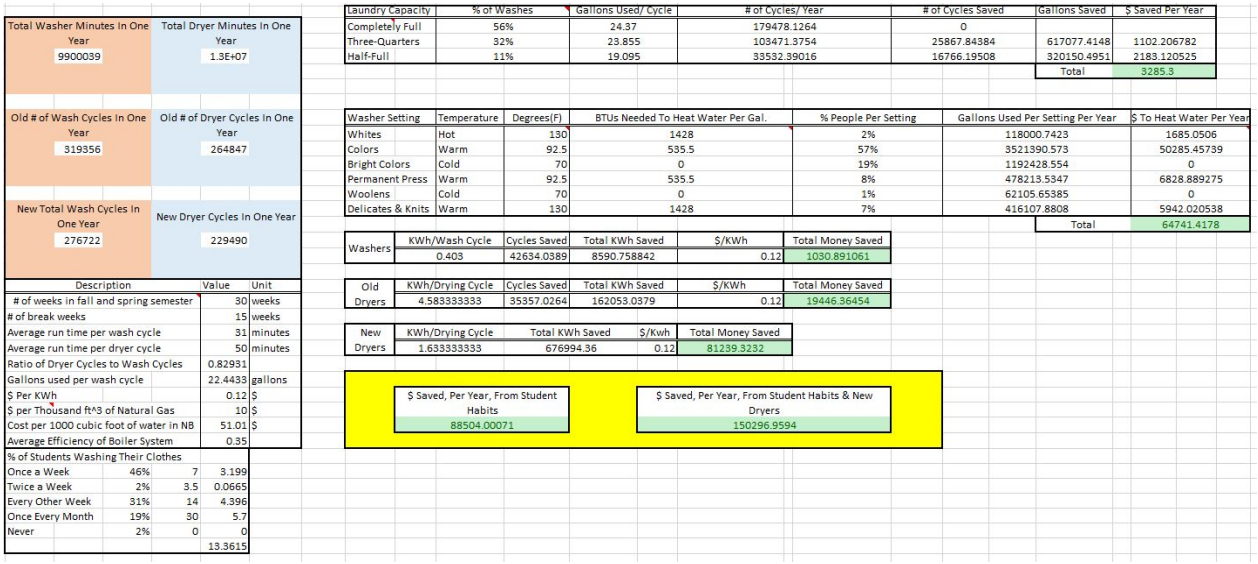
Cost and Energy Savings Per Machine

There were three major calculations made with washing machines: gallons saved when all students wash laundry with a full load, electricity saved when all students wash with a full load, and the natural gas saved when all students use cold water settings. There are 470 Maytag Energy Advantage Front-Load Washers in dorms and apartments at Rutgers University-New Brunswick (see Appendix C to see table used for this calculation). In total, washers run for around 9,900,000 minutes per year at RU-NB. With every wash cycle on average running 31 minutes long (see Appendix D), this is approximately 319,000 wash cycles run per year. The SEED team broke down each wash cycle into three types of capacities which were full (4.5 kg of laundry), three-quarters full (3 kg of laundry), and half-full (1 kg of laundry) capacity. SEED found that 56% of people wash their laundry with a full-load, 32% with a three-quarters full load, and 11% with a half-full load. A full load of laundry uses 24.4 gallons per cycle, a three-quarters full load of laundry uses 23.9 gallons per cycle, and a half-full load of laundry uses 19.1 gallons of water per cycle. Through these numbers, it was found that if all students washed their clothes with a full load, 42,600 wash cycles could be saved per year at Rutgers-New Brunswick. This equates to 937,000 gallons of water saved from being used which at $51 per 1000 cubic feet of water equates to $3,290 saved per year (Murtha, 2017). At 0.403 KWh per cycle and $0.12/KWh ($0.120156 was the exact price per KWh for Evan Lutz's last PSEG bill in New Brunswick),

42,600 wash cycles saved also equates to $1030 a year saved. With the new total of washing machine cycles per year, 229,000 cycles, the savings that would occur if all students switched to cold wash settings were then found. There are six available washer settings for washing machines at Rutgers and these are whites (hot water), colors (warm water), bright colors (cold water), permanent press (warm water), woolens (cold water), and delicates/knits (warm water). By using the SEED survey data, it was assumed that 2% of on-campus students at Rutgers use the whites setting, 57% use colors, 19% use bright colors, 8% use permanent press, 1% use woolens, and 7% use delicates/knits. The SEED team used the values of 70 degrees fahrenheit for cold water, 92.5 degrees fahrenheit for warm water, and 130 degrees fahrenheit for hot water (see Appendix H). It was then calculated that to heat the water from cold to warm, it would take 536 BTU's per gallon of water, and to heat the water from cold to hot it would take 1428 BTU's per gallon of water. These numbers were calculated using a boiler and distribution efficiency of 35% (Dentz, 2016), . The gallons used per year per setting, with the new count of wash cycles, were then calculated and a savings of $64,700 per year was found.

Overall, two calculations were made with dryers at RU-NB. The first was how much money would be saved with a new dryer cycle total, and the second was how much money could be saved if all of the dryers were replaced. There are 330 dryers in total at Rutgers New Brunswick. Of these dryers, 176 are single electric dryers, 73 are double electric dryers, 7 are single gas dryers, and 74 are double gas dryers. The ratio for dryer cycles used to wash cycles used was found to be .83, thus it was calculated that if 42,600 wash cycles were saved, 35,400 dryer cycles could be saved. At 4.58 KWh per cycle, this amounts to 162,100 cycles saved which at .12 KWh/$ is $19,400 saved a year. With this new dryer cycle total per year, it was then

calculated how much money could be saved a year if new dryers were implemented. If every dryer was replaced with the LG DLHX4072 model (see Appendix G for the spec sheet), which runs at 1.96 KWh per cycle and $0.12 per KWh equates to $81,200 a year. Refer to Figure 1 for the exact Excel sheet used for these calculations. There is a larger version of Figure 1 in Appendix K.



Total Washer Minutes In One Year	Total Dryer Minutes In One Year
9900039	1.3E+07

Old # of Wash Cycles In One Year	Old # of Dryer Cycles In One Year
319356	264847

New Total Wash Cycles In One Year	New Dryer Cycles In One Year
276722	229490

Description			Value	Unit
# of weeks in fall and spring semester			30	weeks
# of break weeks			15	weeks
Average run time per wash cycle			31	minutes
Average run time per dryer cycle			50	minutes
Ratio of Dryer Cycles to Wash Cycles			0.82931	
Gallons used per wash cycle			22.4433	gallons
$ Per KWh			0.12	$
$ per Thousand ft^3 of Natural Gas			10	$
Cost per 1000 cubic foot of water in NB			51.01	$
Average Efficiency of Boiler System			0.35	
% of Students Washing Their Clothes				
Once a Week	46%	7	3.199	
Twice a Week	2%	3.5	0.0665	
Every Other Week	31%	14	4.396	
Once Every Month	19%	30	5.7	
Never	2%	0	0	
			13.3615	

Laundry Capacity	% of Washes	Gallons Used/ Cycle	# of Cycles/ Year	# of Cycles Saved	Gallons Saved	$ Saved Per Year
Completely Full	56%	24.37	179478.1264	0		
Three-Quarters	32%	23.855	103471.3754	25867.84384	617077.4148	1102.206782
Half-Full	11%	19.095	33532.39016	16766.19508	320150.4951	2183.120525
					Total	3285.3

Washer Setting	Temperature	Degrees(F)	BTUs Needed To Heat Water Per Gal.	% People Per Setting	Gallons Used Per Setting Per Year	$ To Heat Water Per Year
Whites	Hot	130	1428	2%	118000.7423	1685.0506
Colors	Warm	92.5	535.5	57%	3521390.573	50285.45739
Bright Colors	Cold	70	0	19%	1192428.554	0
Permanent Press	Warm	92.5	535.5	8%	478213.5347	6828.889275
Woolens	Cold	70	0	1%	62105.65385	0
Delicates & Knits	Warm	130	1428	7%	416107.8808	5942.020538
					Total	64741.4178

	KWh/Wash Cycle	Cycles Saved	Total KWh Saved	$/KWh	Total Money Saved
Washers	0.403	42634.0389	8590.758842	0.12	1030.891061

	KWh/Drying Cycle	Cycles Saved	Total KWh Saved	$/KWh	Total Money Saved
Old Dryers	4.583333333	35357.0264	162053.0379	0.12	19446.36454

	KWh/Drying Cycle	Total KWh Saved	$/Kwh	Total Money Saved
New Dryers	1.633333333	676994.36	0.12	81239.3232

$ Saved, Per Year, From Student Habits	$ Saved, Per Year, From Student Habits & New Dryers
88504.00071	150296.9594

Figure 1: Excel Sheet Used For Calculations

Explanation of Calculations

SEED used a web-scraping script to get an accurate measure of the amount of time laundry machines are run at RU-NB. This script was deployed automatically every five minutes and scraped the eSuds site to get the number of laundry machines in use in each residence building at RU-NB. At the time of writing, a full school week was recorded as well as a full break week. To get the total amount of washer and dryer minutes in a year, the counts were multiplied by a factor of five, then the school week total minutes was multiplied by a factor of 30 (fall and spring semester are both 15 weeks). The break week total was multiplied by 15 to

represent the weeks in which Rutgers hosts students outside of fall and spring semester). See Figure 2 for a visual representation of the machine usage during each week type, Figure 3 for exact numbers, and Appendix A for an in-depth explanation.

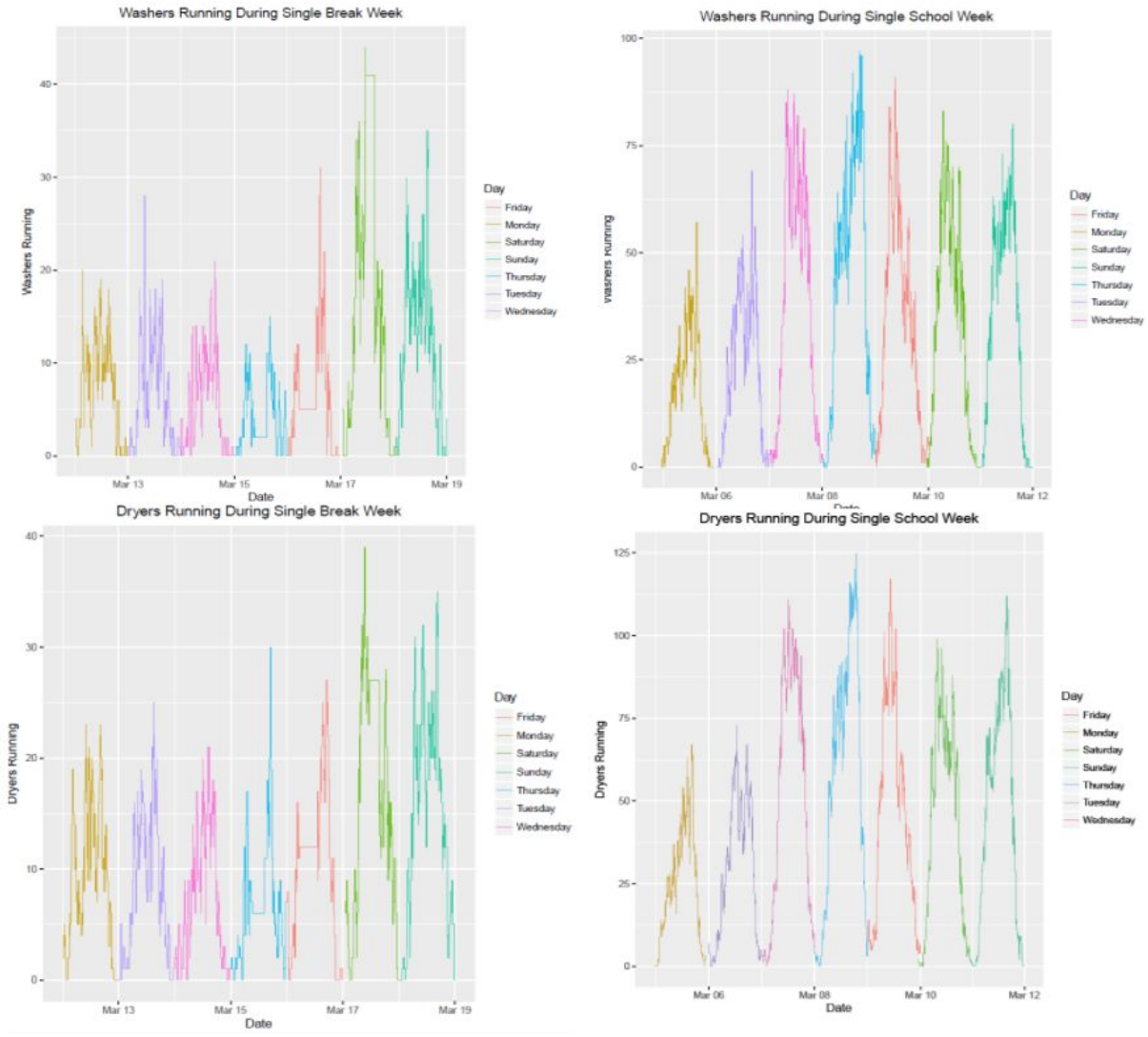


Figure 2: Data recordings of washer and dryer counts for one week of break and school.

Semester Week	Washers	Dryers		Break Week	Washers	Dryers
Monday	25280	34375		Monday	10540	13015
Tuesday	33095	42100		Tuesday	9655	11765
Wednesday	53655	74095		Wednesday	8690	11280
Thursday	60955	81820		Thursday	4530	7025
Friday	48490	65740		Friday	6450	8985
Saturday	46345	60335		Saturday	13855	15880
Sunday	47205	64055		Sunday	16475	20575
SUM	315025	422520		SUM	70195	88525

Figure 3: Exact minutes calculated for each kind of week and machine

Swati Modhwadia, with the help of Francis Jordan, spent upwards of six hours recording the electricity and water flow data for various washing cycles in Perry Hall. The team used the 1 kg, 3 kg, and 4.5 kg load masses for the experiment. These masses represented half-full, three-quarters full, and completely full loads for the specific size drum of the Maytag washing machine being used. Then, each load was tested twice under the whites setting and two, three-quarters full testings, were completed with the permanent press setting. The results from the whites setting were only used and the gallons per capacity were averaged. From these testings it was found that 31 minutes was the average run time for a washer. Unfortunately, there was not enough time to translate the plug flow data for the electricity of the washing machine, and there was also no time to test the drying machines within Perry Hall. As a result of this experiment, the SEED team was able to retrieve gallons used per washing machine capacity. The SEED team was also able to read the fine details on the washing machines and understand how settings translate to temperature. Using data from eSuds, the team calculated the average run time for the dryers used is 50 minutes. See Appendix B for experimental data.

The SEED team created laundry room habits survey to get student habit input. Within this survey, the following questions were asked:

- What dormitory do you wash your clothes in?
- About how much do you usually fill the washer?
- What washer setting do you normally use?
- Which dryer setting do you normally use?
- When drying your clothes, how often do you remove lint from your dryer screen?
- How often do you wash your clothes or bed sheets in on-campus laundry rooms?

In total, 105 people answered our survey. See Appendix E for further details.

Michael Kornitas, the energy conservation manager for Rutgers University, assisted SEED by providing an Excel sheet of all the washers and dryers on-campus at Rutgers, as well as the specifications for these machines. These specifications were used to determine the KWh for each machine. It must be noted that although there were four kinds of dryers, it was assumed that every dryer was the same in these calculations. The SEED team used specifications from the single electric dryers. See Appendix F for the specification sheets used and Appendix C for the the total washer and dryer counts.

Lastly, there is some multiplication that requires explaining. To find the amount of british thermal units required to increase the temperature of water, the change in temperature required was multiplied by a factor of 8.8. To obtain how many 1000 cubic feet of gas this is, the british thermal units were divided by 1,000,000. Kilowatt hours were calculated by multiplying the given KWh(s) on the specification sheets, by the run time for each cycle. The information from Appendix I helped the SEED team make these calculations.

Implementation Suggestions

1. Using eSuds data, the SEED team has calculated the buildings that contribute the most to dryer usage and have the most instances of at least one dryer running. Therefore, SEED recommends that dryers are replaced two at a time to the buildings in the order specified in Appendix J.
2. The posters should be placed directly next to the eSuds payment box of every laundry room. The posters will recommend students to add 4.5 kg of laundry and encourage them to use cold water unless they are removing stains.
3. A scale should be included in each laundry room and placed underneath every poster to help students figure out how much their laundry weights. The BalanceFrom High Accuracy Digital Bathroom Scale with Backlit Display and Step-On Technology is a good scale to use. It costs only $10.00, has an accuracy of .2 lbs, and runs on batteries, which is relatively inexpensive and does not require an outlet.
4. Cold water detergents can be made more accessible to students by adding them to vending machines in the residence halls. The detergent would be sold in single-use packets. One detergent that can be sold is the Lewis N. Clark Woolite Travel Laundry Liquid Soap. It comes in a 20 pack that is sold online for $10.58, making it suitable for selling in vending machines.

Implementation Timeline.

Our plan for making the laundry rooms at Rutgers more sustainable can be split up into two stages: immediate changes and progressive changes. Immediate changes to the laundry

rooms would include implementing posters encouraging students to use 4.5 kg loads of laundry as well as cold water settings, installing scales to measure the weight of the laundry before washing, and making cold water laundry detergent available for students. These immediate changes will encourage and inform students to have more eco-friendly laundry habits. Not only do these immediate changes help the environment and reduce carbon emissions, but it will also save Rutgers money. Rutgers can save an estimated $88,504 from these changes in student habits alone. As the university saves money from implementing low-cost laundry room changes, the SEED team recommends the university reinvest this money for progressive, more expensive changes. The progressive changes include changing the current dryers in the laundry rooms to more efficient and newer models. Currently, the most efficient dryer model is the LG DLHX4072, which retails for $1,530 and costs $550 to install and ship. It will cost Rutgers an estimated $2,080 at the very most to replace one dryer. By reinvesting savings from student habit changes, Rutgers will not need to spend any additional money to replace all the dryers throughout Rutgers laundry rooms. By looking at the provided Excel sheet it is apparent that this process of replacing the dryers will take six years, and afterwards, Rutgers will begin collect the full yearly savings of $150,300 from these changes. The amount of dryers to be bought each year was calculated by dividing the total profit by the cost of buying and installing a single dryer. This gives the amount of dryers that can be bought for that year. The total profit was calculated by adding the savings from student habits to the savings from the new dryers. The savings from the new dryers were calculated by multiplying the savings from one dryer by the current number of new dryers. Refer to Figure 4 for calculations.

	$ from Student Habits	$ from One New Dryer	Current # of New Dryers	$ from New Dryers	Total Profit	Cost of New Dryer and Installation ($)	# of New Dryers Gained
Year 1	88504	248.44	0	0	88504	2079	42
Year 2	88504	248.44	42	10434.48	98938.48	2079	47
Year 3	88504	248.44	89	22111.16	110615.16	2079	53
Year 4	88504	248.44	142	35278.48	123782.48	2079	59
Year 5	88504	248.44	201	49936.44	138440.44	2079	66
Year 6	88504	248.44	267	66333.48	154837.48	2079	60
						Total # of New Dryers Installed:	327

Figure 4: Calculations for the 6 year implementation of new dryers.

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Appendix A

Data Collection

eSuds is a service employed by Rutgers University that gives laundry users in Rutgers buildings more information about the status of their loads. The washers and dryers are connected to a computer so when a student begins a cycle, the computer will post information about that machine to the eSuds website. A user can look at the eSuds site to see how many minutes are left in a cycle and which machines are available.

The eSuds site is the starting point of our data pipeline. Our script, implemented in Python, sends a web request to the eSuds public API. The eSuds site will respond with data encoded in HTML about a specified Rutgers building. Using a web-scraping library called BeautifulSoup, the script will parse the HTML response and extract the number of machines with the status 'In Use', meaning it will count the number of running machines.

This script can be used to get the number of running machines (washers and dryers) in Rutgers Buildings at any given time. However, to get an estimation of the number of minutes these machines are running, this script must be run at multiple times.

Using the Amazon Web Services serverless computation platform Lambda, this script is automatically deployed and run every five minutes. When deployed, it performs the steps previously outlined and appends the number of running washers and dryers to a file in Amazon's S3 data storage.

Appendix B

Programs	Load Size(kg)	Start		End:		Subtotal		Total:(gallons)
		Hot water(gal	Cold water:(gal)	Hot water(gal	Cold water:(gal)	Hot:(gallons)	Cold:(gallons)	
Whites	3	50.63	155	60.62	168.88	9.99	13.88	23.81
	3	56.29	1171.42	66.78	1184.83	10.49	13.41	23.9
	1	66.78	1184.83	74.48	1196.27	7.7	11.44	19.14
	1	47.67	55.34	53.32	68.74	5.65	13.4	19.05
	4.5	63.27	185.53	76.3	200.54	11.03	15.01	26.04
	4.5	53.32	68.76	60.79	84.01	7.47	15.25	22.72
Permanent Press								
	3	44.73	35.21	47.67	55.34	2.94	20.13	23.07
	3	60.62	168.88	63.27	185.53	2.65	16.65	19.3

Appendix C

Rutgers University Laundry Equipment Inventory 2018

CAMPUS	LOCATION NAME	Washer	Single Electric Dryer	Double Electric Dryer	Single Gas Dryer	Double Gas Dryer	Combo Washer / Electric Dryer
BUSCH	Allen Hall	4		2			
BUSCH	[redacted]	4		2			
BUSCH	[redacted]	6		3			
BUSCH	[redacted]	6		3			
BUSCH	[redacted]	3		2			
BUSCH	[redacted]	14		8			
BUSCH	[redacted]	1	1				
BUSCH	[redacted]	1	1				
BUSCH	[redacted]	2	2				
BUSCH	[redacted]	1	1				
BUSCH	[redacted]	4				2	
BUSCH	[redacted]	4				2	
BUSCH	[redacted]	4				2	
BUSCH	[redacted]	4				2	
BUSCH	[redacted]	4				2	
BUSCH	[redacted]	4				2	
BUSCH	[redacted]	1	1				
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BUSCH	[redacted]	2	2				
BUSCH	[redacted]	1	1				
BUSCH	[redacted]	7	7				
BUSCH	[redacted]	7	7				
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BUSCH	[redacted]	2	2				
BUSCH	[redacted]	1	1				
BUSCH	[redacted]	8	8				
BUSCH	[redacted]	8	8				
BUSCH	[redacted]	18	20				
	Page Subtotal	142	81	22	0	12	0

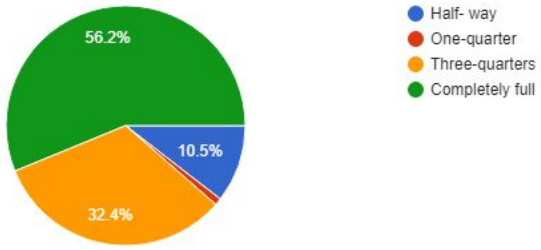
Appendix D

This picture represents the common time it took for a load of laundry to go through the washing machine, also the bottom sticker represents the temperatures associated with each setting.

Appendix E

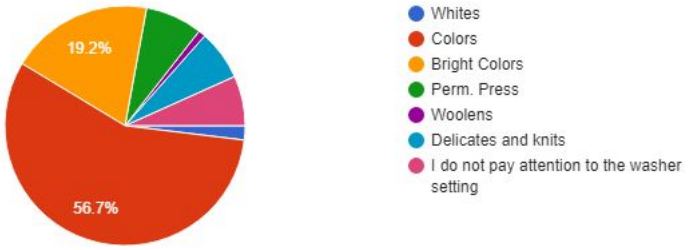
About how much do you usually fill the washer?

105 responses



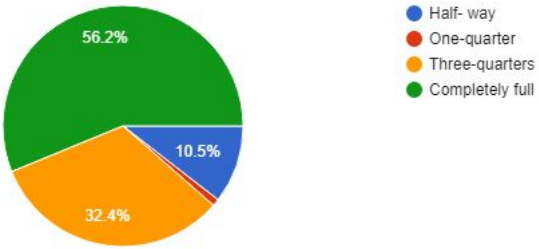
Which washer setting do you normally use?

104 responses



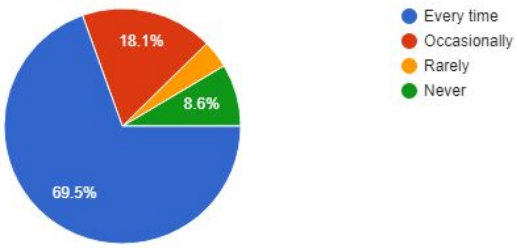
About how much do you usually fill the washer?

105 responses



When drying your clothes, how often do you remove lint from your dryer screen?

105 responses



Appendix F

MAH22PD

MAYTAG® COMMERCIAL ENERGY ADVANTAGE™ HIGH-EFFICIENCY FRONT-LOAD WASHERS

MAYTAG COMMERCIAL LAUNDRY

LEGENDARY MAYTAG DEPENDABILITY

Maximizing your equipment investment for over a half century.

A COMPLETE LINE OF ENERGY-EFFICIENT SOLUTIONS

Maytag built the first appliance ever to receive the ENERGY STAR® label. Today we offer a complete line of high-efficiency laundry appliances — from energy-efficient dryers to highly efficient ENERGY STAR®-qualified washers — to help you save money and build profits.

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- Easy-To-Use One-Touch Cycle Selection
- Flexible Wash Options
- Time Remaining Display
- Automatic Detergent, Softener And Bleach Dispenser
- Large Window For Convenience
- Front Controls For Ease-Of-Use
- ADA Compliant With Optional Pedestal

FOR YOUR OPERATION:

- High Efficiency Design Offers Significant Utility Savings
- Super Cycle Option Increases Revenue
- Self-Diagnostic Feature Cuts Service Cost And Minimizes Downtime
- Accu Trac® Audit System With Two-Way Data Communication
- Debit Card Compatibility
- Advanced Computer Trac® Controls Allow For Easy Programming
- Simple Soft-Mount Design For Easy Installation
- Dual Coin-Drop Option

BUILT-TO-LAST™ FEATURES:

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- Precision Endurance Drive
- Centrifuged Induction Motor
- High Security Vault
- Best Warranty In The Business

SAVE UP TO 50% OR MORE EVERY YEAR* ON ENERGY, WATER AND SEWER COSTS.

* Based on ANAV load sizes. Individual savings may vary.

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www.maytagcommerciallaundry.com

OUR COMMITMENT TO DEPENDABLE QUALITY

At Maytag, we believe durable goods should remain just that. That's why every Maytag® product is constructed of the highest-quality materials and with the utmost in precision craftsmanship. It's also why we stand behind our equipment with solid service and support from our professional Maytag laundry suppliers. Simply put, when you choose Maytag® products, you ensure your peace of mind.

MAH22PD

MAYTAG® COMMERCIAL ENERGY ADVANTAGE™ HIGH-EFFICIENCY FRONT-LOAD WASHERS

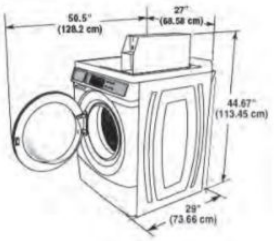
Maytag® Energy Advantage™ Front-Load Washer

MICROPROCESSOR COIN-DROP

WASHER SPECIFICATIONS	
MODEL	MAH22PD
MOTOR	
Variable-speed, reversible, thermoprotected, high-efficiency, controlled induction	•
Wash — HP (kw)	.17 (.13)
Extract — HP (kw)	.87 (.65)
APPROXIMATE WATER USAGE — gallons (liters)	
Average hot water usage per cycle	1.60*
Average total water usage per cycle	11.80*
ELECTRICAL RATING	
Domestic model — voltage	120V/60Hz
Export model — voltage	220-240V/50Hz
BREAKER/FUSE REQUIREMENTS	
Domestic amps	15
Export amps	10
CYLINDER	
Volume — cu. ft. (liters)	2.99 (84.7)
Diameter — in. (mm)	21.6 (548)
Depth — in. (mm)	13.5 (342)
DOOR OPENING	
In. (mm)	14 (355.6)
WASH SPEED	
RPM	40
EXTRACT SPEED	
Maximum rpm	1,000
Maximum g-force	306
OPERATING PRESSURE	
Psi (bar)	20-100 (1-8)
INLET HOSE	
Ft. (m)	4 (1.22)
DRAIN HOSE	
Ft. (m)	6 (1.83)
ADJUSTABLE LEVELING LEGS	•
APPROXIMATE WEIGHT	
Crated — lbs. (kg)	263 (119.3)
Uncrated — lbs. (kg)	243 (110.2)
DIMENSIONS	
Width — in. (mm)	27 (685.8)
Depth — in. (mm)	29 (736.6)
Height — in. (mm)	44.67 (1134.52)

* Average based on 2 testing with factory preset cycles.

See specific instructions for proper installation. Because of continuous product improvement, Maytag reserves the right to change specifications without notice.



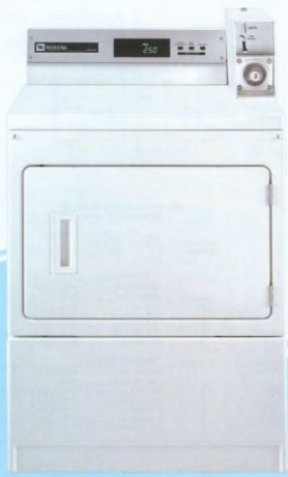
5 YEARS ON ALL PARTS

For a period from the date of original purchase through the time listed above, the designated parts that fail in normal commercial use will be repaired or replaced free of charge for the part itself, with the owner paying all other costs, including labor, transportation and customs duty. Chemical damage is excluded from all warranty coverage. See complete warranty for details.

MDE/MDG17PD

MAYTAG® COMMERCIAL SUPER-CAPACITY DRYER

MAYTAG COMMERCIAL LAUNDRY



LEGENDARY MAYTAG DEPENDABILITY

Maximizing your equipment investment for over a half century.

FOR YOUR CUSTOMERS:

- Extra-Large 7.4 cu. ft. Capacity
- Easy To Use One-Touch Cycle Selection
- High Air Flow For Better Clothes Care
- Time Remaining Display
- Optional Top Off

FOR YOUR OPERATION:

- TurboVent™ — Better Performance On Long Vents
- Advanced Computer Trac® Controls Allow For Easy Programming
- Front Access For Easier Self Service
- Accu Trac® Audit System With Two-Way Data Communication
- Large-Capacity Metal Mesh Lint Filter
- Debit Card Compatibility
- Dual Coin-Drop Option

BUILT-TO-LAST™ FEATURES:

- Premium Porcelain-Enamel Top
- Four Roller Suspension With Permanently Lubricated Bearings
- Blower Guard Reduces Service Calls
- High Security Vault
- Best Warranty in the Business

FASTER DRYING WITH TURBOVENT™

LAUNDRY SOLUTIONS YOU CAN DEPEND ON.

CLP88

MAYTAG COMMERCIAL LAUNDRY

www.maytagcommerciallaundry.com

OUR COMMITMENT TO DEPENDABLE QUALITY

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MDE/MDG17PD

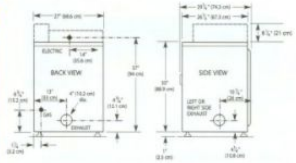
MAYTAG® COMMERCIAL SUPER-CAPACITY DRYER

Maytag® Super-Capacity Dryer

MICROPROCESSOR COIN-DROP

DRYER SPECIFICATIONS	
MODEL	MDE/MDG17PD
MOTOR	
Single-phase, thermoprotected against overload, auto-reset	•
HP (kw)	½ (.25)
CAPACITY	
Cu. ft. (liters)	7.4 (209.5)
AIRFLOW	
Gas models — cfm (cmm)	230 (6.5)
Electric models — cfm (cmm)	215 (6.1)
TUMBLE SPEED	
RPM	51.5 ± 3
ELECTRICAL REQUIREMENTS	
MDE model — voltage	240V/60Hz
MDG model — voltage	120V/60Hz
BREAKER/FUSE REQUIREMENTS	
MDE model — amps	30
MDG model — amps	15
APPROXIMATE OVERALL DRAW	
Watts	6,000
EXHAUST DUCT DIAMETER	
In. (mm)	4 (101.6)
ELECTRONIC BURNER IGNITION	
MDG model	•
GAS RATING	
MDG model — BTU/hr. (kcal/hr.)	24,000 (6,048)
GAS INLET	
MDG model — in.	¾ N.P.T.
AUTOMATIC PRESSURE REGULATOR	
MDG model	•
ADJUSTABLE LEVELING LEGS	•
APPROXIMATE WEIGHT	
Crated — lbs. (kg)	153.5 (69.6)
Uncrated —lbs. (kg)	139.5 (63.3)

See specific instructions for proper installation. Because of continuous product improvement, Maytag reserves the right to change specifications without notice.



MAXIMUM EXHAUST DUCT LENGTH PER NUMBER OF TURNS

Number Of 90° Turns

Rigid Metal Vent

	Box Hood and Louvered Style	Angled Hood Style
0	135 ft. (41.2 m)	129 ft. (39.3 m)
1	125 ft. (38.1 m)	119 ft. (36.3 m)
2	115 ft. (35.1 m)	109 ft. (33.2 m)
3	106 ft. (32.3 m)	100 ft. (30.5 m)
4	98 ft. (29.9 m)	92 ft. (28.0 m)

Flexible Metal Vent

	Box Hood and Louvered Style	Angled Hood Style
0	76 ft. (23.2 m)	62 ft. (18.9 m)
1	71 ft. (21.6 m)	57 ft. (17.4 m)
2	67 ft. (20.4 m)	53 ft. (16.2 m)
3	65 ft. (19.8 m)	51 ft. (15.6 m)
4	63 ft. (19.2 m)	49 ft. (14.9 m)

5 YEARS ON ALL PARTS

For a period from the date of original purchase through the time listed above, the designated parts that fail in normal commercial use will be repaired or replaced free of charge for the part itself, with the owner paying all other costs, including labor, transportation and customs duty. Chemical damage is excluded from all warranty coverage. See complete warranty for details.

Appendix G

ENERGY STAR Most Efficient 2018 — Clothes Dryers

LG DLHX4072*

LG
DLHX4072*

Type	Electric
Drum Capacity (cu-ft)	7.3
Height (inches)	38.69
Width (inches)	27.0
Depth (inches)	30.0
Combined Energy Factor (CEF)	4.3
Estimated Annual Energy Use (kWh/yr)	556
Estimated Energy Test Cycle Time (min)	58
Paired ENERGY STAR Clothes Washer Available	No
Additional Dryer Features	Drum light,Time remaining display,Wrinkle prevention option,Steam cycle,Sanitization cycle
Vented or Ventless	Vented
Connected	No
Date Available on Market	08/22/2014

- EcoHybridTM Energy-Saving Technology saves money and energy with every load
- 7.3 cu. ft. ultra large capacity handles large loads & saves time
- TrueSteam Technology generates real steam to reduce wrinkles
- With 5 drying levels allow versatile clothing care options
- SmartDiagnosis

The key number to look at here is KWh per year. Energy Star assumes 283 cycles per year and 556 divided by 283 gives 1.96 KWh.

Appendix H

Screenshot taken from Maytag Commercial Washer Advice

https://www.maytagcommerciallaundry.com/content.jsp?pageName=FAQwashers-Q24

- Use a hot water (120-140 degrees F) wash for most white fabrics and heavily soiled colored fabrics, if they are colorfast.
- A warm (80-105 degrees F) wash is the best choice for most other clothes.
- A cold (65-75 degrees F) wash is recommended for very lightly soiled or brightly colored garments.
- Keep in mind, cold water should not be lower than 65 degrees F. If the temperature is below 65 degrees F, select a warm wash water setting or partially fill with warm water and complete the fill with cold water.
- Use a liquid detergent when washing in cold water.
- Pour the detergent into the washer tub before adding the load, or into the dispenser.
- If using warm or cold water, add a non-chlorine bleach (like Clorox 2) for better cleaning or presoaking heavily soiled items
- To save energy, always use a cold rinse. A cold rinse is just as effective as a warm one.

Appendix I

What Does It Cost To Heat Your Water?

It is generally accepted that it costs about 1¢ to 2¢ to heat a gallon of water. The exact amount will depend on the efficiency of your water heater, whether you use gas or electric and exactly what your electric or gas costs are.

Energy Required To Heat 1000 Gallons Of Water

- A Btu, or British thermal unit, is the amount of energy needed to raise one pound of water from 60°F to 61°F at sea level.
- A gallon of water weighs 8.33 lbs.
- If the incoming water is 60°F and we want to raise it to 140°F, that is a 80°F rise.
- Heating a gallon of water thus requires 8.33 x 80 = 667 Btu's, at 100% efficiency.

Cost To Heat Water Using Natural Gas

- A typical gas tank water heater is only 59% efficient. It takes 667 ÷ 59% = 1131 Btu's to heat a gallon of water with gas
- One therm is 100,000 Btu's. One Btu is 0.00001 therms
- 1131 Btu's is 0.0113 therms.
- It will take 0.0113 therms to heat a gallon of water, or 0.0113 x 1000 = 11.31 therms to heat 1000 gallons.
- At $1.20 /therm, it costs 11.31 x $1.20 = $13.58 to heat 1000 gallons.

Cost To Heat Water Using Electricity

- A typical electric water heater is 90.4 to 95% efficient or 92.7% average efficiency.
- It takes 667 ÷ 92.7% = 720 Btu's to heat a gallon of water using electricity.
- One kWh is 3413 Btu's. One Btu is 0.000293 kWh.
- 667 Btu's x 0.000293 kWh/Btu = 0.195 kWh
- It will take 0.195 kWh to heat a gallon of water, or 0.195 x 1000 = 195 kWh to heat 1000 gallons
- At $0.11/kWh, it costs 195 x $0.11 = $21.45 to heat 1000 gallons of water

This information was found from

http://webbsupplycompany.com/scalesafe/what-does-it-cost-to-heat-your-water/.

Appendix J

Rank	eSuds Building Code
1	1672
2	1572
3	1575
4	2043488
5	2043487
6	2043489
7	2076549
8	1218
9	2083734
10	1306

Appendix K

Total Washer Minutes In One Year	Total Dryer Minutes In One Year
9900039	1.3E+07

Old # of Wash Cycles In One Year	Old # of Dryer Cycles In One Year
319356	264847

New Total Wash Cycles In One Year	New Dryer Cycles In One Year
276722	229490

Description	Value	Unit
# of weeks in fall and spring semester	30	weeks
# of break weeks	15	weeks
Average run time per wash cycle	31	minutes
Average run time per dryer cycle	50	minutes
Ratio of Dryer Cycles to Wash Cycles	0.82931	
Gallons used per wash cycle	22.4433	gallons
$ Per KWh	0.12	$
$ per Thousand ft^3 of Natural Gas	10	$
Cost per 1000 cubic foot of water in NB	51.01	$
Average Efficiency of Boiler System	0.35	

% of Students Washing Their Clothes			
Once a Week	46%	7	3.199
Twice a Week	2%	3.5	0.0665
Every Other Week	31%	14	4.396
Once Every Month	19%	30	5.7
Never	2%	0	0
			13.3615

Laundry Capacity	% of Washes	Gallons Used/ Cycle	# of Cycles/ Year	# of Cycles Saved	Gallons Saved	$ Saved Per Year
Completely Full	56%	24.37	179478.1264	0		
Three-Quarters	32%	23.855	103471.3754	25867.84384	617077.4148	1102.206782
Half-Full	11%	19.095	33532.39016	16766.19508	320150.4951	2183.120525
					Total	3285.3

Washer Setting	Temperature	Degrees(F)	BTUs Needed To Heat Water Per Gal.	% People Per Setting	Gallons Used Per Setting Per Year	$ To Heat Water Per Year
Whites	Hot	130	1428	2%	118000.7423	1685.0506
Colors	Warm	92.5	535.5	57%	3521390.573	50285.45739
Bright Colors	Cold	70	0	19%	1192428.554	0
Permanent Press	Warm	92.5	535.5	8%	478213.5347	6828.889275
Woolens	Cold	70	0	1%	62105.65385	0
Delicates & Knits	Warm	130	1428	7%	416107.8808	5942.020538
					Total	64741.4178

	KWh/Wash Cycle	Cycles Saved	Total KWh Saved	$/KWh	Total Money Saved
Washers	0.403	42634.0389	8590.758842	0.12	1030.891061

	KWh/Drying Cycle	Cycles Saved	Total KWh Saved	$/KWh	Total Money Saved
Old Dryers	4.583333333	35357.0264	162053.0379	0.12	19446.36454

	KWh/Drying Cycle	Total KWh Saved	$/Kwh	Total Money Saved
New Dryers	1.633333333	676994.36	0.12	81239.3232

$ Saved, Per Year, From Student Habits	$ Saved, Per Year, From Student Habits & New Dryers
88504.00071	150296.9594