Southern California Edison
High-Performance Clothes Washer Demonstration
at Leisure World Laguna Woods
Final Report

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Executive Summary

In response to increasing electricity demand, escalating cost, and its underserved multifamily sector, Southern California Edison (SCE) commissioned Battelle Pacific Northwest Laboratory (Battelle) to evaluate the energy and water efficiency of high-performance coin-operated clothes washers installed in a multifamily setting in Southern California. The site selected was Leisure World, a prominent senior citizen community located in Laguna Woods, CA. This report provides the results of this evaluation.

The approach included the baseline metering (Phase I) of clothes washers in three laundry buildings located at Leisure World. Each building containing four vertical-axis General Electric (GE) clothes washers. The Phase I effort lasted about six weeks. The Phase II effort followed with the installation of 12 high-performance clothes washers, four from each of three different manufacturers (Maytag, Speed Queen, and Whirlpool). In Phase II, each of the laundry buildings had clothes washers from one manufacture. Table S.1 presents the participating clothes washer characteristics. Note that of the new equipment installed only the Whirlpool is a top-loading vertical axis washer, the other two are front-loading horizontal axis washers.

The same parameters were metered in Phase I and Phase II, these were:

- hot and cold water volumes
- hot and cold water temperatures
- motor electricity use.

All parameters were captured on a per-cycle basis.

The efficiency results presented below are from data for over 350 clothes washer cycles from each manufacturer's clothes washers. The average number of cycles per day per machine for the study period varied between 1 and 4; the overall average was 2.2 cycles per day per machine.

Figure S.1 presents the clothes washer water use in gallons per cycle. All three high-performance washers showed a reduced total water use when compared to the baseline GE washers. The baseline average water use was 37.9 gallons/cycle, while the Maytag used 15.4 gallons/cycle, the Speed Queen used 17.0 gallons/cycle, and the Whirlpool used 27.4 gallons/cycle. The average water savings compared to the baseline GE washers were Maytag with 22.5 gallons/cycle, Speed Queen with 20.9 gallons/cycle, and Whirlpool with 10.5 gallons/cycle. Table S.2 presents these savings and the percentage savings in relation to the GE Baseline.

Table S.1. Participating Manufacturer Clothes Washer Characteristics

Clothes Washer Manufacturer (Model No.)	Tub Volume (cu ft)	Axis of Rotation of Tub	Clothes Loading Direction	Age of Equipment (years)	Approximate Retail Cost (Dec., 2000)
General Electric/GE (WCCD2050Y) Baseline Clothes Washer	2.7	Vertical (V-axis)	Top	2-14	$640
Maytag/Maytag Corp. (MAH20PD)	2.85	Horizontal (H-axis)	Front	New	$1,500(1)
Speed Queen/Alliance Laundry Systems (SWR 261)	2.8	Horizontal (H-axis)	Front	New	$1,250(1)
Whirlpool/Whirlpool Corp(2) (Commercial Resource Saver)	3.0	Vertical (V-axis)	Top	New	$700-$900 (3)

(1) This washer will qualify for a $250 water utility rebate beginning in February 2001, per discussions with Joe Berg, Water Use Efficiency Program Manager, Municipal Water District of Orange County.
(2) Whirlpool washers in the study are a pre-production commercial version of the residential Resource Saver washer. A new version of this washer is expected to be commercially available in the fall of 2001.
(3) Whirlpool cost is a best estimate received from sales staff.

As with the total water consumption, significant hot and cold-water use reductions were found for the three high-performance washers. Figure S.1 also breaks out the total average water use into the hot and cold-water components. The baseline average hot water use was 10.3 gallons/cycle. The three high-performance washers reduced the average hot water use to 2.7 gallons/cycle with Maytag, 2.9 gallons/cycle with Speed Queen, and 7.3 gallons/cycle with Whirlpool.

Figure S.2 presents the average energy use (hot water and motor/controls energy use) in kilowatt-hours (kWh) per cycle. All three high-performance washers showed a reduced energy use compared to the baseline washer, with Maytag at 0.58 kWh/cycle, Speed Queen at 0.57 kWh/cycle, and Whirlpool at 1.38 kWh/cycle. Table S.3 presents these savings and the percentage savings in relation to the GE Baseline.

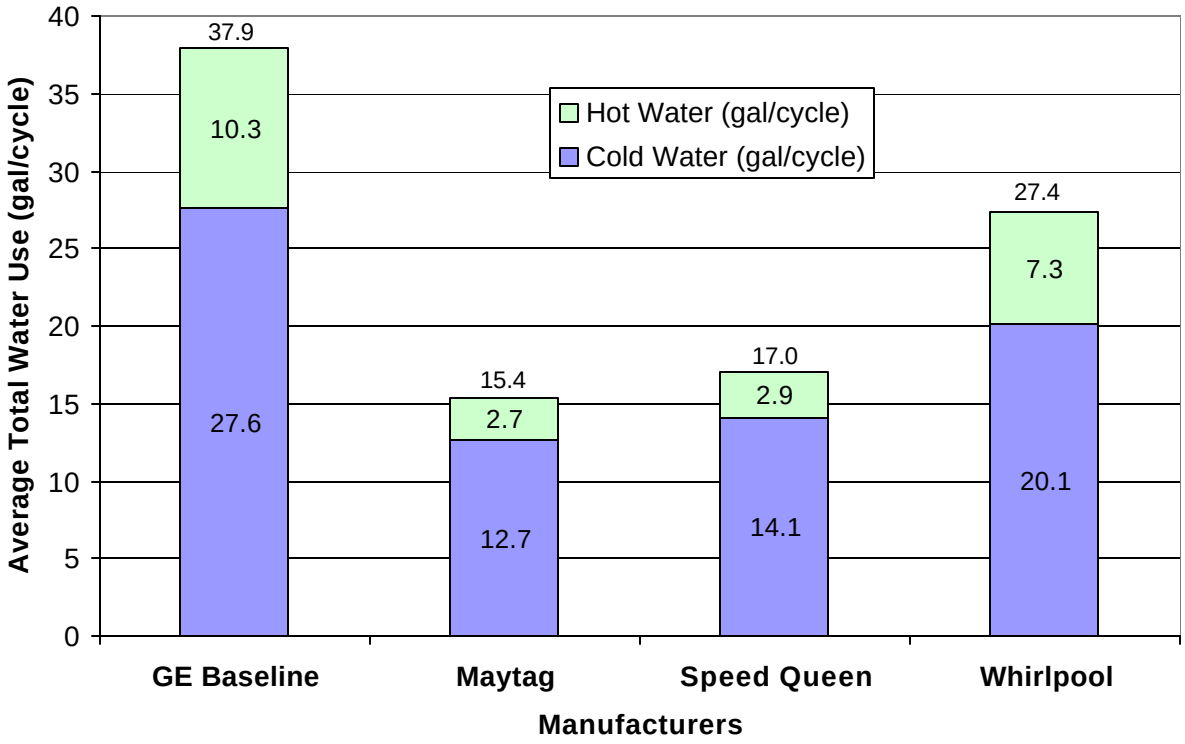

Figure S.1. Leisure World Average Clothes Washer Water Use (gallons/cycle)

Table S.2. Summary of Per-Washer Average Water Savings Compared to GE Baseline

Clothes Washer Manufacturer	Average Water Savings Compare to GE Baseline (gal/cycle)	Percent Water Savings Compared to GE Baseline
Maytag	22.5	59%
Speed Queen	20.9	55%
Whirlpool	10.5	28%

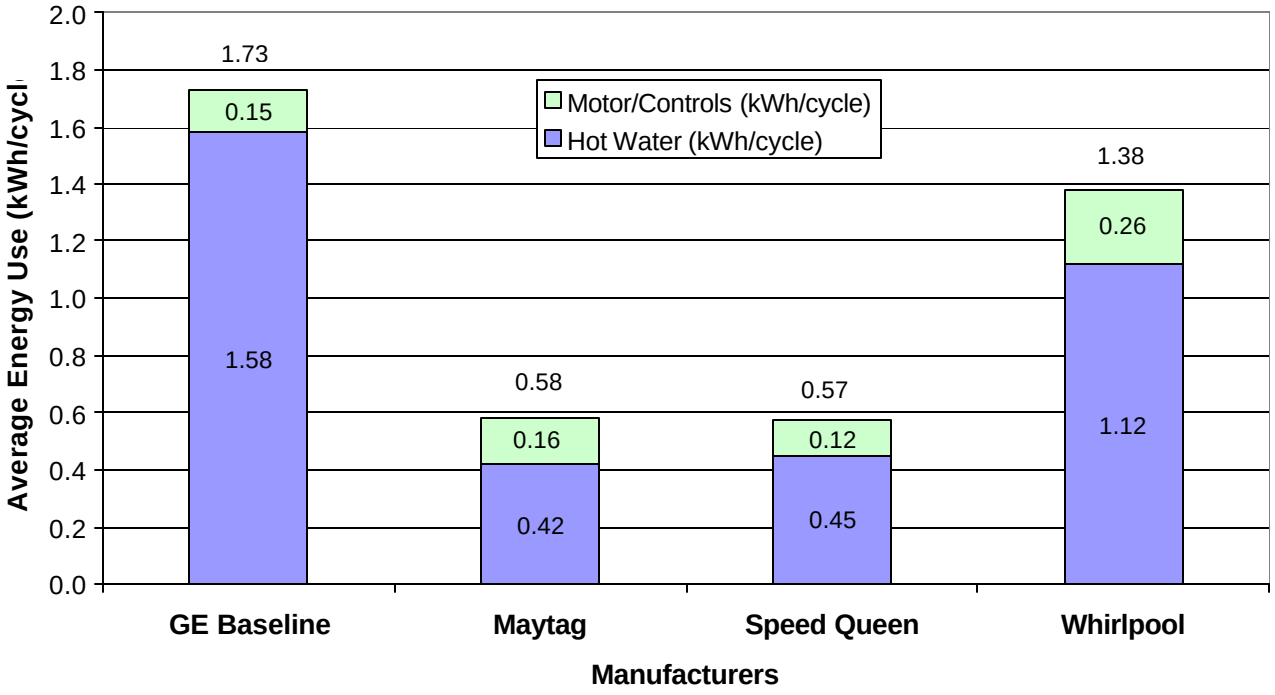

Figure S.2. Leisure World Average Clothes Washer Energy Use (kWh/cycle)

Table S.3. Summary of Per-Washer Average Electricity Savings Compared to GE Baseline

Clothes Washer Manufacturer	Average Electricity Savings Compare to GE Baseline (kWh/cycle)	Percent Electricity Savings Compared to GE Baseline
Maytag	1.15	66%
Speed Queen	1.16	67%
Whirlpool	0.35	20%

Figure S.3 presents the average annual cost of operation for the four washer types at Leisure World. The assumptions used in this calculation include the marginal water price of $1.67/1,000 gallons ($1.67/kgal)[1] and the marginal electricity price of $0.117/kWh[2].

[1] Water service is provided to Leisure World Laguna Woods by the El Toro Water District. Rate information provided by Michael King, Customer Service Supervisor, El Toro Water District.

[2] Electricity service is provided to Leisure World Laguna Woods by Southern California Edison, Inc. Electricity rate is as reported in GS-1 rate tariff.

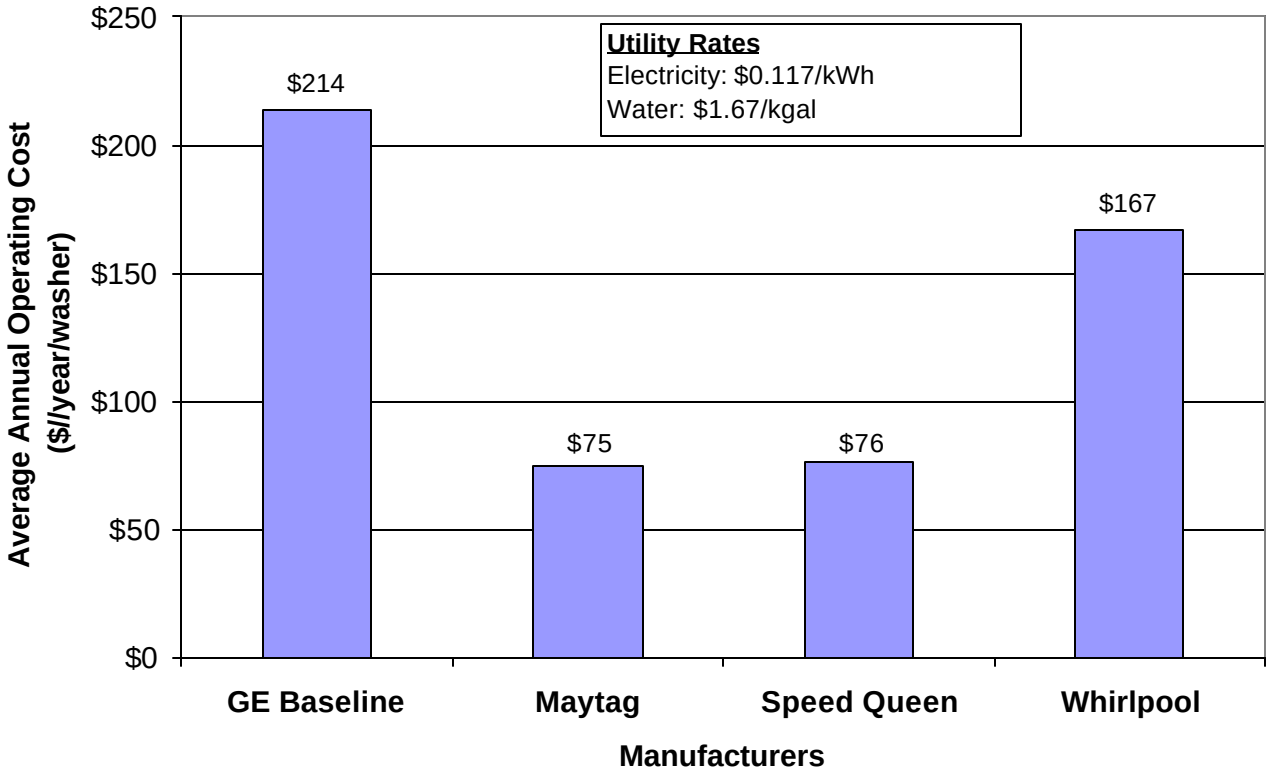

Figure S.3. Leisure World Average Annual Clothes Washer Utility Cost

Additionally, this analysis assumes each machine is used an average of 2.2 times per day, this was the average-use metered during the demonstration.

At Leisure World, relative to the baseline GE clothes washer, all three high-performance washers saved significant amounts of energy and water. Table S.4 presents these savings. The resulting dollar savings are $139/year/washer for the Maytag washer, $138/year/washer for the Speed Queen washer, and $47/year/washer for the Whirlpool washer. The difference between the Maytag/Speed Queen savings and the Whirlpool savings reflect the greater water and energy efficiency the front-loading washers had over the pre-production version of the top-loading Whirlpool washer.

Residents who have used one of the 3 high-performance washers were surveyed to determine their level of satisfaction with the new machines. Surveys were completed for 64 residents across the 3 different laundry rooms. Overall, the high-performance washers were positively received, with 72% of those surveyed stating they were "somewhat" or "very" satisfied with the washers. The majority of users of the Maytag and Speed Queen washers would prefer permanent replacement of the existing GE washer with these machines. The users of the Whirlpool washer were evenly divided as to permanent replacement of the existing GE washers.

Table S.4. Summary of Per-Washer Annual Water, Electricity, and Dollar Savings Compared to GE Baseline

Clothes Washer Manufacturer	Average Water Savings Compare to GE Baseline (gal/year)	Average Electricity Savings Compare to GE Baseline (kWh/year)	Annual Dollar Savings Compared to GE Baseline ($/year)
Maytag	18,070	923	$139
Speed Queen	16,780	931	$138
Whirlpool	8,430	281	$47

Reasons for being satisfied with the high-performance washers included "my clothes are much cleaner and they smell nice", "it's much easier to use", "I use less detergent", "the clothes dryer takes a lot less time", and "I can put more clothes in". Reasons for being dissatisfied with the high-performance machines included "my clothes are not cleaner", "the new washer is harder to use", "I cannot get as many clothes in as I can with the old washers", and "I don't like having the door lock after the wash starts". Should PCM decide to replace the existing washers with high-performance washers, we suggest developing and implementing a communications plan to address the negative comments.

Finally there are significant dollar savings potential over the life of the clothes washers by replacing existing GE washers with high-performance clothes washers. Table S.5 presents discounted and undiscounted savings for each of the high-performance clothes washers compared to the GE baseline washer. These savings assume a 13-year clothes washer life and the conservative assumption of ***no change*** in either the water or the electricity rates paid by Leisure World over the 13-year washer life.

Table S.5. Lifetime Clothes Washer Savings Summary: Per-Machine Discounted (8%) and Undiscounted Savings Compared to GE Baseline

Clothes Washer Manufacturer	Lifetime Savings Compared to GE Baseline (discounted at 8%)	Lifetime Savings Compared to GE Baseline (undiscounted)
Maytag	$1,099	$1,807
Speed Queen	$1,091	$1,794
Whirlpool	$371	$611

Given the lifetime savings of $1,099 (the discounted case), this investment opportunity will show a positive cash flow as long as the incremental cost of the new washer (over the baseline washer) does not exceed $1,099. In the case of the Maytag washer, the incremental cost is $610, $1,500 (retail cost) - $250 (water utility rebate)[1] - $640 (GE cost) = $610. Therefore, the net positive savings from investing in the Maytag washer is about $490 per washer. Again, it should be pointed out that these dollar savings represent a conservative estimate. These calculations ***did not*** take credit for expected increases in utility costs, which, when implemented, would serve to better the cost-effectiveness of the project. While this investment not only offers a positive cash flow today, but it also affords a method of hedging against future utility cost escalations.

As a final note, the savings presented here report one piece of the total potential laundry room savings. Taken as a system, the interactions between the clothes washer, the clothes dryer, and the water heater, represent a significant energy-efficiency opportunity. While this study evaluated the savings potential of only the clothes washers, the authors feel there is significant opportunity to achieve additional savings, by treating the laundry room as a system. The additional savings would result from reduced dryer energy use (clothes removed from an H-axis washer are typically dryer due to the high spin speeds achieved compared to the V-axis washer), and through the proper sizing of hot water heaters now serving a greatly reduced hot water load.

[1] Per discussions with Joe Berg, Conservation Program Manager, Metropolitan Water District of Orange County, the Maytag and Speed Queen washers will qualify for a $250 high-performance washer rebate. This rebate program will begin accepting application on 2/1/01 and offer rebates retroactively to 7/1/00.

Acknowledgments

This report is the result of numerous people working to achieve a common goal of improving energy and water efficiency at Leisure World. The authors wish to acknowledge the contribution and valuable assistance provided by the staff of Professional Community Management (PCM), property manager for Leisure World, Laguna Woods. Specifically, we would like to thank the PCM Operations Supervisor, Chris Guidry, and Building Maintenance Manager Jim Dyer. In addition, we would like to thank the residents of the manors served by Laundry Buildings 71, 212, and 303. We appreciated their patience and willingness to help in our demonstration of these clothes washers.

Integral to the success of this demonstration was the coordination and support of the participating clothes washer manufacturers—the Maytag Corporation, Alliance Laundry Systems LLC (Speed Queen), and the Whirlpool Corporation. In particular, we would like to recognize the efforts of Alan Tomchin of Pride Laundry (Maytag distributor), Mike Harlow from PWS (Alliance Laundry Systems distributor), David Fuller from Golden State Laundry (Whirlpool distributor), and John Kurtz from the Whirlpool Corporation.

Appreciation is extended to Terry Shoemaker, Woody Renn, Karen Mueller, and Tami Weber for the conscientious, team-oriented, and high quality assistance they brought to this project.

Finally, we wish to recognize Bill Grimm and Dean Homstad of Southern California Edison, for their commitment and support in creating this project.

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1.0 Introduction

This multifamily clothes washer program targets the replacement of family-sized coin-operated washers that are owned by multifamily owners and operators with high-performance energy- and water-saving clothes washers. As part of the overall program, this report presents the evaluation findings of a demonstration conducted at Leisure World Laguna Woods, CA.

The high-performance clothes washer demonstration included the baseline metering (Phase I) of clothes washers in three laundry buildings located at Leisure World. Each building contained four vertical-axis (V-axis) coin-operated General Electric (GE) clothes washers. Leisure world charges $0.50 to wash a load of clothes – the clothes dryers (3 in each building) are free. The Phase I effort lasted about six weeks. The Phase II effort followed with the installation of 12 high-performance clothes washers, four from each of three different manufacturers (Maytag, Speed Queen, and Whirlpool) and also lasted about six weeks. In Phase II, each of the laundry buildings had clothes washers from one manufacturer. The metering for Phase I and Phase II captured the same parameters that included hot and cold-water volumes, hot and cold-water temperatures, and motor electricity consumption. All parameters were metered on a per-cycle basis.

The goal of this project was to demonstrate and verify the performance, energy, water, and monetary savings of high-performance coin-operated clothes washers. Two of the key questions that this demonstration set out to answer were:

1. Do the dollar savings from reduced water and energy consumption more than compensate for the increased first cost?
2. Do the LWLW residents like them?

The balance of this report is organized as follows:

- Section 2 provides some background on the project and the equipment.
- Section 3 provides the technical approach used in this analysis.
- Section 4 presents the results of the energy and water analysis.
- Section 5 describes the user acceptance results.
- Section 6 contains the references cited in this report.
- Appendix A provides details on the washers included in this study.

- Appendix B provides details on the metering equipment used in this study.
- Appendix C provides the survey instrument used for the user surveys.
- Appendix D provides the results of the surveys conducted.
- Appendix E provides information on the incentive available through the SCE Residential Contractor Program.

2.0 Background

Multifamily properties typically provide a variety of amenities and onsite services for tenants, including laundry rooms having coin-op washers and dryers. Research conducted over the past three years (Kaszczij and Liotta, 2000, Currie and Parker 1999, Currie and Parker 1998, Edgemon and Parker 1998, CH2M-Hill and Knowlton 1997) has led to three important findings:

1. There is a significant lack of data regarding coin-op washer saturation and ownership.

2. There is a lack of understanding of the various forms of ownership/lease arrangements for these washers.

3. There is a lack of understanding of the performance and cost-effectiveness of the different high-performance coin-op washers currently available. Understanding which washers are most cost-effective is vitally important because commercial clothes washers are not subject to Federal appliance efficiency testing standards (10 CFR 430 1998) and thus are not sold with a Federal Trade Commission (FTC) Energy guide label indicating their efficiency. Therefore, no substantial independent performance data are available to make informed decisions.

To affect these findings, Southern California Edison (SCE) commissioned Battelle Pacific Northwest Laboratory (Battelle) to evaluate the energy and water efficiency of high-performance energy and water-saving clothes washers installed in a multi-family setting in Southern California. The site selected was Leisure World, a prominent senior citizen community located in Laguna Woods, CA.

In March of 1999, Leisure World, located nearly equidistant between Los Angeles and San Diego, became Orange County's 32nd city. This private gated community is the largest such project for adults 55 years and older on the West Coast. Leisure World is home to some 18,000 residents and residency in the city is restricted to families having at least one member age 55 or older. Over 99% of the residential units in leisure World are multifamily buildings.

There are over 300 laundry rooms in Leisure World with more than 1,000 family-sized coin-op washers. The city of Leisure World does not use natural gas and all hot water is electrically heated. In fact, Leisure World is home to the single greatest concentration of coin-op washers using electrically heated water served by SCE. By our estimates, Leisure World contains 22% of all such washers in SCE's customer base. Thus, this is the most logical place to begin such a demonstration.

The clothes washers typically used in the multifamily setting are family-sized commercial-type coin-op washers. While many claims have been made regarding energy and water savings

of high-performance coin-op clothes washers, very little independently generated data are available for field applications in institutional settings. Manufacturer claims of energy savings from high-performance clothes washers range from 30% to 70% and water savings range from 30% to 50% over the standard V-axis designs.

The goal of this program is to provide SCE and Leisure World with a greater understanding of the potential energy, water, and monetary savings, from using high-performance clothes washers in its many multifamily laundry applications.

3.0 Technical Approach

The objective of this study was to evaluate and quantify the energy and water efficiency of high-efficiency energy and water-saving clothes washers in the multifamily setting. Our approach included baseline metering and tracking (Phase I) of three laundry rooms located at Leisure World, each containing four, conventional GE V-axis coin-operated clothes washers. The Phase I effort lasted about six weeks. The Phase II effort followed with the installation of 12 high-performance clothes washers, four from each of three different manufacturers (Maytag, Speed Queen, and Whirlpool). Each of the Phase II laundry rooms has clothes washers from one manufacturer.

The approach included the following steps:

1. select high-performance clothes washers
2. select candidate laundry buildings
3. develop an end-use metering plan and install metering equipment
4. collect and analyze data
5. conduct user acceptance surveys
6. report findings.

3.1 Select High-Performance Equipment to Study

After a careful review of the market, Battelle identified three manufacturers of high-performance clothes washers for participation. This equipment included washers from the Maytag Corporation, Alliance Laundry LLC (Speed Queen), and the Whirlpool Corporation. The Maytag and Speed Queen washers are the front loading, horizontal-axis (H-axis) style, while the Whirlpool was a pre-production version of a new top loading V-axis style.

With the H-axis design, the washer drum rotates about a horizontal, rather than a vertical, axis. The benefit to the H-axis washer is that the drum only partially fills with water during the wash and rinse cycles; as the drum turns about its horizontal axis, the clothes are tumbled into and out of the water. For the high-performance V-axis design, a “spray-rinse” system is used to rinse the clothes, reducing the amount of water used in the rinsing operation. Both of these high-performance designs are in contrast to the standard V-axis design that requires the clothes to be fully immersed in water and moving about a central agitator for proper washing and rinsing. Because most of a clothes washer’s energy use is tied to hot water use, any savings in hot water

translate to energy savings. Additional energy savings result from higher-efficiency motors and the higher spin speeds achieved in the H-axis designs. These higher spin speeds reduce the water content in the clothes at the end of the wash cycle, thus potentially saving dryer energy which was not metered in this study. Table 3.1 presents the participating manufacturer clothes washer characteristics.

Table 3.1. Participating Manufacturer Clothes Washer Characteristics

Clothes Washer Manufacturer (Model No.)	Tub Volume (cu ft)	Axis of Rotation of Tub	Clothes Loading Direction	Age of Equipment (years)	Approximate Retail Cost (Dec., 2000)
General Electric/GE (WCCD2050Y) Baseline Clothes Washer	2.7	Vertical (V-axis)	Top	2-14	$640
Maytag/Maytag Corp. (MAH20PD)	2.85	Horizontal (H-axis)	Front	New	$1,500(1)
Speed Queen/Alliance Laundry Systems (SWR 261)	2.8	Horizontal (H-axis)	Front	New	$1,250(1)
Whirlpool/Whirlpool Corp(2) (Commercial Resource Saver)	3.0	Vertical (V-axis)	Top	New	$700-$900 (3)

(1) This washer will qualify for a $250 water utility rebate beginning in February 2001, per discussions with Joe Berg, Conservation Program Manager, Metropolitan Water District of Orange County.
(2) Whirlpool washers in the study are a pre-production commercial version of the residential Resource Saver washer. A new version of this washer is expected to be commercially available in the fall of 2001.
(3) Whirlpool cost is a best estimate received from sales staff.

Figures 3.1 through 3.5 present photographs of all equipment from the demonstration. Figures 3.1a and b are the baseline V-axis washer (General Electric). Figures 3.2a and b are the Maytag H-axis washer. Figures 3.3a and b are the Speed Queen H-axis washer, Figures 3.4a and b, are the Whirlpool V-axis washers.

Prior to this demonstration, the users of these clothes washers received notification of the demonstration, its goals and purpose. In addition, as the new washers were installed, instruction on the important differences between the baseline and the high-performance clothes washers were made into signs and hung in each laundry room. The instructions included details on proper loading, unloading, operation, and detergent use for the washers. A sample of one of the wall signs is provided in Figure 3.5.

Figure 3.1a. General Electric V-Axis Clothes Washer

Figure 3.1b. General Electric Baseline V-Axis Clothes Washer

Figure 3.2a. Maytag H-Axis Clothes Washer

Figure 3.2b. Maytag H-Axis Clothes Washer

Figure 3.3a. Speed Queen H-Axis Clothes Washer

Figure 3.3b. Speed Queen H-Axis Clothes Washer

Figure 3.4a. Whirlpool V-Axis Clothes Washer

Figure 3.4b. Whirlpool V-Axis Clothes Washer

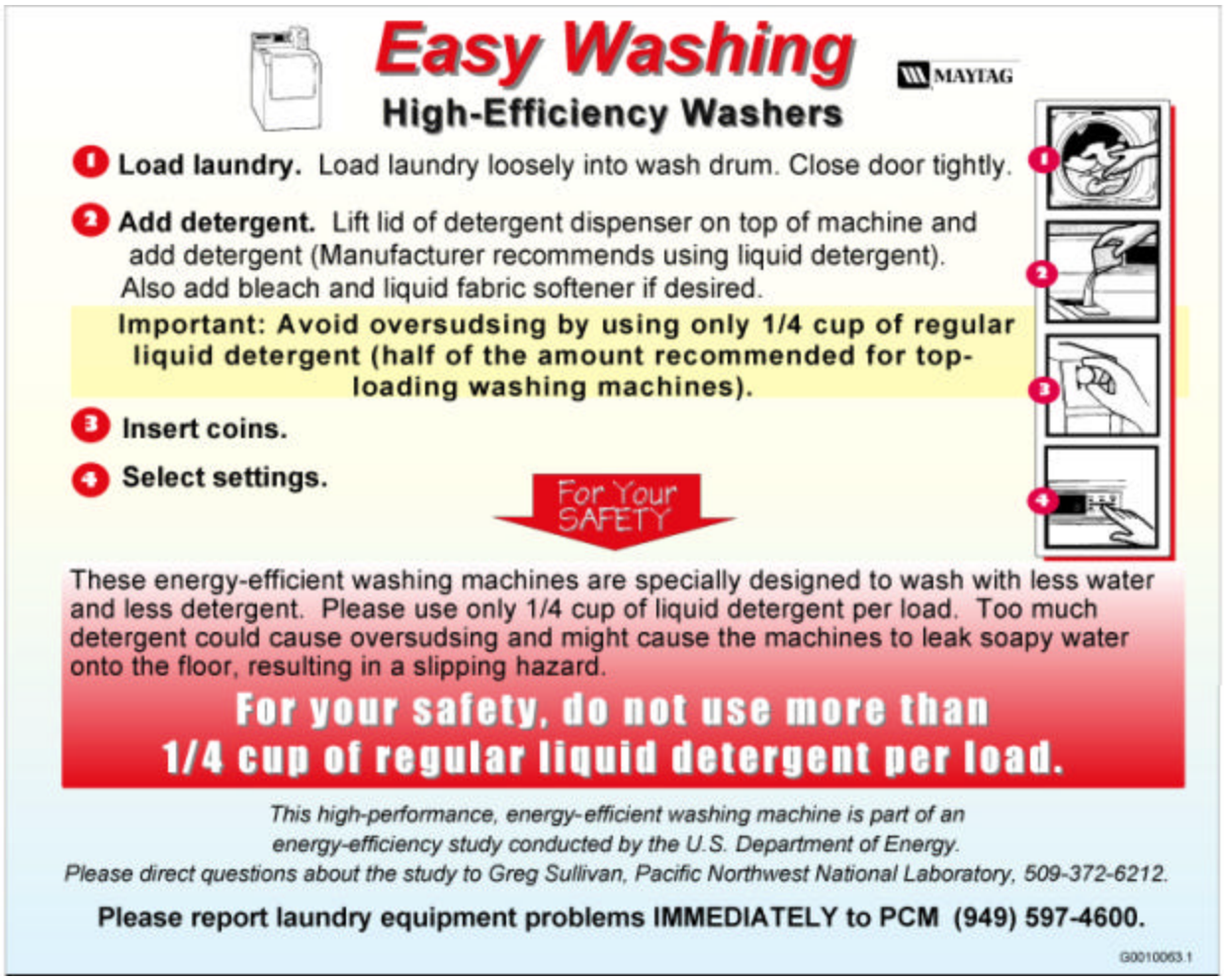

Figure 3.5. Wall Sign Use in the Leisure World Clothes Washer Demonstration

3.2 Select Candidate Laundry Buildings

In this demonstration, three Leisure World laundry buildings were metered: Phase I for the baseline and Phase II for the three high-performance manufacturers. The buildings selected were chosen because they are the same style, size, and serve roughly the same number of residents.

By design, each laundry building was located to serve between 45 and 60 manors (a manor is a residential unit). The occupancy of each manor varies, but on average is roughly 1.5 residents per manor. Therefore, each laundry building serves between 60 and 90 residents.

The physical layout of the three chosen laundry buildings is nearly identical. Each building has four coin-op washers and three residential-style (non coin-op) dryers. In two of the laundry

buildings, the four washers are served by two 80 gallon, electric hot water heaters. In one of the laundry buildings the 2 water heaters are nearly new and downsized to 50-gallon capacity. Figure 3.6 is a picture of one of the selected laundry buildings.

Figure 3.6. Laundry Building from the Leisure World Clothes Washer Demonstration

3.3 Develop End-Use Metering Plan

Each of the three selected laundry buildings received identical end-use metering equipment. In each laundry building, four data loggers were installed to record and store the relevant per-cycle energy and water data, one for each machine. A description of each metered parameter is included below; baseline V-axis and new high-performance washer monitoring was identical. Figure 3.7 details the metering arrangement common to each clothes washer. Appendix B presents the technical details of the metering equipment.

Metered Parameters

Clothes Washer Water Temperature: Water temperature, both hot and cold, was metered using resistance temperature detectors (RTDs) attached to the water supply piping. The RTDs provide the temperature data to the data logger where it is stored in a time-series format. Each washer has one RTD attached to either the hot or the cold water supply piping, thus, multiple (redundant) hot and cold-water temperature measurements were collected.

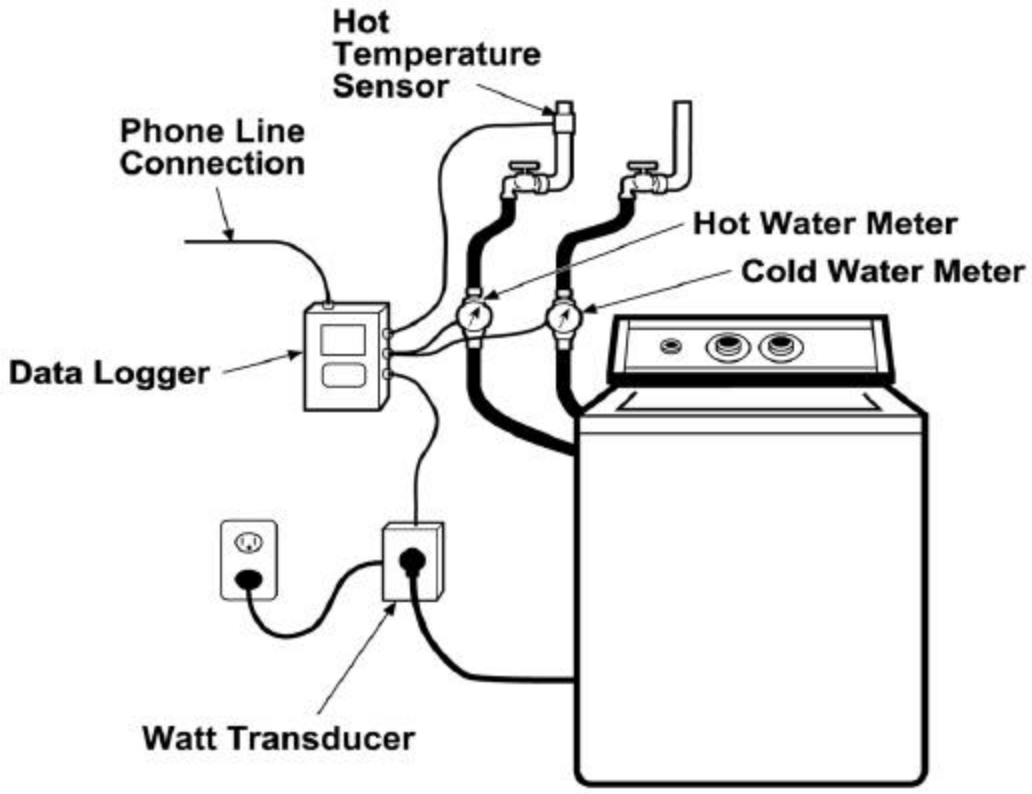

Figure 3.7. Leisure World Clothes Washer Metering Connections

Clothes Washer Water Use: Water use was metered by water-flow meters installed on the hot and cold supply line to each machine. The water meters are installed in series with the standard washer-hose connections and placed on the floor behind the washers. This is a proven installation technique and, because it does not affect existing piping, it eliminates the need for a plumber's intervention. The meters provide per-cycle (hot and cold) water use data to the data logger where is stored in a time-series format.

Clothes Washer Electrical Energy Use: Electrical energy use (washer motor and controls) was metered by a watt transducer. The watt transducer was designed to be plugged into an existing electrical outlet and to have the washer plugged into it. This also is a proven installation technique and, because it does not affect existing electrical circuitry, it eliminates the need for an electrician's intervention. The watt transducer provides per-cycle electricity use data to the data logger where it is stored in a time-series format

Clothes Washer Utilization: The total number of cycles per machine was captured by the watt transducer in the form of run-time data. The watt transducer provides the run-time data to the data logger where it is stored in a time-series format.

Data Collection and Storage: The data logger used to record and store the temperature, energy, and water use data is downloaded remotely via the telephone lines on a weekly basis.

3.4 Collect and Analyze Data

All data stored in the data loggers were retrieved on a weekly basis. By design, these data loggers communicate, via telephone lines, with a central polling computer located at Battelle. In addition to this polling arrangement being convenient, it also allowed Battelle staff to look at clothes washer use in a real-time format. These data were collected for two six-week periods, one for the baseline phase and one for the high-performance phase.

The data integration interval (time interval over which data was summed and stored) was 5 minutes. A 5-minute integration period is a compromise between the desire to minimize the volume of data collected and the need to be able to discern individual clothes washing events.

3.5 Conduct User Acceptance Surveys

User acceptance surveys were conducted to give the residents who used the three laundry rooms housing the high-performance washers the opportunity to express their opinion. The survey was administered over a three-day period during which the residents were given free use of the washers in exchange for completing the survey. In addition to free washing, each interviewee received a free screw-in subcompact (sub-CFL) light bulb.

4.0 Energy and Water Efficiency Results

The results presented below are from data representing more than 350 clothes washing cycles from each manufacturer's set of washers. The average number of cycles per day per washer varied between 1 and 4. The overall average was 2.2 cycles per day per washer.

The most consistent use pattern captured by the metering was the time-of-day that laundry was done. Most laundry was done between mid-morning and late afternoon, with a typical peak between 10:00 AM and 12:00 PM. Figure 4.1 presents washer use data by time-of-day for one week at one laundry building (Building 71). As shown, the completed washes were summed across the four machines in the laundry building and placed in one-hour time bins.

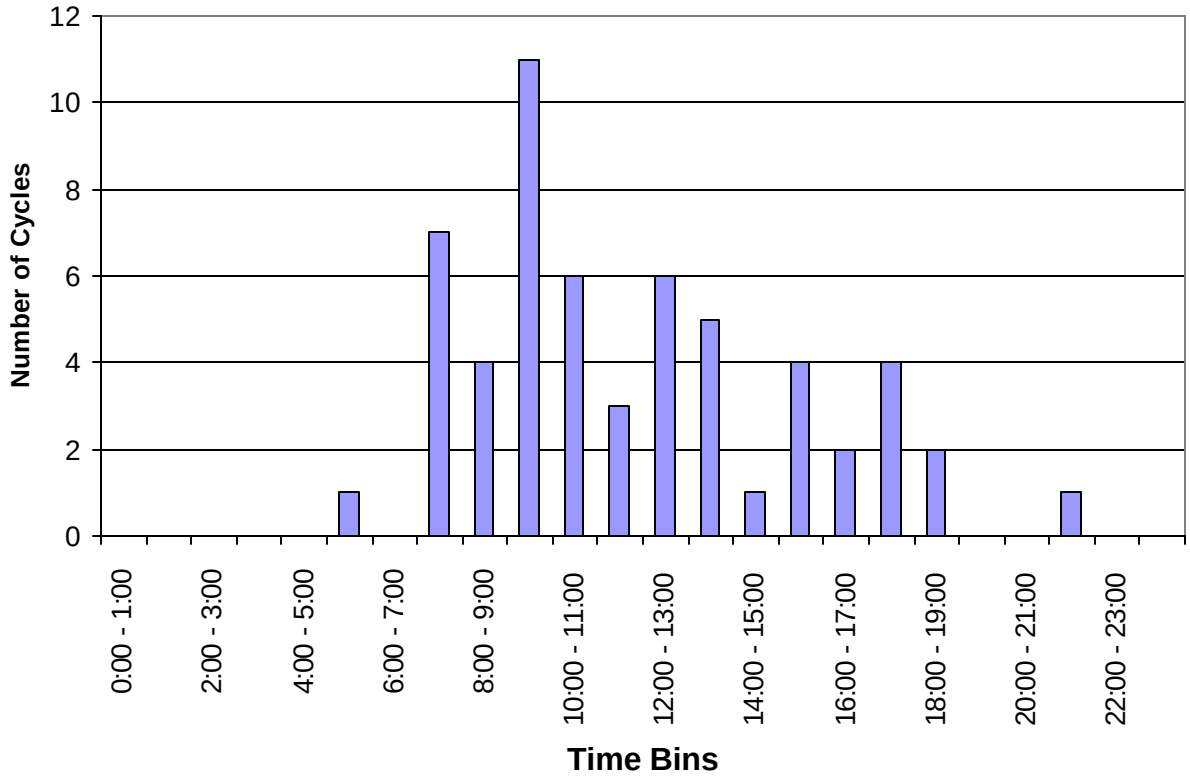

Figure 4.1. Typical Weekly Wash Cycles by Hourly Bin: Building 71, Week of September 8, 2000

There was a less-consistent use pattern for the day-of-the-week that laundry was done. In most cases, some laundry was done on each day; however, there were days for each building that appeared to be most popular. In Building 71, Friday seemed to be the most popular day, followed by Monday, and then Wednesday. Figure 4.2 presents use-data by day-of-the-week for one laundry building (Building 71) for a typical week.

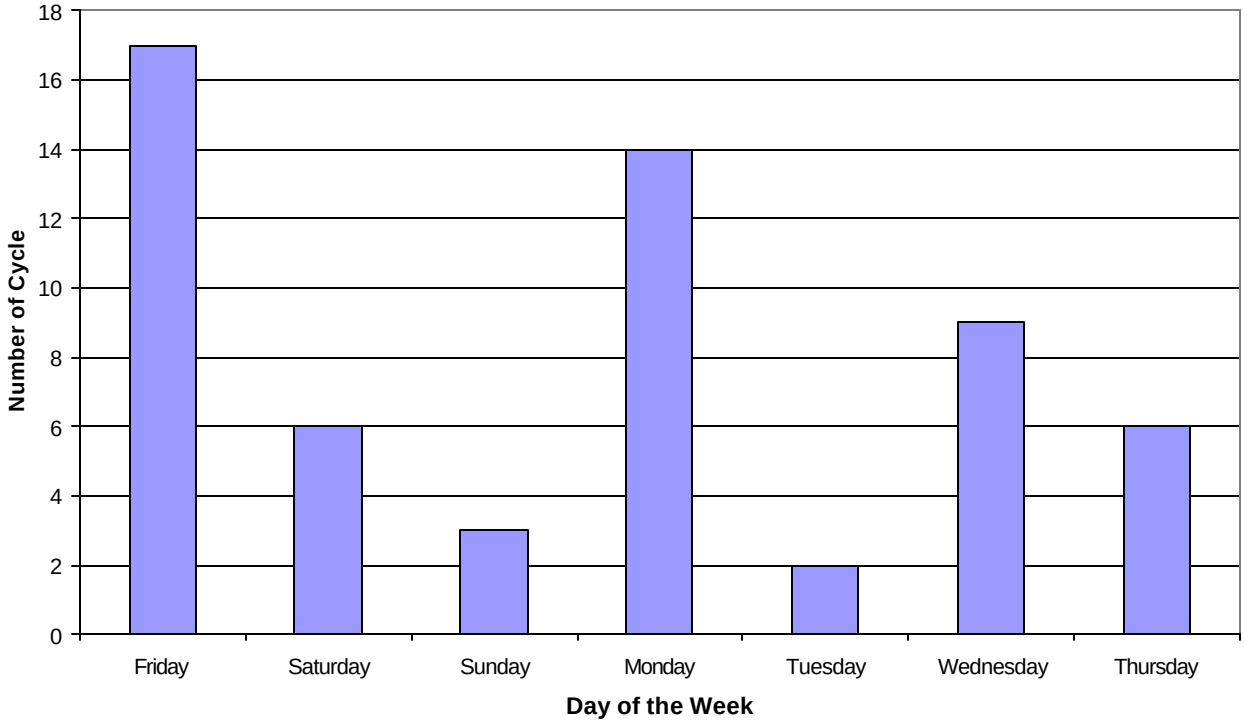

Figure 4.2. Typical Weekly Wash Cycles by Day-of-the-Week: Building 71, Week of September 8, 2000

4.1 Water Use

Figure 4.3 presents the average clothes washer water use in gallons per cycle. All three high-performance washers showed a reduced average total water use compared to the baseline washer. The baseline GE washer used an average of 37.9 gallons/cycle, while Maytag used 15.4 gallons/cycle, and Speed Queen used 17.0 gallons/cycle, and Whirlpool used 27.4 gallons/cycle. Figure 4.3 also breaks out the average water use into the hot and cold-water components.

As with the total water consumption, significant hot and cold-water use reductions were found for all high-performance manufacturers. The baseline average hot water use was 10.3 gallons/cycle. The three high-performance manufacturers reduced the average hot water use to 2.7 gallons/cycle with Maytag, 2.9 gallons/cycle with Speed Queen, and 7.3 gallons/cycle with Whirlpool. It is important to note that these hot water values are true averages over all cycles recorded. In other words, in calculating these averages, cycles using no hot water were also averaged. Thus, if one were to look at any individual cycle that used hot water, it is expected that the hot water used in that cycle would be greater than the averages reported here.

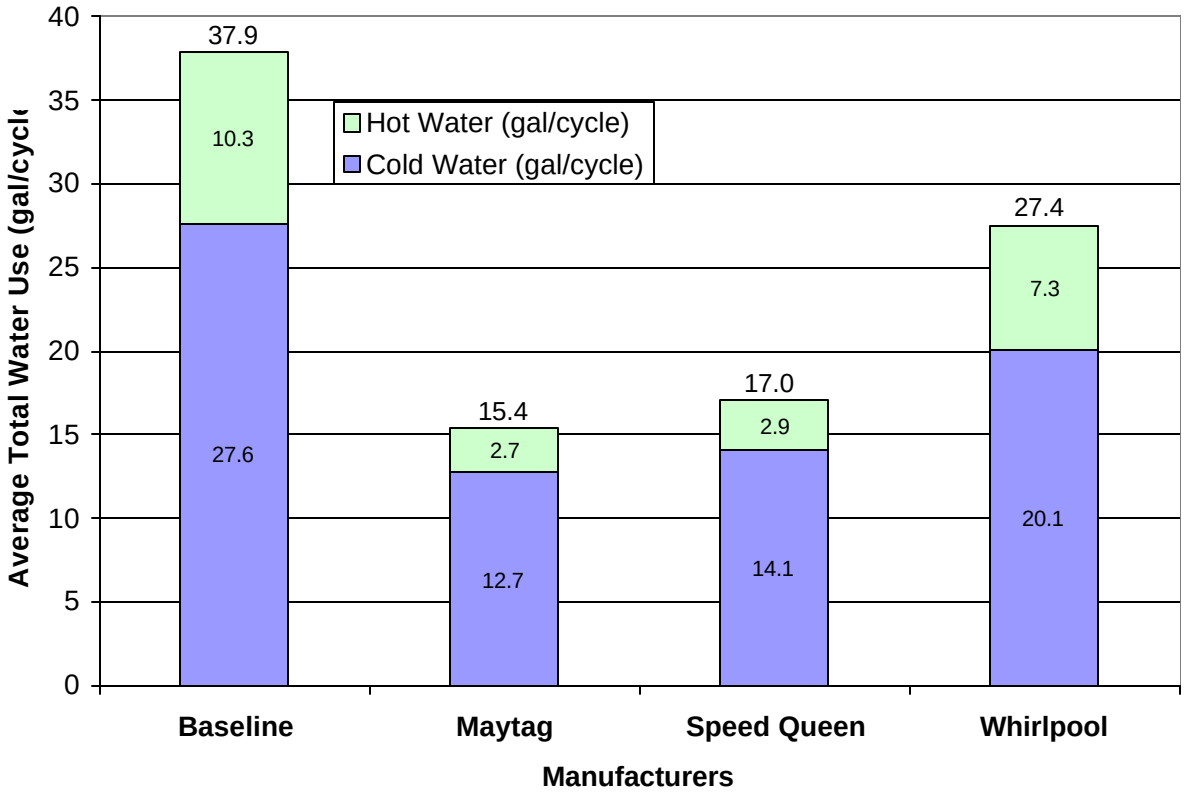

Figure 4.3. Leisure World Average Clothes Washer Water Use (gallons/cycle)

4.2 Total Energy Use

The combined energy use of the clothes washer studied is presented in Figure 4.4. The combined energy use is made up of the electricity used for the washer motor and controls and the energy necessary to heat the hot water used by the washer. All three high-performance washers showed a reduced energy use compared to the baseline washer, with Maytag at 0.58 kwh/cycle, Speed Queen at 0.57 kWh/cycle, and Whirlpool at 1.38/cycle.

The Maytag clothes washer was the only washer with full electronic controls and thus it was the only washer to have a standby power draw. A standby power draw is the constant power use by the machine in periods of non-use. In Maytag's case, a 7-watt standby power is necessary for display lighting and internal diagnostics and memory functions. This standby power draw was included in Maytag's motor and controls per-cycle energy use.

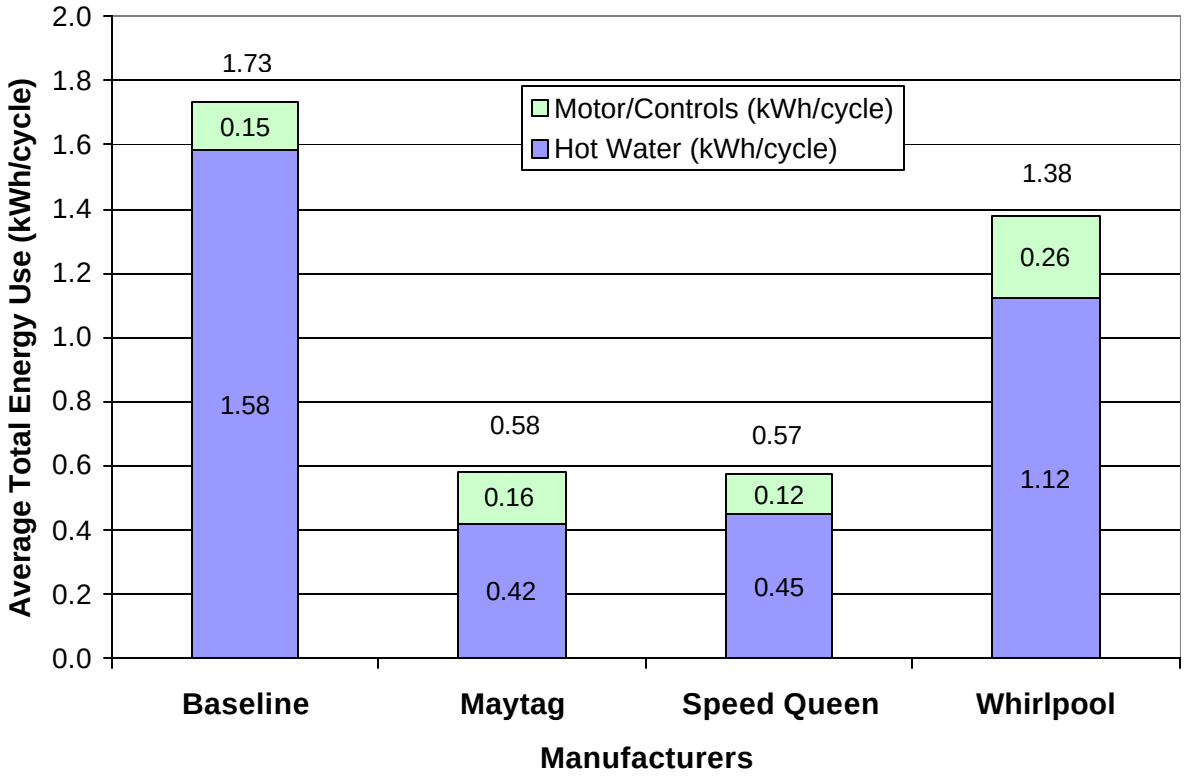

Figure 4.4. Leisure World Average Clothes Washer Energy Use (kWh/cycle)

4.3 Economics

The economics and cost-effectiveness of this technology will vary with utility rates and clothes washer usage. From the data collected at Leisure World, and using the appropriate marginal water/wastewater and electricity rates (combined marginal cost of water/wastewater rate of $1.67/1,000 gallons ($1.67/kgal)[1] and the marginal electricity rate of $0.117/kWh[2] this demonstration calculated nearly equal annual dollar savings for the Maytag ($139/year/washer) and Speed Queen ($138/year/washer) washers, and $47/year/washer for the Whirlpool washer. These are annual savings compared to the GE washers. The difference between the Maytag/Speed Queen savings and the Whirlpool savings reflect the relative efficiency gains the front-loading washers had over the pre-production version of the top-loading Whirlpool washer.

[1] Water service is provided to Leisure World Laguna Woods by the El Toro Water District. Rate information provided by Michael King, Customer Service Supervisor, El Toro Water District.
[2] Electricity service is provided to Leisure World Laguna Woods by Southern California Edison, Inc. Electricity rate is as reported in GS-1 rate tariff.

Figure 4.5 presents the calculated annual dollar savings of the efficient washers over the baseline washers.

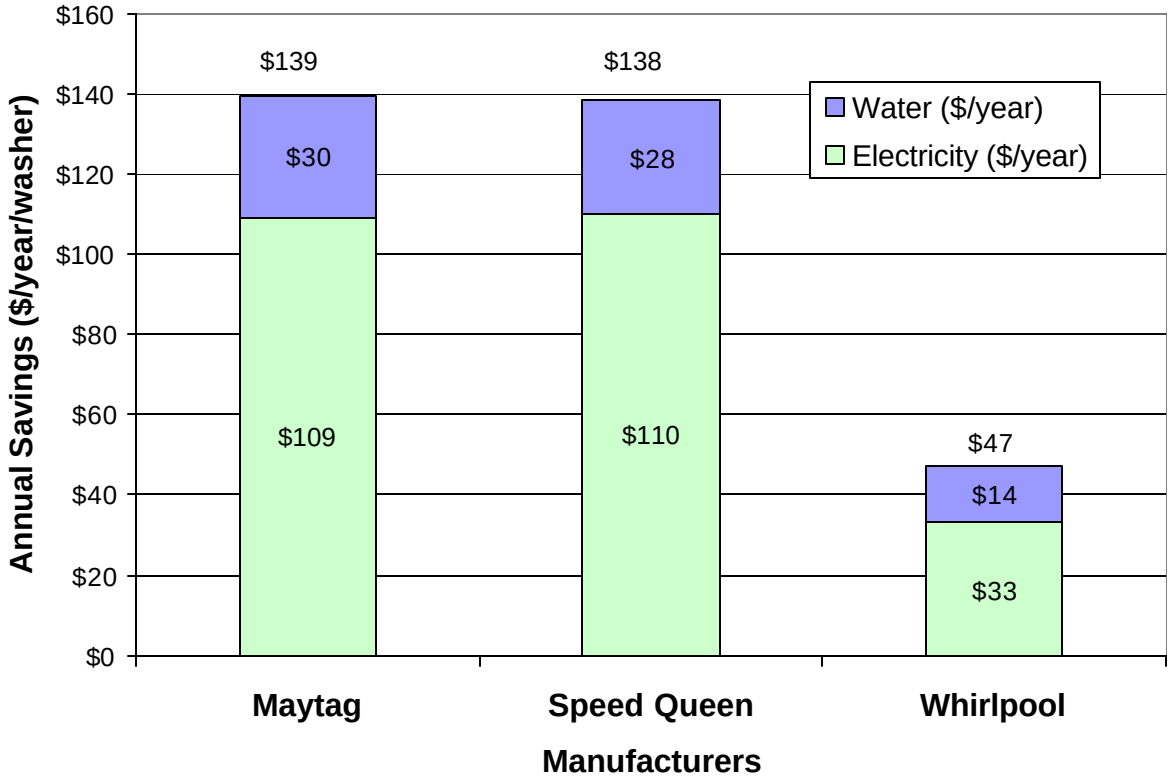

Figure 4.5. Leisure World Annual High-Performance Clothes Washer Dollar Savings Over GE Baseline Washers ($/year)

Using the retail clothes washer cost figures presented in Table 3.1, and the annual dollar savings figures presented above, the simple payback for each washer was calculated. The data and simple payback values are presented in Table 4.1.

As shown, the simple payback values range from 2.6 years for the Speed Queen to 4.4 years for the Maytag, with Whirlpool in the middle at 3.4 years. After discussions with the various providers of this equipment it became clear that the simple payback values for the Maytag and Speed Queen were longer than normal due to their relative low use. Equipment distributors explained that this type of washer is built for the high-use environment of the coin-op laundromat where the average use per-day per-washer is about 6.0. In this high-use environment, expected equipment lifetimes are about 5-years. Comparing these values to the use values recorded in the demonstration (2.2 uses per-day per-washer) suggests that the relative low use environment at Leisure World should translate into a life exceeding the 5-year life of the high-use laundromat environment. Indeed, to make an estimate of the life expectancy of this

Table 4.1. Leisure World Clothes Washer Demonstration Simple Payback Calculations

Clothes Washer Manufacturer	Retail Cost Including Rebate ($)	Average Annual Electricity Savings from Baseline (kWh/year)	Average Annual Dollar Savings from Baseline ($/year)	Simple Payback from Baseline (years)
GE Baseline	$640	NA	NA	NA
Maytag	$1,250	923	$139	4.4
Speed Queen	$1,000	931	$138	2.6
Whirlpool	$800	281	$47	3.4

equipment in Leisure World, one would only have to ratio the relative number of average daily uses (laundromat to Leisure world) and apply that to the expected 5-year life. Performing this calculation leads to an expected life of more than 13.5 years for this equipment. This calculated life expectancy holds true to the baseline GE equipment. PCM records show that some of the baseline washers are in excess of 15 years old.

It should be noted that simple payback calculations presented here **do not** include impending utility rate increases - higher utility rates will shorten payback periods. Additionally, this analysis did not take credit for incentives available as part of Southern California Edison's Residential Contractor Program (RCP). The RCP is offering financial incentives to owners of multifamily properties who install certain energy efficiency measures as long as the measures are installed by an eligible RCP contractor. This program and incentives are described in Appendix E.

4.4 Hot Water Heater Energy Use

While not part of the original proposal, after completing the initial clothes washer data analyses, Battelle staff began exploring the potential for downsizing the existing water heaters in each of the laundry buildings.

The baseline configuration in all laundry rooms includes two electric water heaters providing hot water to the four clothes washers and a utility sink. Preliminary evaluations indicated that each water heater serves two washers, one of the two has the additional load of the utility sink.

In two of the three laundry buildings examined, the water heaters were 80-gallon capacity and over 10 years old. One of the laundry buildings had two fairly new 50-gallon water heaters mounted on insulating pads.

Initial calculations indicate that once the hot water load is reduced, as it was shown to be with the Maytag and Speed Queen washers, there is a significant opportunity for added energy savings via the downsizing of the water heaters. The preliminary analysis indicates that the reduced hot water demand of the new Maytag or Speed Queen washers would allow the replacement of **both** 80-gallon water heaters with **one** energy-efficient 50-gallon water heater mounted on an insulating pad. The potential savings from this activity result from the relative reduction in "stand-by loss" (also known as "jacket loss") of the two 80-gallon water heaters in comparison to the one 50-gallon water heater. Table 4.2 presents the findings of this engineering calculation.

Table 4.2. Leisure World Clothes Washer Demonstration Potential Water Heater Savings

Load Placed on the Water Heater	Existing Configuration: 4-GE washers with 2-80 gal. water heaters (kWh/yr)	Retrofit Configuration: 4-Maytag washers with 1-50 gal. Water heater (kWh/yr)	Annual Savings (kWh/yr)
Hot Water for Washing Machine	5,070	1,350	3,720
Stand-by Loss	990	260	730

To justify the use of one 50-gallon water heater, an analysis was conducted using the worst-case scenario or the most hot water use per-cycle for each washing machine simultaneously. The total hot water use in an hour is stated in the 1999 ASHRAE Applications Handbook (ASHRAE 1999) and is given by

$$R = 60NV/(T+10)$$

where N is the number of washers, V is the quantity of hot water supplied during a hot wash fill (gal), and T is the machine cycle time.

The Maytag washers used an average maximum of 6 gallons of hot water per hot wash cycle and had an average cycle time of 38 minutes. Under these conditions the maximum hot water requirement is 30 gallons per hour. The recovery rate and storage capacity of a 50-gallon water heater is sufficient to handle this load. The use patterns from the data we have collected,

however, show that the peak load in a given hour seldom exceeds 15 gallons; the maximum peak-load observed during the metering period was 23 gallons in one hour. This reinforces the argument for only one 50-gallon water heater.

These additional energy savings have brought to light the concept of developing a high-efficiency laundry room. This concept, having not been tried to our knowledge, would serve to quantify the synergistic savings opportunities that result from the interactions between clothes washer, clothes dryer, and water heater.

The clothes washer-water heater interaction, discussed above, results from the reduced hot-water demand placed on the water heater by the efficient clothes washer. This reduced demand offers the opportunity for water heater downsizing and the implicit reduction in stand-by energy loss, as well as the economic gain from buying a smaller water heater.

The clothes washer-clothes dryer interaction relates the ability of an H-axis washer to "spin-out" more of the water remaining in the clothes after the wash. Removing moisture in the washer through mechanical means is much more efficient than in the dryer through thermal (evaporative) means. Clothes removed from the washer with less moisture (lower 'remaining moisture content') potentially result in the dryer using less energy to dry the clothes. This effect was noted anecdotally by residents who made comments that although the washers took longer to wash the clothes, the dryer took less time to dry.

Considerable savings could be achieved by addressing the laundry room as a "system" and optimizing equipment selections to take advantage of these interactive savings. To estimate the impact, we used water heater capital cost information from PCM, clothes washer cost and savings data (the Maytag equipment was used in this example), and the reduced standby loss of the smaller water heater (1, 50-gallon water heater in place of 2, 80-gallon water heaters). A summary of these values and savings are provided in Table 4.3.

As shown, addressing the laundry room as a system can lead to additional savings, and a quicker payback. Taking credit for a smaller water heater load and lower water heater equipment cost reduced the simple payback of the clothes washer-water heater system to 2.7 years (compared to 4.4 years for the clothes washer alone).

It is important to again note that this calculation ***did not*** take into account anticipated increases in utility rates. Rate increases would serve to further reduce the payback time. Furthermore, because there is limited data to cite, potential dryer savings were not accounted for as part of the overall system. As such, the calculation above could be considered an upper bound on the simple payback for the efficient laundry room system.

Table 4.3. Leisure World Clothes Washer Demonstration Potential
Clothes Washer/Water Heater System Retrofit Savings

Equipment Type	Capital Cost Impact per Laundry Building ($)	Annual Water and/or Electricity Savings ($/year)	Simple Payback (years)
Clothes Washer	$2,440 (1)	$556	-
Hot Water Heater	-$700 (2)	$84	-
Total	$1740	$640	2.7 years

(1) The incremental cost of the Maytag washer (including rebate) is $610/washer, times 4 washers per building.
(2) The incremental cost of a 50-gallon water heater is -$700. PCM reported water heater costs of $465 and $230 respectively for the 80-gallon and 50-gallon water heaters. Analysis assumes a replacement of 2 80-gallon water heaters with 1 50-gallon water heater.

5.0 Resident Evaluation of the High-Performance Clothes Washers

High-performance clothes washers are expected to save operating dollars through reduced electricity, water, and sewer bills. However, demonstrating that operating dollars can be saved may not be sufficient for PCM to recommend switching to high-performance machines. The high-performance washers should be acceptable to the people who use the laundry rooms.

High-performance coin-op washer technology is well established and overall performance and customer acceptance is very promising. The City of Toronto (Toronto 2000) has recently published results of a comprehensive study to evaluate 39 high-performance coin-op washers in multifamily laundry rooms. Energy and water savings were in the range projected by the washer manufacturer (Maytag). Furthermore, there was an incredibly high degree of satisfaction expressed by the tenants with 68% being "very satisfied" and 95% being, at least, somewhat satisfied. This high degree of satisfaction could have resulted, in part, because of a carefully designed "communications plan" to inform/educate the tenants on the benefits of the high-performance washers to encourage the tenants to use the machines correctly. One likely result of the communications plan is that 90% of the tenants reported placing more clothes in the new Maytag washers than they were placing in the older, standard vertical axis washers.

The Toronto study did not differentiate tenant responses by demographic characteristics such as age. Recent research commissioned and published by the American Association of Retired People (AARP) revealed that in a nationwide survey of business managers, senior citizens were characterized as relatively "inflexible, averse to change, and resistant to learning and understanding new technologies" (AARP 2000, p.4). If these findings are valid, then it would behoove PCM and SCE to investigate user acceptability of converting Leisure World laundry rooms to high-performance washers.

We could find no studies on senior citizen acceptability of high-performance coin-op clothes washers. Thus, we recommended to PCM and SCE that we formally document residents' evaluation of the three different high-performance models being used in the Leisure World demonstration.

5.1 Evaluation Approach

Our approach was to survey residents who used the three laundry rooms housing the high-performance washers. The survey was conducted near the end of Phase II metering in order to allow residents to have sufficient experience with the high-performance washers to form a solid opinion.

First, we developed a 23-question survey instrument (Appendix C) for interviewing the residents. Second, PCM announced that we would be available in each laundry room over a designated 3-day period to offer any resident free washing in exchange for their opinion regarding the washers in that laundry room. Third, we administered the surveys December 5 through 7. In addition to free washing, we gave each interviewee a free screw-in subcompact (sub-CFL) light bulb. To give every resident the opportunity to express their opinion, PCM provided us with the building addresses of residents most likely to use one of the 3 laundry rooms. We went to 100% of the residences offering a free sub-CFL in exchange for a completed survey.

5.2. Evaluation Results

The complete results are shown in Appendix C. Included, for each survey question, are the combined results for the three laundry rooms as well as individual results for each laundry room. We received 64 completed survey forms. There were 3 questions (#3, #13, #18) that were "bottom line" oriented regarding residents' evaluation of the high-performance washers. The results for these 3 questions are shown in Table 5.1.

Table 5.1. Leisure World Clothes Washer Demonstration Results to Survey Questions #3, #13, and #18

Clothes Washer Manufacturer	New Washer Same or Better	Somewhat or Very Satisfied	Keep the New Washers
Maytag	81%	73%	63%
Speed Queen	57%	78%	57%
Whirlpool	38%	64%	50%
Total	66%	72%	58%

In completing question #3, "comparing the old equipment and the new equipment", 66% of the residents said the new machines are the same or better than the old machines. The Maytag washer faired the best, with 81% of the residents indicating that this washer is the same or better as the old machines. Overall, 36% of the residents indicated that the new equipment is "much better" than the old equipment with 44% of the residents using the Maytag indicating this washer to be "much better".

In completing question #13, "how satisfied are you with new washing machines", 72% of the residents indicated they were at least somewhat satisfied. The Speed Queen faired the best, with 78% of the residents indicating that they were at least somewhat satisfied with this washer. Overall, 44% of the residents indicated that they were "very satisfied" with the new washers. Maytag, Speed Queen, and Whirlpool scored 44%, 43%, and 43% respectively by residents on being "very satisfied".

Respondents were given an opportunity to explain their answers to question #3 and #13. "You cannot get clothes clean using so little water" was a common theme for those not liking the washers. Some people found it difficult to bend over to load the washers. However, after completing the survey, at least 2 people who expressed this view were asked if they found it difficult bending over to use the dryers, and they responded that it was not difficult to use the dryers. More than one respondent mentioned not being able to do a full load of clothes due to the small drum size. Table S1 indicates that the drum for each of the 3 high-performance models is larger than the drum in the baseline GE models. One person demonstrated that one of the Maytag washers would, at times, "eat quarters". Finally, the most often mentioned annoyance was associated with the Speed Queen and Maytag washers. Once the wash cycle begins, the washer door cannot be opened. Thus, if the user discovers after the fact, that he/she did not put all of the dirty clothes in the washer, it is not possible to open the door and toss the item into the drum.

Many respondents indicated that the clothes seemed cleaner compared to the GE washers. Some respondents liked the fact that the washers were new and "high tech". Others mentioned that the high-performance machine was easier to use and that it required less detergent than did the GE washers.

In completing question #18, "given the choice of keeping the new machines or replacing them with the old machines", 58% of the residents indicated that they would "keep the new machines". Maytag faired the best, with 63% of the residents indicating that they would "keep the new machines".

In addition to the results summarized above, there were several other questions that could provide useful information to PCM and SCE. These are highlight below.

- 48% believe it takes more time to wash a load of clothes with the new washers (it does take longer) and only 6% believe it takes less time to dry a load washed by the new washers (it does take less).

- 75% believe it is at least as easy to load clothes into the new washers as it is with the old washers.

- 83% believe their clothes get as clean using the new washers and 34% believe their clothes are cleaner.

- 73% encountered no problems using the new washers.

- 56% know that the new washers use less water than the old washers.

- 47% know that the new washers use less energy than the old washers.

5.3. Recommendations for Implementation

Should PCM decide to replace the GE V-axis washers with high-performance washers, we recommend the development of a communications plan that addresses the negative comments received from the respondents. In the Toronto study, administrators were able to achieve a high degree of acceptance and satisfaction with an effective communications plan and we see no major hurdles in PCM being able to do the same thing.

6.0 Reference

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Appendix A

Clothes Washer Technical Data

A.1 Maytag Product Literature

Introducing The Revolutionary New Maytag High-Efficiency Washer!

MAYTAG
COMMERCIAL

The Maytag Model MAH14PD
High-Efficiency Washer

QUALITY FEATURES

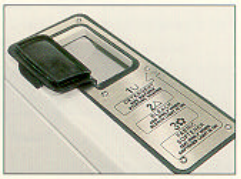
More than big savings. The Maytag high-efficiency washer also boasts an array of innovative features. You just won't find another washer on the market like it!

Porcelain Enamel Top

Provides a glass-smooth surface that resists scratches and laundry chemicals. Exclusive contoured front panel adds a sleek and modern look.

Detergent Dispenser

Self-flushing and indirectly dispenses laundry chemicals. A lighted display prompts the customer when to add detergent, bleach and fabric softener.

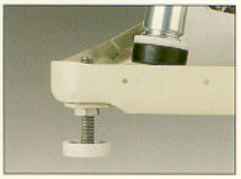


Extra-Large Door Opening

Makes loading laundry a breeze. Reversible door is 35% larger than current 18 pound front-load washers and opens a full 180 degrees.

Soft-Mount Installation

Designed to make set-up quick and easy. Maytag's heavy-duty suspension system eliminates the need to bolt the machine to the floor.



Stainless Steel Wash Basket

Tilted up at a 15 degree angle for greater customer convenience. Maytag's premium-quality stainless steel wash basket will never rust or chip.

Cycle-Based Pricing

Allows you to vary vend prices based on hot, warm and cold cycle temperatures. One touch is all it takes to select the desired cycle.

Precision Endurance Drive

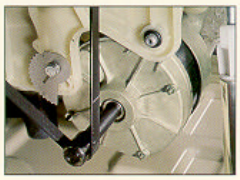
No transmission to service. Maytag's precision drive system self-adjusts its spin speed to adapt to each and every installation.

Computer Trac™ Control

The extra-large vacuum fluorescent panel displays prices, operating instructions and more. Self-diagnostics help pinpoint problems.

Heavy-Duty Motor

Backed by a five year warranty. Maytag's infinite-speed motor has no brushes to wear out and is sealed against exposure to dirt and lint.



Computerized Coin Drop

Virtually puts an end to slugging. An optical sensor measures the size, weight and drop speed of a coin before it's accepted by the machine.

MAYTAG LIMITED WARRANTY

2 YEARS – ALL PARTS

5 YEARS – MOTOR, WASH BASKET, SHAFT ASSEMBLY, BEARINGS, SEALS AND EXTERNAL CABINET AGAINST RUST-THROUGH, INCLUDING TOP, DOOR AND BASEFRAME.

It's The Strongest Warranty In The Industry!

For a period from the date of original purchase through the times listed above, the designated parts which fail in normal commercial use will be repaired or replaced with the owner paying all other costs, including labor, transportation and customs duty.

PRODUCT SPECIFICATIONS

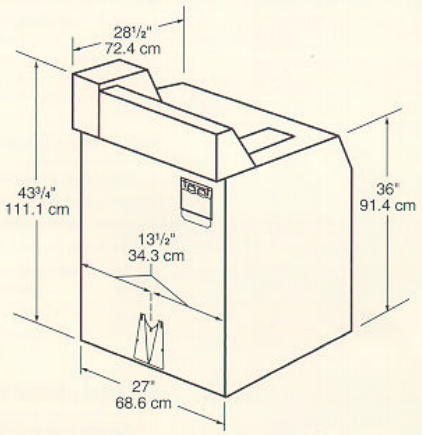
Motor: 120 volt, 60 Hz, single phase, reversible, thermoprotected, high-efficiency, switched reluctance motor. Develops 1/4 HP in wash and 1/2 HP in spin.

Metered Fill: Not dependent on pressure or time.

Inlet Hose Length: 4 feet (1.22 m).

Drain Hose Length: 4 feet (1.22 m).

Water Usage:
18 gallons (68.1 liters) to 24.5 gallons (92.7 liters) depending on load size and cycle chosen.



Leveling Legs: Adjustable to level washer for proper installation.

Colors: White or almond.

Approximate Weight (Crated/Uncrated):
225 lbs. (102 kg) / 195 lbs. (88 kg).

MEETS ALL EXISTING A.D.A. DESIGN STANDARDS

NEW YORK CITY M.E.A.

See specific instructions for proper installation.
Specifications are subject to change without notice.

MATCHING DRYER AVAILABLE

The perfect choice for many multiple-housing laundry facilities. The Maytag high-efficiency washer has a matching single-load dryer with the same contemporary styling, along with all the reliability and exceptional performance you've come to expect from a Maytag. Depend on it.

OUR PROMISE TO YOU

At Maytag, we know long-lasting equipment helps keep costs low and revenues high. That's why every Maytag commercial washer is constructed of the highest quality materials and with the utmost in precision craftsmanship. You can depend on it.

Contact Your Independent Maytag Commercial Laundry Supplier Today!

MAYTAG COMMERCIAL

MAYTAG ONLINE http://www.maytag.com

MAYTAG, One Dependability Square, Newton, Iowa 50208 CL500 2/97 Printed in U.S.A.

A.2 Speed Queen Product Literature

Speed Queen
Alliance Laundry Systems

Coin Slide Start

SWR261

Frontload Washer

- Ultra high efficient with low water consumption and high speed extracts.
- Strong box meter case security.
- Rear controls with push-to-start button.
- Three cycle and temperature selections.
- Reversing wash action for superior washability.
- 2.8 cu. ft. 18 lb. cylinder.
- Stainless steel inner and outer tub.
- Electric specifications 120/60/1, 15 amp circuit.
- Space saving dimension 26-7/8" W x 28" D x 43" H.

Attractive styling with matching washer and dryer!

Additional Features

- ***Front mount supply dispenser***
  Automatically adds detergent, liquid bleach and liquid softener.

- ***High Speed Extract***
  1000 rpm spin speed for maximum water removal from clothes and faster drying.
- ***Stainless Steel Inner and Outer Tubs***
  Large 18 lb. capacity with a lifetime warranty.
- ***Long-lasting cast aluminum trunion and bearing housing***

- ***Cycle Status Lights***
  Cue lights indicate when unit is "In Use" with "Door Locked" plus "Final Spin/Tumble" cycle.

- ***See-through door for viewing***
  New handle positioning and door swing increased to 180° for easier loading and unloading.

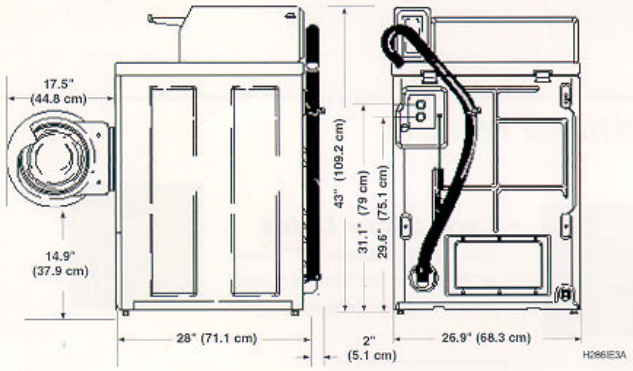
Commercial Built Better To Last Longer!

Specifications

Model	SWR261
Cycles	**3**
Regular	•
Permanent Press	•
Delicate	•
Wash/Rinse Temp.	
Hot/Cold	•
Warm/Cold	•
Cold/Cold	•
Dimensions	
Width	26-7/8" (682 mm)
Depth	28" (711 mm)
Machine Height	43" (1092 mm)
Cabinet Height	36" (910 mm)
Net. Weight	240 lbs. (109 kg)
Shipping Weight	250 lbs. (113 kg)
Agency Approvals	U.L.

Features	SWR261
Stainless Steel Wash Tub	2.8 cu. ft.
Activation	Pull-to-start
Supply dispenser	Detergent, liquid Bleach, Liquid Fabric Softener
Top & Lid Finish	Porcelain
Color	White, Almond
Operating Speeds	
Wash/Tumble	Delicate - 41 Normal - 50
Distribution	80
Spin Speeds	500, 650, 1,000 rpm.
Specifications	
Motor HP	Multi-spd., 3/4 HP
Electrical	120/60/1-15 amp
Water Pressure	20-120 psi (1.4/8.3 Bar)

Motor: 3/4HP reversing, permanently lubricated with a built-in automatic thermal overload protector.
Electrical Requirements: Grounded 3-wire, 120V, 60 Hz AC, 15 amp circuit separately fused.
Heights may vary slightly depending on leveling adjustments. Speed Queen's continuing commitment to quality products may mean a change in specifications without notice.



Ultra High Water Efficient Water Usage

Adjustable Water Level Control		
DOE Load	Hot Water Avg.	Total Water Consumption
8 lb.	2.2 Gal	19.6 Gal
18 lb.	2.6 Gal	23.6 Gal

www.speedqueen.com

Speed Queen
Alliance Laundry Systems

AM00-220

A.3 Whirlpool Product Literature – Note, these data are specific to the Residential Version of the Resource Saver. Product literature for the coin-op version was not available at the time of publication.

Appendix B

Metering Equipment Technical Details

B.1 Data Logging Equipment

ULTRALITE LOGGER™

A Recording 4 Channel Data Logger in Several Configurations:

ELECTRIC CURRENT
•
TEMPERATURE
•
PULSES

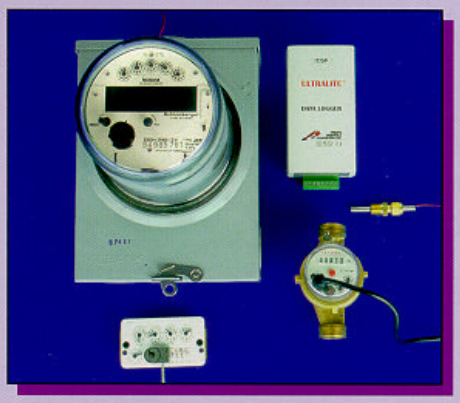
Ideal for any pulse initiating meters, such as gas, water, electric, steam, or sewer. Use the UltraLite Logger for metering plant operations, industrial facilities, commercial and residential buildings.

- Temperature, True-RMS Current and Pulse Recording
- 128K of memory (~30,000 records) or 512K (~120,000 records)
- Self-Powered, no cords to plug in!
- Remote downloading using the optional modem
- Use for submetering, Time-Of-Use metering, or bill disaggregation
- Add a modem for remote data collection

1T/3P ULTRALITE™

OUR MOST POPULAR MODEL!

This unit is capable of monitoring 1 temperature and 3 pulse output meters. It is ideal for monitoring cummulative use of gas, water and electric utilities, as well as the indoor or outdoor temperature.



No pulses are ever missed, and it can count up to 10 pulses per second. The temperature range covered is -40° C to 60°C (-40°F to 140°F) Resolution is .5°F. Utility companies have made the UltraLite 1 T/3P our biggest seller!

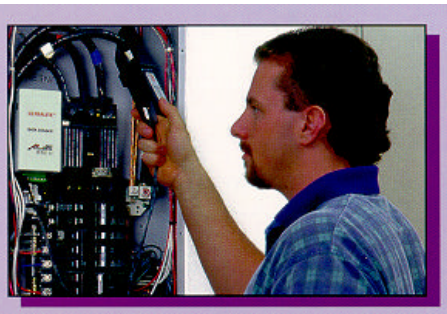
CE

Pacific Science & Technology
64 NW Franklin Avenue
Bend, Oregon 97701
1-800-388-0770 in the USA
541-388-4774 or Fax 541-385-9333
info@pacscitech.com
http://www.pacscitech.com

Data Logging Equipment continued

4C UltraLite™

4 Channels of True-RMS Current can be monitored simultaneously with this unit. Great for monitoring several motors in an HVAC equipment room or 4 branch circuits. Both split-core and clamp-on current transformers are available and come in various sizes, ranging from 5A to 3000A. The UltraLite 4C measures True-RMS current, even for highly distorted waveforms.



4P UltraLite™

Monitor up to 4 pulse channels!

The UltraLite 4P is used for applications where multiple utilities need to be recorded. Use it with electric, gas, water, sewer and steam meters. This unit also records up to 10 pulses per second. If your meter does not have a pulse output, contact us for pulse initiating retrofit kits for electric and gas meters.

Three options available:

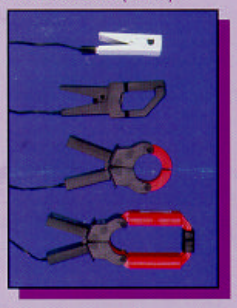
Weather Proof - this version is dust and liquid resistant, allowing the UltraLite to operate in harsh, wet, and outdoor environments.

Internal Modem - any of the UltraLites can come equipped with a built-in internal modem. This will enable easy remote data collection and eliminate the possibility of modem incompatibility. Your choice of 2400 or 9600 baud.

High Memory - this is one option you will want if you do not have telephone lines available. Quadruples the logger memory to 512 kbytes (120,000 records) allowing for long recording periods before downloads are necessary.

Shunted and Safe Current Transformers (CTs)

The UltraLite 4C connects directly to CTs with a voltage output.



Clamp-On CTs

This style combines ease of use, convenience and accuracy. (from top) 150A CT, 500A CT, 1000A CT, 3000A CT

Split Core CTs

are also available in a large number of current ranges.

UltraLite Monitoring Specifications

Inputs	4 channels of current, pulse count, or temperature
Measurements	True RMS (current)
Frequency	10 Hz (pulse) and 50 or 60 Hz (current)
Accuracy	<1% of reading exclusive of sensor accuracy
Baud Rate	1200, 2400, 4800, 9600, 19200 or 2400 and 9600 (Internal Modem)
Resolution	12 bit (1 part in 4,096; ±1 pulse, 0.01 Amp, 0.1°F or °C
Memory	128k (30,000 readings) or 512k (120,000)
Dimensions	8 X 15 X 6 cm (3.2" X 5.9" X 2.4")
Weight	0.4 kg (12 ounces)
Sampling Frequency	7.68 kHz (128 points per current waveform) or 10 Hz, interrupt driven
Recording Intervals	1,5,15,30,60 minutes and 12,24 hours
Real Time Clock	20 ppm accuracy (<1 min/month)
Operating Temp.	-7 to 60° C (20 to 140° F)
Operating Humidity	5% to 95% non-condensing
Battery Life	3+ years @ 1 min. sampling, with LED indicator of low battery charge

B.2. Water Meters

Model Industrial RCDL

Nutating Disc Meter (Bronze and Thermoplastic)

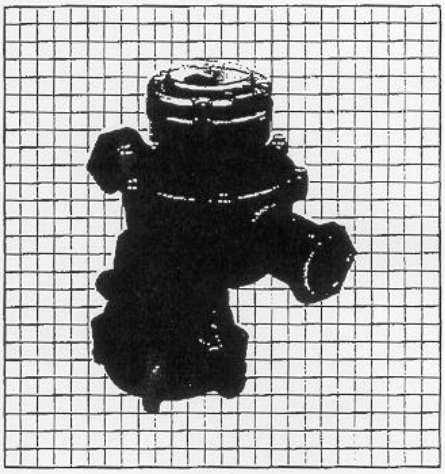
Technical Brief

GENERAL

Badger's RCDL positive displacement meters are one of the most cost effective methods in metering industrial fluids. The RCDL meter's simple but efficient design assures high accuracy and repeatability over the entire meter flow range.

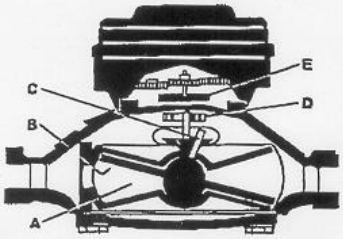
Available in sizes, 1/2" through 2" for flows up to 170 GPM, these meters are extremely rugged and reliable. Maintenance is seldom required, but if necessary, takes but a few minutes. All parts are designed and built of materials to meet your application, providing you with long life and a trouble-free, precision flow meter.

To complement the RCDL meter line, Badger offers a complete line of accessories that includes totalizers, electromechanical and electronic transmitters, rate of flow indicators and batch/process controllers.



OPERATION

The metering principle, known as positive displacement, is based on the continuous filling and discharging of the measuring chamber. Controlled clearances between the disc and the chamber insure minimum leakage for precise measurement of each volume cycle. As the disc nutates, the center spindle rotates a magnet, whose movement is sensed through the meter wall by a follower magnet or by electronic sensors. Each revolution of the magnet is equivalent to a fixed volume of fluid, which is converted to any engineering unit of measure for totalization, indication or process control.



Liquid flowing through the meter chamber (A) causes a disc (B) to nutate or wobble. This motion, in turn, results in the rotation of a spindle (C) and drive magnet (D). Rotation is transmitted through the wall of the meter to a second magnet (E) which operates the transmitter.

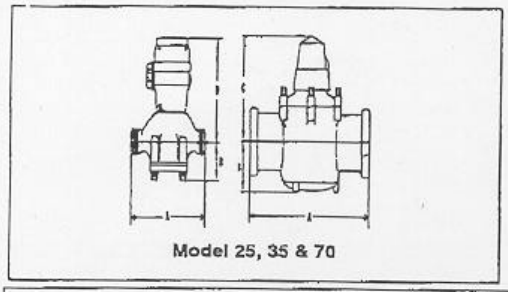
FEATURES

- Accuracy: ±1.5% over full range
- Repeatability: ±0.5%
- Wide flow range
- Rugged bronze or thermoplastic housing
- Maximum Operating Temperature
  Plastic Housing: 100° F
  Bronze Housing: 120° F
  Models 25, 70 and 120; Bronze: 250° F Option
- Maximum Operating Pressure: 150 PSI
- Easily maintained without removing from line
- Durable components for minimal maintenance
- Wide range of compatible accessories
- Direct replacement for SC-ER

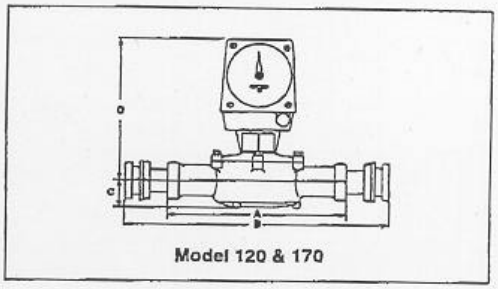
BadgerMeter, Inc.

Bulletin No. ITB-072-08
December 1999

Water Meters continued



Model 25, 35 & 70



Model 120 & 170

SPECIFICATIONS

Dimensions in inches (Without Register)

Meter Model	Meter Size Inches	Housing Material	A Meter Length	B Meter Length w/ Conn.	C Center Line To Base	Flow Rates - Gallons		Approx. Weight Pounds
						Cold Liquids 32° F to 120° F	Hot Water Chemicals & Oils 32° F to 250° F (BZ) 32° F to 100° F (PL)	
M25	5/8	BZ or PL	7-1/2	12-7/16	1-3/8	1/2 - 25	1 - 25	5
M25	3/4	BZ or PL	7-1/2	12-5/8	1-3/8	1/2 - 30	1 - 30	5
M35	3/4	BZ	9	14-1/8	1-3/4	3/4 - 35	N/A	6
M40	1	PL	10-3/4	16-3/16	2-1/4	3/4 - 50	N/A	5
M70	1	BZ	10-3/4	16-5/8	2-1/4	1 - 70	5 - 70	12
M120	1-1/2	BZ	12-5/8	19-3/4	2-5/8	2 - 120	10 - 120	20
M170	2	BZ	15-1/4	22-7/8	3-3/8	2 - 170	N/A	30

BZ = Bronze; PL = Plastic
Connection set assemblies available, all having NPT threads.

N/A = Not available in High Temperature / Chemical option.

HEIGHT DIMENSIONS (INCHES) (D) WITH REGISTER AND ACCESSORIES

Meter Size	With Non Resetable Register	With Transmitter	With MS-ER1 Transmitter	With ECA Transmitter	With 258 Register	With Series 76 Registers
5/8 & 5/8 x 3/4	5-3/4	7-3/8	11-1/4	9-3/8	8	15-1/4
3/4	6-1/8	7-3/4	11-5/8	9-3/8	8-3/8	15-5/8
1 & 1 x 1-1/4	7-1/2	9-1/8	13	11-3/16	9-3/4	17
1-1/2	9-1/8	10-3/8	14-1/4	12-3/4	11	18-1/4
2	10-3/4	12-1/4	16-1/8	14-3/8	12-7/8	20-1/8

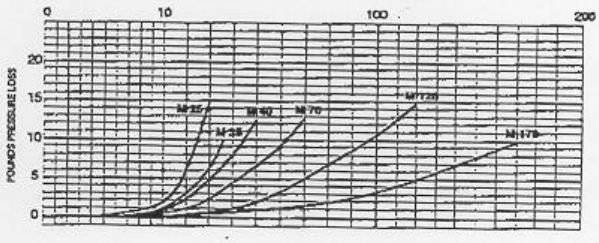
MATERIALS OF CONSTRUCTION

	Cold Liquid Units	High Temp. and/or Chemical Units Models 25, 70 & 120
Housing:	BZ or PL	BZ - 250° F PL - 100° F
Chamber:	Noryl	LCP
Disc:	SAN	LCP
Crossbar:	Nylon	Ultem
Magnetic Assembly:	Nylon	Ultem
Chamber Retainer:	Polyethylene	Metal Clip
Screen:	Polypropylene	None

PRESSURE LOSS CHART

Industrial Disc Meters

Rate of Flow in Gallons Per Minute



PERFORMANCE

Accuracy: ± 1.5%
Repeatability: ± 0.5%
Max. Operating Pressure: 150 PSI

BadgerMeter,Inc.
P. O. Box 245036 Milwaukee, WI 53224-9536
Telephone: (414) 355-0400
Fax: (414) 355-7499

Models MSE5, PM5, & MSE5XP

Mechanical Scalable Transmitters

Technical Brief

GENERAL

The PM5, MSE5, amd MSE5XP models are pulse transmitters designed to be used with Badger Meter's magnetic drive meters. The pulse transmitter provides a scaled electrical pulse signal (switch closure type) for each discrete unit of liquid volume metered. The signal is used to operate instruments and controls.

These transmitters are identical except for the housing. The PM5 transmitter has a glass filled plastic housing and a NEMA 4X rating. The MSE5 and MSE5XP housings are bronze with a NEMA 4 rating.

The transmitters are available in a wide range of gear ratios and pulse rates up to 1500 contact closures per minute.

OPERATION

The flow of liquid through the meter is measured by a disc or piston metering element. The motion of the measuring element is transferred to a magnetic coupling. One of these magnets is in the measuring chamber, the other in the transmitter.

The driven magnet (inside the transmitter) then rotates a gear train and pulse magnet. As the pulse magnet turns, it causes the reed switch to open and close. Contact closures from the switch are transmitted to a remote instrument or counter which records the quantity of flow.

APPLICATIONS

These transmitters are used in metering systems that require pulse closures for recording rate of flow, quantity of flow, liquid feeding, blending and batching.

MSE5 (rear) and PM5 Transmitters

FEATURES

- MSE5 and MSE5XP transmitters are explosion-proof with CSA listing for Class 1, Group D, Division I (Hazardous Locations)
- Does not require external power
- Rugged, Cast Bronze Housing (MSE5 only)
- Corrosion resistant, glass filled plastic enclosure (PM5 only)
- High Temperature Rating: 250° F.
- Watertight - NEMA 4 (Bronze) or NEMA 4X (Plastic) Housing
- Hermetically sealed reed switch output

BadgerMeter,Inc.

Bulletin No. ITB-074-04
Part No. 53406-074
October 1998

B.3 Watt Transducers

OSI WATT/WATTHOUR TRANSDUCER MODEL AGH

UL LISTED, ACCURATE TO 0.2% OF READING

FEATURES

- Accurate regardless of variations in voltage, current, power factor, or load.
- Dual outputs. 0 - 1mA proportional to instantaneous watts, relay closure proportional to watthours.
- Calibrated with standards traceable to NIST.

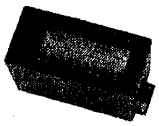
5 YEAR WARRANTY

APPLICATIONS

- Designed for applications which require UL listed devices.
- Integration into energy management systems, or a variety of sub-metering applications.
- Measurement using direct-connection, current and/or potential transformers.

UL

LISTED 87X9
Energy Management Equipment Accessory
E134941



INPUTS		PHASE CONNECTION	NO. OF ELEMENTS	F.S. (WATTS)	STANDARD OUTPUT MODEL AGH- OUTPUT OPTIONS			WATT HOUR COUNTS /HOUR
VOLTS	AMPS				±1mA	±10V	4-20mA	
0 - 150	0 - 5	1 phase, 2 wire	1	500	AGH-001B	AGH-001D	AGH-001E	500
0 - 300	0 - 5	1 phase, 2 wire	1	1000	AGH-002B	AGH-002D	AGH-002E	1000
0 - 600	0 - 5	1 phase, 2 wire	1	2000	AGH-003B	AGH-003D	AGH-003E	1500
0 - 150	0 - 5	3 phase, 3 wire	2	1000	AGH-004B	AGH-004D	AGH-004E	1000
0 - 300	0 - 5	3 phase, 3 wire	2	2000	AGH-005B	AGH-005D	AGH-005E	2000
0 - 600	0 - 5	3 phase, 3 wire	2	4000	AGH-006B	AGH-006D	AGH-006E	4000
0 - 150	0 - 5	3 phase, 4 wire	3	1500	AGH-007B	AGH-007D	AGH-007E	1500
0 - 300	0 - 5	3 phase, 4 wire	3	3000	AGH-008B	AGH-008D	AGH-008E	3000
0 - 150	0 - 5	3 phase, 4 wire	2 1/2	1500	AGH-007.5B	AGH-007.5D	AGH-007.5E	1500
0 - 300	0 - 5	3 phase, 4 wire	2 1/2	3000	AGH-008.5B	AGH-008.5D	AGH-008.5E	3000

To calculate full-scale Watts when using potential and/or current transformers:
a = initial transducer calibration (from table above)
b = current transformer ratio (e.g. 100:5, or 20)
c = potential transformer ratio (e.g. 600:120, or 5)
F.S. WATTS = a x b x c

NOTE: UL recognized current transformers available from factory on page 77.

MODEL AGH SPECIFICATIONS

INPUT
VOLTAGE: See table
CURRENT: 5A
FREQUENCY RANGE: 58 - 62 Hz.
POWER FACTOR: Any
BURDEN:
Voltage: Less than 0.1VA per phase
Current: Less than 0.25VA per phase
Output amplifier: 2 Watts
OVERLOAD:
Voltage (cont.): 150V range: 175V
300V range: 350 V
600V range: 600V
Current (cont.): 2 Times full-scale
(transient): 50A (10 sec./hr.)
250A (1 sec./hr.)
DIELECTRIC TEST (Input/Output/Case):
(150V & 330V)1800Vac
(600V) 2200Vac
Surge: Withstands IEEE SWC Test

OUTPUT
ACCURACY: ± 0.2% RDG.; ± 0.04% F.S.
(Includes combined effects of voltage, current, load and power factor.)
WH RELAY: N/O SPST; 120Vac, 0.5A rated
Contact closure period: 200 milliseconds
CLOSURE CALIBRATION (STD.): 1 watthour/closure
ANALOG OUTPUT RIPPLE: Less than 0.5% F.S.
ANALOG OUTPUT LOADING (OHMS): 0 - 1mA 0 - 10K
0 - 10Vdc: 2K min.
4 - 20mA: 0 - 500
RESPONSE TIME (99%): Less than 400 milliseconds
TEMPERATURE EFFECT (-20° - +60°C):
± 0.005% per degree C
INSTRUMENT POWER: 90 - 135Vac, 60 Hz, 7.5VA

CONNECTION DIAGRAMS AND DIMENSIONS SHOWN ON PAGES 26 - 27

OHIO SEMITRONICS, INC.
4242 REYNOLDS DRIVE * HILLIARD, OHIO * 43026-1264
PHONE: (614) 777-1005 * FAX: (614) 777-4511
WWW.OHIOSEMITRONICS.COM * 1-800-537-6732

OSI WATTHOUR METER WITH INTEGRATED CT — SWH SERIES

DESCRIPTION

The model SWH is a single phase watthour transducer with integrated current transformer. The model SWH has a form A solid state contact closure pulse output.

VOLTAGE (VRMS)	CURRENT (ARMS)	MODEL
115	100	SWH-1100
	200	SWH-1200
	400	SWH-1400
208/230	100	SWH-2100
	200	SWH-2200
277	100	SWH-3100
	200	SWH-3200

FEATURES

- Easy to install split core design
- LED indications of proper installation/operation

APPLICATIONS

- Energy Allocations
- Sub Metering
- Revenue Metering
- Process Control

ORDERING INFORMATION
Example: 100/5A input current CT
230Vac L-N Voltage
SWH-2100

SPECIFICATIONS

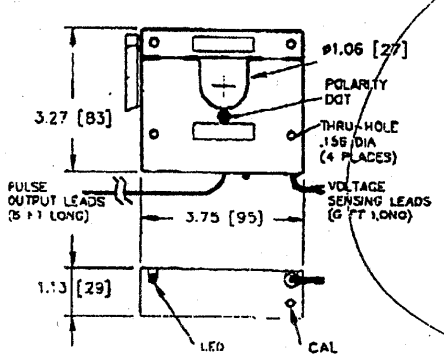
INPUT

CURRENT:		0 to 125% rated
	BURDEN:	VA < .1(100A), .4 (200A)
VOLTAGE:		± 10% rated
	BURDEN:	<0.2VA
POWER FACTOR:		any
FREQUENCY:		48 to 62Hz
INSTRUMENT POWER:		self powered

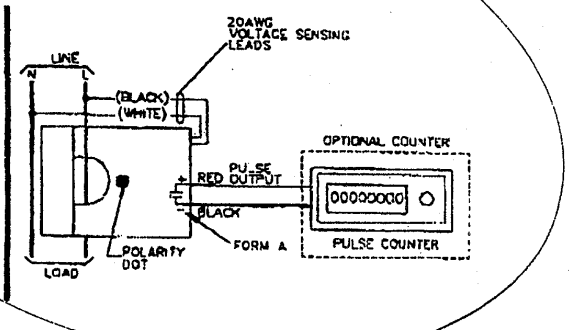
OUTPUT

LED:		Energy Rate & Direction Indicator Scaling same as pulse output Green = Forward Red = Reverse
PULSE:		10 Wh / pulse, 71 ms min std
CONTACT RATING:		Form A, 30V peak, 100mA max
ACCURACY:		1% F.S.
ISOLATION:	(current/potential/output)	2250Vac
TEMPERATURE:		-20 to 70°C

CASE DIMENSIONS



CONNECTION DIAGRAMS



OHIO SEMITRONICS, INC.
4242 REYNOLDS DRIVE HILLIARD, OHIO 43026-1264
Phone: (614) 777-1005 FAX: (614) 777-4511
TO PLACE AN ORDER: 1-800-537-6732

8902-383B1 08/09/99

B.4 Telephone/Data Line-Sharing Switch

TELTONE
HOME

METERING
- Line Sharing Switch and Polling Controller
- Weatherproof Line Sharing Switch

SUBSTATION
- Substation Line Sharing Switch
- Data Switch
- Cellular Interface Unit

POLETOP
- Weatherproof Line Sharing Switch

SUPPORT
- Application Notes
- Product Manuals
- Software Downloads
- Product Registration

- Send Me Info
- How to Buy
- News / Events
- Contact Us
- Utility Products Home

Site Map

Utility Communications

Line Sharing Switch and Polling Controller

>Features
>Line Sharing Switch Specifications
>Polling Controller Specifications

- **Rugged, "network quality" design**
- **Full remote programmability**
- **Emergency outbound dialing priority**
- **Access security for remote modems**

Teltone's Line Sharing Switch and Polling Controller let you take advantage of the unused capacity of your phone lines by allowing up to four telecommunications devices (phone, modems, fax, etc.) to share a single line. In addition, multiple Line Sharing Switches can be easily cascaded or paralleled to allow more than four devices to share a single line. Your inbound or outbound data collection and other online transactions will take place as with dedicated lines, but without the extra line cost. Emergency override access to the phone line can be provided as needed for your application. The Line Sharing Switch operates alone or with the Polling Controller to give you a flexible, cost-effective way to collect data without affecting critical telephone service.

Efficient Polling Connections from Host

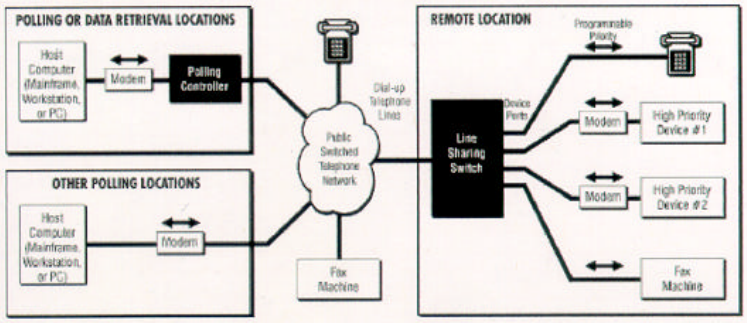
When the Line Sharing Switch and Polling Controller are connected in a dual-unit architecture "polling system," they make the most cost-effective and functional outbound system of its type. In this configuration, the Polling Controller is located at the central polling location, and a Line Sharing Switch is located at the remote location. These components communicate across the public switched network to set up and disconnect calls quickly and accurately.

At the beginning of a polling session, the Polling Controller receives the host dial string and converts this to a proprietary access code. This code is sent to the Line Sharing Switch, which then routes the call to the requested device. If no access code is received by the Line Sharing Switch, calls are defaulted to the telephone port. By deflecting uncoded calls, a barrier is erected in front of your remote modems, adding to the protection your system has from unauthorized entry.

Outbound Dialing from Remote Locations

The Line Sharing Switch eliminates the cost of extra lines at your remote site regardless of whether you dial your call from your host or from your remote location. The Line Sharing Switch will allow you to share the outbound access of one line with two to four devices and prioritize how each device can interrupt the others to use the line. Any device that can be connected to a standard telephone line can receive or place calls through the Line Sharing Switch, including telephones, modems, point-of-sale terminals, credit/debit authorization terminals, fax machines, voice mail systems, answering machines, and others. A Polling Controller is only required at your host site if you need to download data or new software to the remote site. You get significant line cost savings and line access flexibility.

Telephone/Data Line -Sharing Switch continued



Simple Installation and Setup

Installation of the Line Sharing Switch and Polling Controller requires no changes to your existing polling hardware. The Automatic Generation of Transfer Code feature in the Polling Controller can also eliminate any dialing string changes. All connections are made through standard telephone or power connectors in an easy-to-understand configuration. To select desired access options, you can program the Line Sharing Switch remotely from a standard touch-tone phone, or Teltone's free Cipher, a Windows®-based application which streamlines programming of single or multiple Line Sharing Switches or Polling Controllers.

Emergency Access Priority

When immediate telephone access at the remote location is needed during a polling session, personnel can break the connection and use the line if you authorize such calls. Teltone's Line Sharing Switch can be programmed to properly end the data session and quickly give the caller priority. The unit supports three priority configurations:

Emergency Priority: If data transfer is in progress, the telephone receives a dial tone generated internally by the Line Sharing Switch. The dialed digits are screened for "allowed" or "disallowed" numbers. (For example, 9-1-1 emergency calls could be allowed, but personal phone numbers disallowed.) When the Line Sharing Switch detects an "allowed" telephone number, it properly halts data transfer and frees the phone line for the telephone user.

Total Priority: When a caller goes off-hook, the Line Sharing Switch halts data transfer and gives immediate access to the line. This option can be used to interrupt polling sessions for credit authorization calls.

No Priority: The line is not available to the telephone user or other ports when a data transfer session is taking place.

Quick Payback

Teltone's Line Sharing Switch and Polling Controller easily pay for themselves in less than one year, based on typical business telephone line rates. In the longer term, the high quality design and tested reliability of the units ensure that they will pay you back with years of trouble-free service.

System Components

B.5 Pictures of Metering Equipment and Installation at Leisure World Laguna Woods

Figure B.5.1 Metering Equipment Installed at Leisure World Laguna Woods

Figure B.5.2 Metering Equipment Installed at Leisure World Laguna Woods

Appendix C

User Acceptance Survey Instrument

Laundry Questionnaire

Hi. My name is _____. I am with Battelle, Pacific Northwest National Laboratory… etc.

1. Are you aware that new washing machines were recently placed in the laundry room?
   - ❑ Yes
   - ❑ No
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused

2. Have you used the new washing machines yet?
   - ❑ Yes
   - ❑ No

   (If no) how come? Please be as specific as you can. _____

   How many loads do you do in a week? _____

3. In comparing the old equipment and the new equipment, would you say the new equipment is
   - ❑ much better
   - ❑ somewhat better
   - ❑ the same
   - ❑ somewhat worse
   - ❑ much worse

   Why do you say that? Please be specific. _____ Anything else? _____

4. Are you aware that the new machines require half the detergent of the old machines?
   - ❑ Yes
   - ❑ No
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused

5. With the new machines, would you say you wash
   - ❑ More clothes per load
   - ❑ The same amount of clothes per load
   - ❑ Less clothes per load
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) Refused

6. Are there any types of items you are currently washing with the new machines that you did not wash in the old machines?
   - ❑ Yes
   - ❑ No
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused

   If yes, Are these items
   - ❑ Delicate
   - ❑ Bulky
   - ❑ Something else? Please specify _____

7. With the new machines would you say it takes
    - ❑ More time to wash a load of clothes
    - ❑ The same amount of time
    - ❑ Less time to wash a load of clothes
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

8. With the new machines, would you say it takes
    - ❑ More time to dry a load of clothes
    - ❑ The same amount of time
    - ❑ Less time to dry a load of clothes
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

9. How easy or difficult is it to load the new washing machines?
    - ❑ Very easy
    - ❑ Somewhat easy
    - ❑ Somewhat difficult
    - ❑ Very difficult
    - ❑ Does not make a difference
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

10. Would you say the instruction on the new washing machines are
    - ❑ Very easy to understand
    - ❑ Somewhat easy to understand
    - ❑ Somewhat difficult to understand
    - ❑ Very difficult to understand
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

11. Would you say the walls signs are
    - ❑ Very easy to understand
    - ❑ Somewhat easy to understand
    - ❑ Somewhat difficult to understand
    - ❑ Very difficult to understand
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

12. With the new machines, would you say that your clothes are
    - ❑ Cleaner than before
    - ❑ As clean as before
    - ❑ Not as clean as before
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

13. How satisfied are you with the new washing machines? Would you say you are
    - ❑ Very satisfied
    - ❑ Somewhat satisfied
    - ❑ Not very satisfied

- ❑ Not at all satisfied
- ❑ (Don't read) Don't know
- ❑ (Don't read) refused

Why do you say that? Please be as specific as you can. _____
Any other reasons? _____

14. What, if anything, do you feel are the benefits of using the new washing machines? Any thing else?
_____

15. Did you encounter any problems using the new washing machines?
    - ❑ Yes
    - ❑ No
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    What were the problems? _____

16. Are you aware that the new washing machines use less water overall?
    - ❑ Yes
    - ❑ No
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

17. Are you aware that the new washing machines use less energy overall?
    - ❑ Yes
    - ❑ No
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

18. If you were given the choice of keeping the new machines or replacing them with the old machines which would you prefer to do?
    - ❑ Keep the new machines
    - ❑ Go back to the old machines
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

19. How important are water and energy conservation to you?
    - ❑ Very important
    - ❑ Somewhat important
    - ❑ Not very important
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

20. Would you like to know about other water and energy conservation measures in place at Leisure World?
    - ❑ Yes
    - ❑ No
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

21. Would you like to see other water and energy conservation measures put in place at Leisure World?
    - ❑ Yes
    - ❑ No
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

22. Would you be interested in information on energy and water conservation steps you can take in your own home?
    - ❑ Yes
    - ❑ No
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

23. Just a few more questions to help us classify the data:

    A. Gender
    - ❑ Male ‘ Female

    B. Into which category does your age fall?
    - ❑ 55-65 ‘ 66-75
    - ❑ 76-85 ‘ 86+

    C. How many individuals live in your household?

    D. Which building or area do you live in?
    <<Or – for surveyor
    - ❑ Maytag ‘ Speed Queen
    - ❑ Whirlpool >>

Thank you for helping us with this energy efficiency study

Appendix D

User Acceptance Survey Results

Laundry Questionnaire Survey Results - Maytag

Hi. My name is _____. I am with Battelle, Pacific Northwest National Laboratory… etc.

1. Are you aware that new washing machines were recently placed in the laundry room?
   - ❑ Yes **26**
   - ❑ No
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **1**

2. Have you used the new washing machines yet?
   - ❑ Yes **25**
   - ❑ No
   - ❑ Na **2**

   (If no) how come? Please be as specific as you can. _____

   How many loads do you do in a week? **__1 – 5; 2 – 8; 3 – 5; 4 – 1; 5 – 1; 6 – 3; 7 –1; 1.5 - 1**

3. In comparing the old equipment and the new equipment, would you say the new equipment is
   - ❑ much better **12**
   - ❑ somewhat better **4**
   - ❑ the same **4**
   - ❑ somewhat worse **3**
   - ❑ much worse **4**
   - ❑ Na

   Why do you say that? Please be specific. _____ Anything else? _____

4. Are you aware that the new machines require half the detergent of the old machines?
   - ❑ Yes **22**
   - ❑ No **5**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na

5. With the new machines, would you say you wash
   - ❑ More clothes per load **3**
   - ❑ The same amount of clothes per load **16**
   - ❑ Less clothes per load **6**
   - ❑ (Don't read) Don't know **1**
   - ❑ (Don't read) Refused **1**

6. Are there any types of items you are currently washing with the new machines that you did not wash in the old machines?
   - ❑ Yes **3**
   - ❑ No **24**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused

- ❑ Na

If yes, Are these items

- ❑ Delicate
- ❑ Bulky **2**
- ❑ Something else? Please specify _____

7. With the new machines would you say it takes
   - ❑ More time to wash a load of clothes **14**
   - ❑ The same amount of time **9**
   - ❑ Less time to wash a load of clothes **3**
   - ❑ (Don't read) Don't know **1**
   - ❑ (Don't read) refused

8. With the new machines, would you say it takes
   - ❑ More time to dry a load of clothes **1**
   - ❑ The same amount of time **19**
   - ❑ Less time to dry a load of clothes **3**
   - ❑ (Don't read) Don't know **4**
   - ❑ (Don't read) refused
   - ❑ Na

9. How easy or difficult is it to load the new washing machines?
   - ❑ Very easy **12**
   - ❑ Somewhat easy **4**
   - ❑ Somewhat difficult **6**
   - ❑ Very difficult
   - ❑ Does not make a difference **3**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **2**

10. Would you say the instruction on the new washing machines are
    - ❑ Very easy to understand
    - ❑ Somewhat easy to understand **16**
    - ❑ Somewhat difficult to understand **4**
    - ❑ Very difficult to understand **2**
    - ❑ (Don't read) Don't know **3**
    - ❑ (Don't read) refused **1**
    - ❑ Na **1**

11. Would you say the walls signs are
    - ❑ Very easy to understand **19**
    - ❑ Somewhat easy to understand **3**
    - ❑ Somewhat difficult to understand **2**
    - ❑ Very difficult to understand
    - ❑ (Don't read) Don't know **1**
    - ❑ (Don't read) refused
    - ❑ Na **2**

12. With the new machines, would you say that your clothes are
    - ❑ Cleaner than before **5**
    - ❑ As clean as before **16**
    - ❑ Not as clean as before **5**
    - ❑ (Don't read) Don't know **1**
    - ❑ (Don't read) refused

13. How satisfied are you with the new washing machines? Would you say you are
    - ❑ Very satisfied **12**
    - ❑ Somewhat satisfied **7**
    - ❑ Not very satisfied **3**
    - ❑ Not at all satisfied **5**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    Why do you say that? Please be as specific as you can. _____
    Any other reasons? _____

14. What, if anything, do you feel are the benefits of using the new washing machines? Any thing else?
    _____

15. Did you encounter any problems using the new washing machines?
    - ❑ Yes **9**
    - ❑ No **18**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    What were the problems? _____

16. Are you aware that the new washing machines use less water overall?
    - ❑ Yes **18**
    - ❑ No **7**
    - ❑ (Don't read) Don't know **2**
    - ❑ (Don't read) refused
    - ❑ Na

17. Are you aware that the new washing machines use less energy overall?
    - ❑ Yes **12**
    - ❑ No **10**
    - ❑ (Don't read) Don't know **4**
    - ❑ (Don't read) refused
    - ❑ Na **1**

18. If you were given the choice of keeping the new machines or replacing them with the old machines which would you prefer to do?
    - ❑ Keep the new machines **17**
    - ❑ Go back to the old machines **9**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused
    - ❑ Na **1**

19. How important are water and energy conservation to you?
    - ❑ Very important **18**
    - ❑ Somewhat important **5**
    - ❑ Not very important **3**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused
    - ❑ Na **1**

20. Would you like to know about other water and energy conservation measures in place at Leisure World?
    - ❑ Yes **12**
    - ❑ No **13**
    - ❑ (Don't read) Don't know **1**
    - ❑ (Don't read) refused
    - ❑ Na **1**

21. Would you like to see other water and energy conservation measures put in place at Leisure World?
    - ❑ Yes **13**
    - ❑ No **5**
    - ❑ (Don't read) Don't know **5**
    - ❑ (Don't read) refused
    - ❑ Na **4**

22. Would you be interested in information on energy and water conservation steps you can take in your own home?
    - ❑ Yes **11**
    - ❑ No **10**
    - ❑ (Don't read) Don't know **3**
    - ❑ (Don't read) refused
    - ❑ Na **3**

23. Just a few more questions to help us classify the data:

    A. Gender
    - ❑ Male **8** ' Female 1**9**

    B. Into which category does your age fall?
    - ❑ 55-65 **5** ' 66-75 **4**
    - ❑ 76-85 **15** ' 86+ **2**
    - ❑ Na **1**

    D. How many individuals live in your household?
    1 – 15; 2 – 8; na - 4

    E. Which building or area do you live in?
    <<Or – for surveyor
    - ❑ Maytag **27** ' Speed Queen
    - ❑ Whirlpool >>

Thank you for helping us with this energy efficiency study!

Laundry Questionnaire Survey Results – Speed Queen

Hi. My name is _____. I am with Battelle, Pacific Northwest National Laboratory… etc.

1. Are you aware that new washing machines were recently placed in the laundry room?
   - ❑ Yes **23**
   - ❑ No
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na

2. Have you used the new washing machines yet?
   - ❑ Yes **23**
   - ❑ No
   - ❑ Na

   (If no) how come? Please be as specific as you can. _____

   How many loads do you do in a week? **__1 – 9; 2 – 3; 3 – 2; 4 – 1; 1.5 - 1**

3. In comparing the old equipment and the new equipment, would you say the new equipment is
   - ❑ much better **8**
   - ❑ somewhat better **5**
   - ❑ the same **3**
   - ❑ somewhat worse **4**
   - ❑ much worse **3**
   - ❑ Na

   Why do you say that? Please be specific. _____ Anything else? _____

4. Are you aware that the new machines require half the detergent of the old machines?
   - ❑ Yes **23**
   - ❑ No
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na

5. With the new machines, would you say you wash
   - ❑ More clothes per load **3**
   - ❑ The same amount of clothes per load **15**
   - ❑ Less clothes per load **5**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) Refused

6. Are there any types of items you are currently washing with the new machines that you did not wash in the old machines?
   - ❑ Yes **4**
   - ❑ No **18**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **1**

If yes, Are these items

- ❑ Delicate **2**
- ❑ Bulky **2**
- ❑ Something else? Please specify _____

7. With the new machines would you say it takes
   - ❑ More time to wash a load of clothes **12**
   - ❑ The same amount of time **8**
   - ❑ Less time to wash a load of clothes **2**
   - ❑ (Don't read) Don't know **1**
   - ❑ (Don't read) refused

8. With the new machines, would you say it takes
   - ❑ More time to dry a load of clothes **2**
   - ❑ The same amount of time **9**
   - ❑ Less time to dry a load of clothes **10**
   - ❑ (Don't read) Don't know **2**
   - ❑ (Don't read) refused
   - ❑ Na

9. How easy or difficult is it to load the new washing machines?
   - ❑ Very easy **8**
   - ❑ Somewhat easy **5**
   - ❑ Somewhat difficult **3**
   - ❑ Very difficult **3**
   - ❑ Does not make a difference **4**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na

10. Would you say the instruction on the new washing machines are
    - ❑ Very easy to understand
    - ❑ Somewhat easy to understand **18**
    - ❑ Somewhat difficult to understand **5**
    - ❑ Very difficult to understand
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused
    - ❑ Na

11. Would you say the walls signs are
    - ❑ Very easy to understand **18**
    - ❑ Somewhat easy to understand **4**
    - ❑ Somewhat difficult to understand
    - ❑ Very difficult to understand
    - ❑ (Don't read) Don't know **1**
    - ❑ (Don't read) refused
    - ❑ Na

12. With the new machines, would you say that your clothes are
    - Cleaner than before **13**
    - As clean as before **9**
    - Not as clean as before **1**

(Don't read) Don't know
(Don't read) refused

13. How satisfied are you with the new washing machines? Would you say you are
    - ❑ Very satisfied **10**
    - ❑ Somewhat satisfied **8**
    - ❑ Not very satisfied **1**
    - ❑ Not at all satisfied **4**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    Why do you say that? Please be as specific as you can. _____
    Any other reasons? _____

14. What, if anything, do you feel are the benefits of using the new washing machines? Any thing else?
_____

15. Did you encounter any problems using the new washing machines?
    - ❑ Yes **5**
    - ❑ No **18**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    What were the problems? _____

16. Are you aware that the new washing machines use less water overall?
    - ❑ Yes **11**
    - ❑ No **9**
    - ❑ (Don't read) Don't know **2**
    - ❑ (Don't read) refused
    - ❑ Na **1**

17. Are you aware that the new washing machines use less energy overall?
    - ❑ Yes **12**
    - ❑ No **8**
    - ❑ (Don't read) Don't know **3**
    - ❑ (Don't read) refused
    - ❑ Na
    - ❑

18. If you were given the choice of keeping the new machines or replacing them with the old machines which would you prefer to do?
    - ❑ Keep the new machines **13**
    - ❑ Go back to the old machines **8**
    - ❑ (Don't read) Don't know **2**
    - ❑ (Don't read) refused
    - ❑ Na

19. How important are water and energy conservation to you?
    - ❑ Very important **14**
    - ❑ Somewhat important **7**
    - ❑ Not very important **2**

- ❑ (Don't read) Don't know
- ❑ (Don't read) refused
- ❑ Na

20. Would you like to know about other water and energy conservation measures in place at Leisure World?
    - ❑ Yes **10**
    - ❑ No **10**
    - ❑ (Don't read) Don't know **3**
    - ❑ (Don't read) refused
    - ❑ Na

21. Would you like to see other water and energy conservation measures put in place at Leisure World?
    - ❑ Yes **13**
    - ❑ No **6**
    - ❑ (Don't read) Don't know **3**
    - ❑ (Don't read) refused
    - ❑ Na **1**

22. Would you be interested in information on energy and water conservation steps you can take in your own home?
    - ❑ Yes **11**
    - ❑ No **8**
    - ❑ (Don't read) Don't know **3**
    - ❑ (Don't read) refused
    - ❑ Na **1**

23. Just a few more questions to help us classify the data:

    A. Gender
    - ❑ Male **5** ' Female **18**

    B. Into which category does your age fall?
    - ❑ 55-65 **5** ' 66-75 **11**
    - ❑ 76-85 **6** ' 86+ **1**
    - ❑ Na

    E. How many individuals live in your household?
    1 – 17; 2 – 6

    D. Which building or area do you live in?
    <<Or – for surveyor
    - ❑ Maytag ' Speedqueen **23**
    - ❑ Whirlpool >>

Thank you for helping us with this energy efficiency study!

Laundry Questionnaire Survey Results - Whirlpool

Hi. My name is _____. I am with Battelle, Pacific Northwest National Laboratory… etc.

1. Are you aware that new washing machines were recently placed in the laundry room?
   - ❑ Yes **14**
   - ❑ No
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na

2. Have you used the new washing machines yet?
   - ❑ Yes **14**
   - ❑ No
   - ❑ Na

   (If no) how come? Please be as specific as you can. _____

   How many loads do you do in a week? **__1 – 1; 2 – 0; 3 – 3; 4 – 2; 1.5 - 1**

3. In comparing the old equipment and the new equipment, would you say the new equipment is
   - ❑ much better **3**
   - ❑ somewhat better **2**
   - ❑ the same **1**
   - ❑ somewhat worse
   - ❑ much worse **4**
   - ❑ Na **4**

   Why do you say that? Please be specific. _____ Anything else? _____

4. Are you aware that the new machines require half the detergent of the old machines?
   - ❑ Yes **2**
   - ❑ No **2**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **10**

5. With the new machines, would you say you wash
   - ❑ More clothes per load
   - ❑ The same amount of clothes per load **13**
   - ❑ Less clothes per load **1**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) Refused

6. Are there any types of items you are currently washing with the new machines that you did not wash in the old machines?
   - ❑ Yes **1**
   - ❑ No **13**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na

If yes, Are these items

- ❑ Delicate
- ❑ Bulky **1**
- ❑ Something else? Please specify _____

7. With the new machines would you say it takes
   - ❑ More time to wash a load of clothes **5**
   - ❑ The same amount of time **5**
   - ❑ Less time to wash a load of clothes **1**
   - ❑ (Don't read) Don't know **3**
   - ❑ (Don't read) refused

8. With the new machines, would you say it takes
   - ❑ More time to dry a load of clothes **1**
   - ❑ The same amount of time **7**
   - ❑ Less time to dry a load of clothes **2**
   - ❑ (Don't read) Don't know **2**
   - ❑ (Don't read) refused
   - ❑ Na **2**

9. How easy or difficult is it to load the new washing machines?
   - ❑ Very easy **7**
   - ❑ Somewhat easy
   - ❑ Somewhat difficult
   - ❑ Very difficult
   - ❑ Does not make a difference **5**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **2**

10. Would you say the instruction on the new washing machines are
    - ❑ Very easy to understand **10**
    - ❑ Somewhat easy to understand **1**
    - ❑ Somewhat difficult to understand
    - ❑ Very difficult to understand
    - ❑ (Don't read) Don't know **1**
    - ❑ (Don't read) refused
    - ❑ Na **2**

11. Would you say the walls signs are
    - ❑ Very easy to understand **12**
    - ❑ Somewhat easy to understand
    - ❑ Somewhat difficult to understand **1**
    - ❑ Very difficult to understand
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused
    - ❑ Na **1**

12. With the new machines, would you say that your clothes are
    - Cleaner than before **4**
    - As clean as before **6**
    - Not as clean as before **3**
    - (Don't read) Don't know **1**
    - (Don't read) refused

13. How satisfied are you with the new washing machines? Would you say you are
    - ❑ Very satisfied **6**
    - ❑ Somewhat satisfied **3**
    - ❑ Not very satisfied **3**
    - ❑ Not at all satisfied **2**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    Why do you say that? Please be as specific as you can. _____
    Any other reasons? _____

14. What, if anything, do you feel are the benefits of using the new washing machines? Any thing else?
_____

15. Did you encounter any problems using the new washing machines?
    - ❑ Yes **3**
    - ❑ No **11**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    What were the problems? _____

16. Are you aware that the new washing machines use less water overall?
    - ❑ Yes **7**
    - ❑ No **6**
    - ❑ (Don't read) Don't know **1**
    - ❑ (Don't read) refused
    - ❑ Na

17. Are you aware that the new washing machines use less energy overall?
    - Yes **6**
    - No **5**
    - (Don't read) Don't know **3**
    - (Don't read) refused
    - Na

18. If you were given the choice of keeping the new machines or replacing them with the old machines which would you prefer to do?
    - ❑ Keep the new machines **7**
    - ❑ Go back to the old machines **6**
    - ❑ (Don't read) Don't know **1**
    - (Don't read) refused
    - Na

19. How important are water and energy conservation to you?
    - ❑ Very important **11**
    - ❑ Somewhat important **1**
    - ❑ Not very important **1**
    - ❑ (Don't read) Don't know

    (Don't read) refused
    Na **1**

20. Would you like to know about other water and energy conservation measures in place at Leisure World?

    Yes **7**
    No **3**
    (Don't read) Don't know **1**
    (Don't read) refused
    Na **3**

21. Would you like to see other water and energy conservation measures put in place at Leisure World?

    Yes **10**
    No **3**
    (Don't read) Don't know
    (Don't read) refused
    Na **1**

22. Would you be interested in information on energy and water conservation steps you can take in your own home?

    Yes **11**
    No **2**
    (Don't read) Don't know
    (Don't read) refused
    Na **1**

23. Just a few more questions to help us classify the data:

    A. Gender
    - ❑ Male **5** ' Female **9**

    B. Into which category does your age fall?
    - ❑ 55-65 **2** ' 66-75 **8**
    - ❑ 76-85 **4** ' 86+
    - ❑ Na

    C. How many individuals live in your household?
    1 – 6; 2 – 6; na - 2

    D. Which building or area do you live in?
    <<Or – for surveyor
    - ❑ Maytag ' Speed Queen
    - ❑ Whirlpool >> **14**

Thank you for helping us with this energy efficiency study!

Laundry Questionnaire Survey Results - All Washers

Hi. My name is _____. I am with Battelle, Pacific Northwest National Laboratory… etc.

1. Are you aware that new washing machines were recently placed in the laundry room?
   - ❑ Yes **63**
   - ❑ No
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **1**

2. Have you used the new washing machines yet?
   - ❑ Yes **62**
   - ❑ No
   - ❑ Na **2**

   (If no) how come? Please be as specific as you can. _____

   How many loads do you do in a week? **__1 – 15; 2 – 11; 3 – 10; 4 – 4; 5 – 1; 6 - 3__**

3. In comparing the old equipment and the new equipment, would you say the new equipment is
   - ❑ much better **23**
   - ❑ somewhat better **11**
   - ❑ the same **8**
   - ❑ somewhat worse **7**
   - ❑ much worse **11**
   - ❑ Na **4**

   Why do you say that? Please be specific. _____ Anything else? _____

4. Are you aware that the new machines require half the detergent of the old machines?
   - ❑ Yes **47**
   - ❑ No **7**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **10**

5. With the new machines, would you say you wash
   - ❑ More clothes per load **6**
   - ❑ The same amount of clothes per load **44**
   - ❑ Less clothes per load **12**
   - ❑ (Don't read) Don't know **1**
   - ❑ (Don't read) Refused **1**

6. Are there any types of items you are currently washing with the new machines that you did not wash in the old machines?
   - ❑ Yes **8**
   - ❑ No **55**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **1**

If yes, Are these items

- ❑ Delicate **2**
- ❑ Bulky **5**
- ❑ Something else? Please specify _____**1**_____

7. With the new machines would you say it takes
   - ❑ More time to wash a load of clothes **31**
   - ❑ The same amount of time **22**
   - ❑ Less time to wash a load of clothes **6**
   - ❑ (Don't read) Don't know **5**
   - ❑ (Don't read) refused

8. With the new machines, would you say it takes
   - ❑ More time to dry a load of clothes **4**
   - ❑ The same amount of time **35**
   - ❑ Less time to dry a load of clothes **15**
   - ❑ (Don't read) Don't know **8**
   - ❑ (Don't read) refused
   - ❑ Na **2**

9. How easy or difficult is it to load the new washing machines?
   - ❑ Very easy **27**
   - ❑ Somewhat easy **9**
   - ❑ Somewhat difficult **9**
   - ❑ Very difficult **3**
   - ❑ Does not make a difference **12**
   - ❑ (Don't read) Don't know
   - ❑ (Don't read) refused
   - ❑ Na **4**

10. Would you say the instruction on the new washing machines are
    - ❑ Very easy to understand **44**
    - ❑ Somewhat easy to understand **10**
    - ❑ Somewhat difficult to understand **2**
    - ❑ Very difficult to understand **3**
    - ❑ (Don't read) Don't know **2**
    - ❑ (Don't read) refused
    - ❑ Na **3**

11. Would you say the walls signs are
    - ❑ Very easy to understand **49**
    - ❑ Somewhat easy to understand **7**
    - ❑ Somewhat difficult to understand **3**
    - ❑ Very difficult to understand
    - ❑ (Don't read) Don't know **2**
    - ❑ (Don't read) refused
    - ❑ Na **3**

12. With the new machines, would you say that your clothes are
    - Cleaner than before **22**
    - As clean as before **31**
    - Not as clean as before **9**

(Don't read) Don't know **2**
(Don't read) refused

13. How satisfied are you with the new washing machines? Would you say you are
    - ❑ Very satisfied **28**
    - ❑ Somewhat satisfied **18**
    - ❑ Not very satisfied **7**
    - ❑ Not at all satisfied **11**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    Why do you say that? Please be as specific as you can. _____
    Any other reasons? _____

14. What, if anything, do you feel are the benefits of using the new washing machines? Any thing else?
_____

15. Did you encounter any problems using the new washing machines?
    - ❑ Yes **17**
    - ❑ No **47**
    - ❑ (Don't read) Don't know
    - ❑ (Don't read) refused

    What were the problems? _____

16. Are you aware that the new washing machines use less water overall?
    - ❑ Yes **36**
    - ❑ No **22**
    - ❑ (Don't read) Don't know **5**
    - ❑ (Don't read) refused
    - ❑ Na **1**

17. Are you aware that the new washing machines use less energy overall?
    Yes **30**
    No **23**
    (Don't read) Don't know **10**
    (Don't read) refused
    Na **1**

18. If you were given the choice of keeping the new machines or replacing them with the old machines which would you prefer to do?
    - ❑ Keep the new machines **37**
    - ❑ Go back to the old machines **23**
    - ❑ (Don't read) Don't know **3**

    (Don't read) refused
    Na **1**

19. How important are water and energy conservation to you?
    - ❑ Very important **43**
    - ❑ Somewhat important **13**
    - ❑ Not very important **6**
    - ❑ (Don't read) Don't know

- ❑ (Don't read) refused
- ❑ Na **2**

20. Would you like to know about other water and energy conservation measures in place at Leisure World?
    Yes **29**
    No **26**
    (Don't read) Don't know **5**
    (Don't read) refused
    Na **4**

21. Would you like to see other water and energy conservation measures put in place at Leisure World?
    Yes **36**
    No **14**
    (Don't read) Don't know **8**
    (Don't read) refused
    Na **6**

22. Would you be interested in information on energy and water conservation steps you can take in your own home?
    Yes **33**
    No **20**
    (Don't read) Don't know **6**
    (Don't read) refused
    Na **5**

23. Just a few more questions to help us classify the data:

    A. Gender
    - ❑ Male **18** ' Female **46**

    B. Into which category does your age fall?
    - ❑ 55-65 **12** ' 66-75 **23**
    - ❑ 76-85 **25** ' 86+ **3**
    - ❑ Na **1**

    C. How many individuals live in your household?
    1 – 38; 2 – 20; na - 6

    D. Which building or area do you live in?
    <<Or – for surveyor
    - ❑ Maytag **26** ' Speedqueen **23**
    - ❑ Whirlpool >> **14**

Thank you for helping us with this energy efficiency study!

Appendix E

Incentives Available Through the Southern California Edison Residential Contractors Program

Incentives Available Through the Southern California Edison Residential Contractor Program

Southern California Edison (SCE) is offering financial incentives to owners of multifamily properties (defined as properties of 5 or greater units) who install certain energy efficiency measures as long as the measures are installed by an eligible contractor from the California statewide Residential Contractor Program (RCP). To become eligible as an RCP contractor, an insured and licensed contractor in the State of California only needs to attend the free RCP training offered by SCE and thus become a certified RCP contractor.

Under this program, the owner of a multifamily property (the Host Customer[1]) contacts SCE to obtain a voucher for a particular type of energy efficiency measure such as high performance clothes washers, refrigerators, dishwashers or lighting. The amount of the voucher will depend upon the measure and the financial incentive paid by SCE for installation of that measure (see example below). The Host Customer then selects a qualified RCP contractor (the Project Sponsor[2]), the RCP Project Sponsor purchases and installs the measure[3]. At completion of the work, the Host Customer pays for the installed measure, less the amount on the voucher which is signed over to the Project Sponsor. The Project Sponsor then submits the signed voucher – along with documentation showing that the measure was installed - to SCE for payment of the amount on the voucher.

High performance clothes washers – like those evaluated in this study - qualify under the RCP for an incentive from SCE if purchased and installed by a qualified RCP Project Sponsor. There are two incentive amounts available to LWLW[4]. An incentive of $0.25/kWh/year is paid using the standard SCE calculated savings for the particular high performance clothes washer selected. An incentive of $0.31/kWh/year is paid if the savings are measured over the period of a year based on a measurement protocol defined by SCE.

Based on the *calculated savings*, the following potential incentive is available to LWLW for <u>each</u> high performance clothes washer installed in the laundry rooms through the RCP:

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[1] The Host Customer is defined as "… one who pays the Public Goods Charge, is the owner or authorized representative of existing multifamily housing, and is served by the Utility Administrator."

[2] The Project Sponsor is "any entity that contracts with the Host Customer to perform energy efficiency retrofits, including, but not limited to, Energy Service Companies (ESCOs), lighting installers, consulting engineers, energy management companies and HVAC contractors."

[3] Note that the "Host Customer" may not act as the "Project Sponsor" in this Program.

[4] Multifamily Element of the 2000 Residential Contractor Program: Policy and Procedures Manual. May 2000, Version 3.0. Pacific Gas and Electric Company, San Diego Gas and Electric Company, Southern California Edison, Southern California Gas Company.

Maytag: $0.25/kWh x 1952.04 kWh = $488.

Speed Queen $0.25/kWh x 1878.39 kWh = $470

Whirlpool $0.25/kWh x 1728.43 kWh = $432

If an additional energy efficiency measure is installed by the RCP Project Sponsor (such as Energy Star refrigerators or dishwashers), in conjunction with a clothes washer replacement project, an additional 10% incentive is paid for *both* measures. Thus, for example, the incentive paid for each Maytag high performance washer would be $537. Note that any incentive paid under the RCP is in addition to any incentive or rebate available through the servicing water utility.