

# This presentation premiered at WaterSmart Innovations

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# **Commercial Dish Washing Equipment**

**By**

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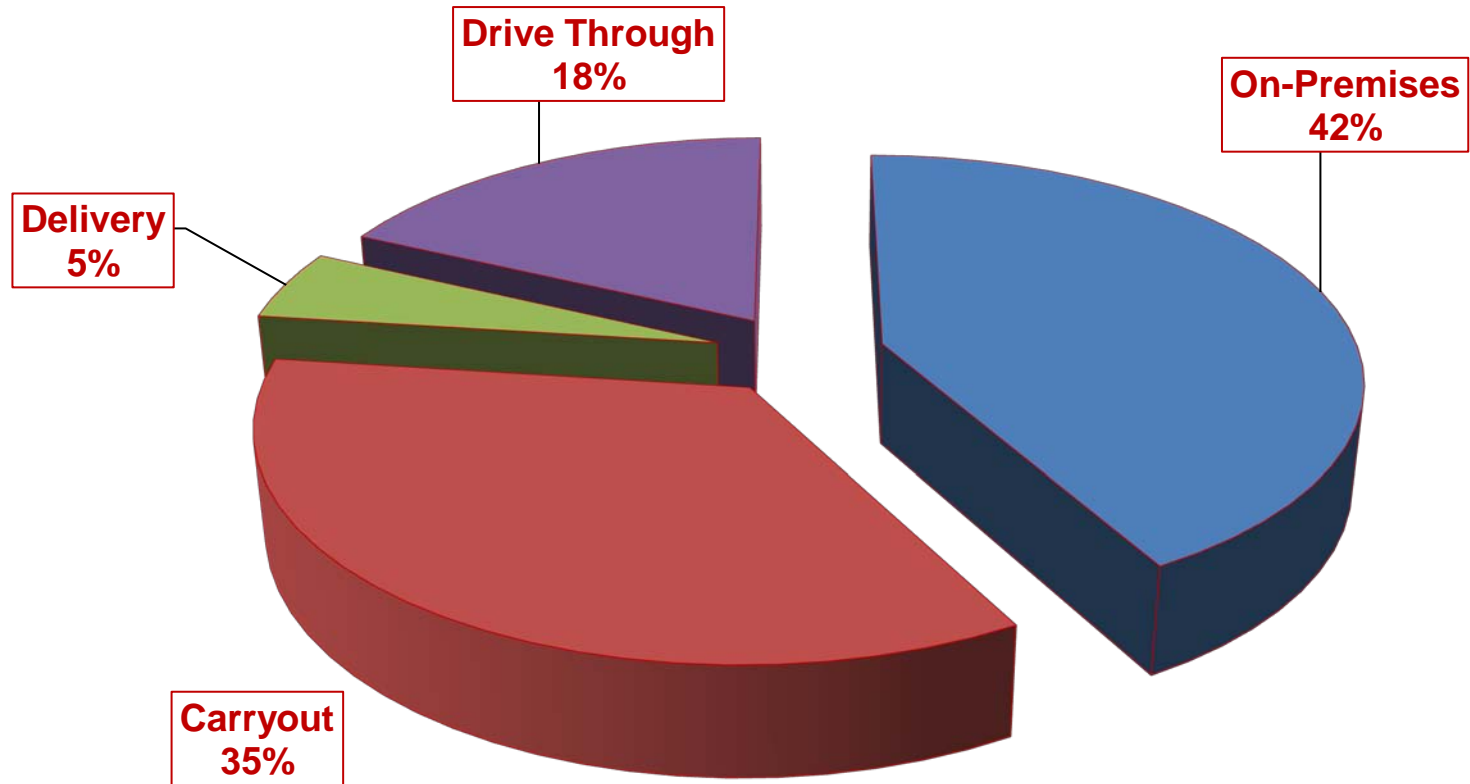
# **What Will be Covered**

- I. Introduction**
- II. Ware Washing Equipment**
- III. Ware Washer Market Dynamics**
- IV. Water Use Characteristics**
- V. Potential Future Water Savings**
- VI. Regulations and Incentives**

# Top Five States by Number of Restaurants In 2003

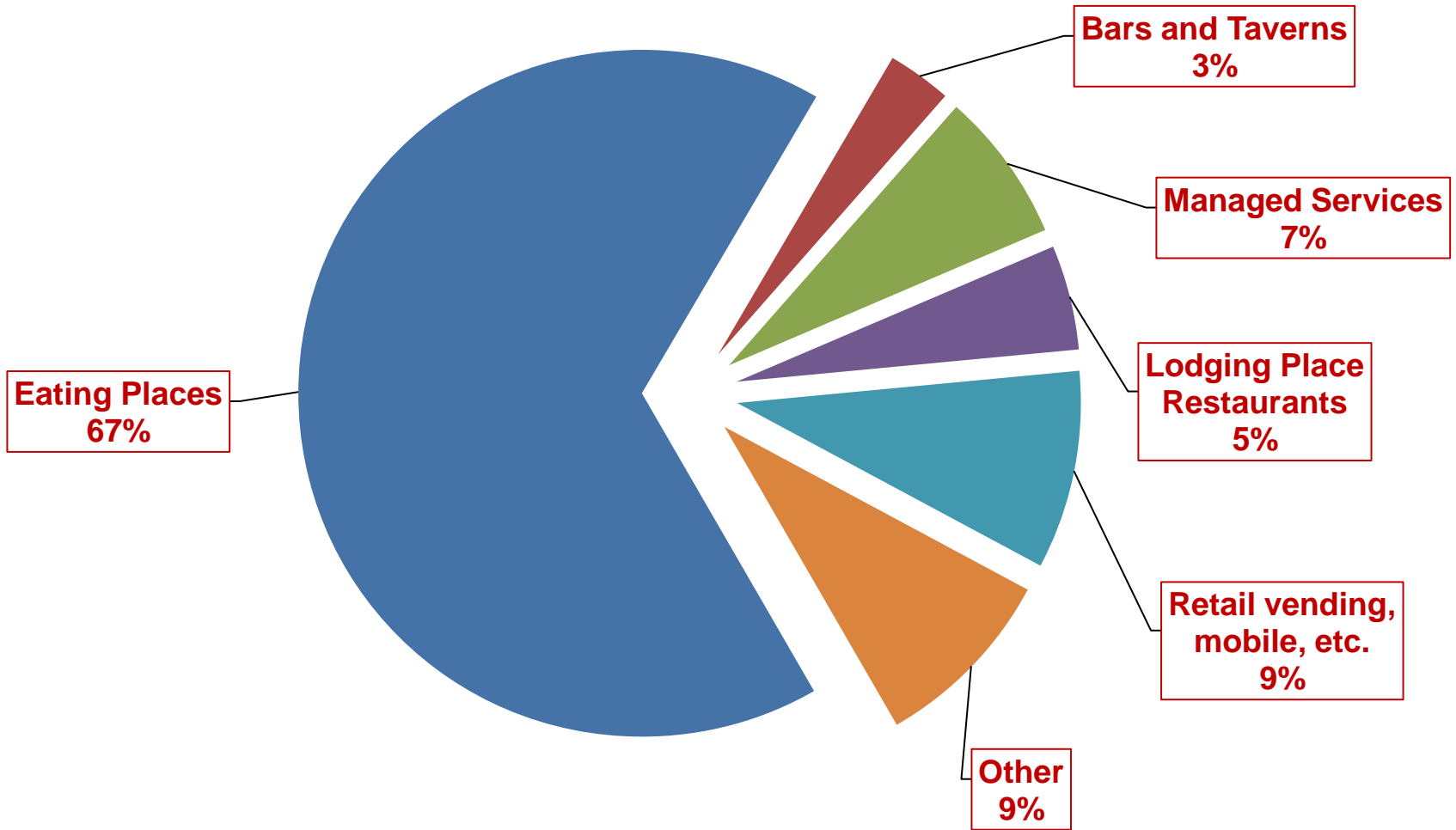
| State                  | Number of<br>Establishments | Restaurants per<br>1,000<br>Population |
|------------------------|-----------------------------|----------------------------------------|
| California             | 87,225                      | 2.41                                   |
| New York               | 58,027                      | 3.01                                   |
| Texas                  | 53,631                      | 2.35                                   |
| Florida                | 41,901                      | 2.36                                   |
| Pennsylvania           | 31,466                      | 2.53                                   |
| <b>National Totals</b> | <b>714,232</b>              | <b>2.41</b>                            |

# US Distribution of Restaurant Customer Traffic, 2001



# 2009 National Sales

*National Restaurant Association*



# Scullery Operations

- **Garbage grinders, pulpers, etc.**
- **Sluice troughs**
- **Pre-rinsing**
- **Pot and pan soaking equipment**
- **Ware Washing**
- **Cleaning and sanitation**

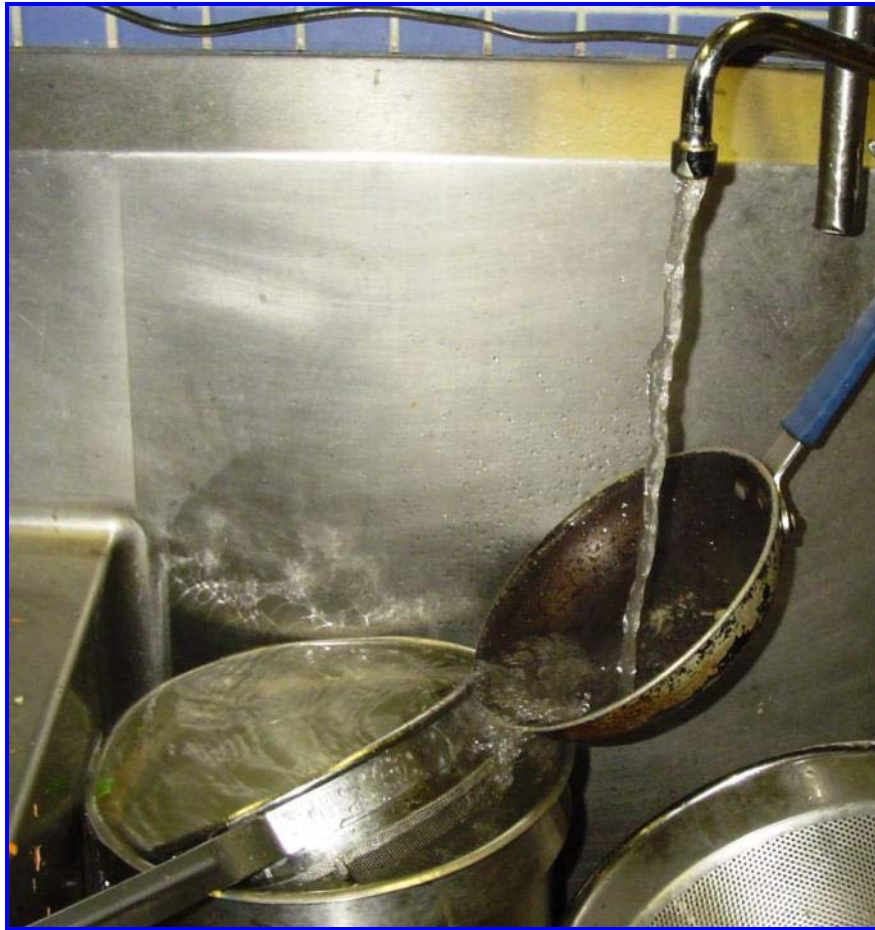
***Dish Washers***



# Pot Soaking Equipment



# There are better ways



# Commercial Dishwasher Types

- Under Counter
- Door-type
- Conveyor-type
- Flight-type



Door-type



Under Counter



Flight-type



Conveyor-type

# The Rack



- Typically 20 inches X 20 inches
- 2-3 full service place settings
- 14 plates
- 25 glasses
- 100 pieces for **flatware** (*must be run twice so that is equivalent to 50 pieces of flatware*)

# National Commercial Dishwasher Numbers and Sales Estimates

| <b>Dishwasher Type</b> | <b>Number of Units Installed as of 2001*</b> | <b>Percent of Total Installed</b> | <b>2003 Sales of New Units**</b> | <b>Percent of 2003 Sales</b> |
|------------------------|----------------------------------------------|-----------------------------------|----------------------------------|------------------------------|
| <b>Under Counter</b>   | <b>60,000</b>                                | <b>12%</b>                        | <b>12,206</b>                    | <b>33%</b>                   |
| <b>Door Type</b>       | <b>325,000</b>                               | <b>65%</b>                        | <b>17,949</b>                    | <b>48%</b>                   |
| <b>Conveyor Type</b>   | <b>90,000</b>                                | <b>18%</b>                        | <b>6,700</b>                     | <b>18%</b>                   |
| <b>Flight Type</b>     | <b>25,000</b>                                | <b>5%</b>                         | <b>465</b>                       | <b>1%</b>                    |
| <b>TOTALS</b>          | <b>505,000</b>                               | <b>100%</b>                       | <b>37,320</b>                    | <b>100%</b>                  |

Sources: 2006, Energy Star® for Commercial Dishwashers: Sizing up the Savings Opportunity, by Rachel Schmeltz, U.S. EPA, June 14

# Estimated Number of Commercial Dishwashers in California

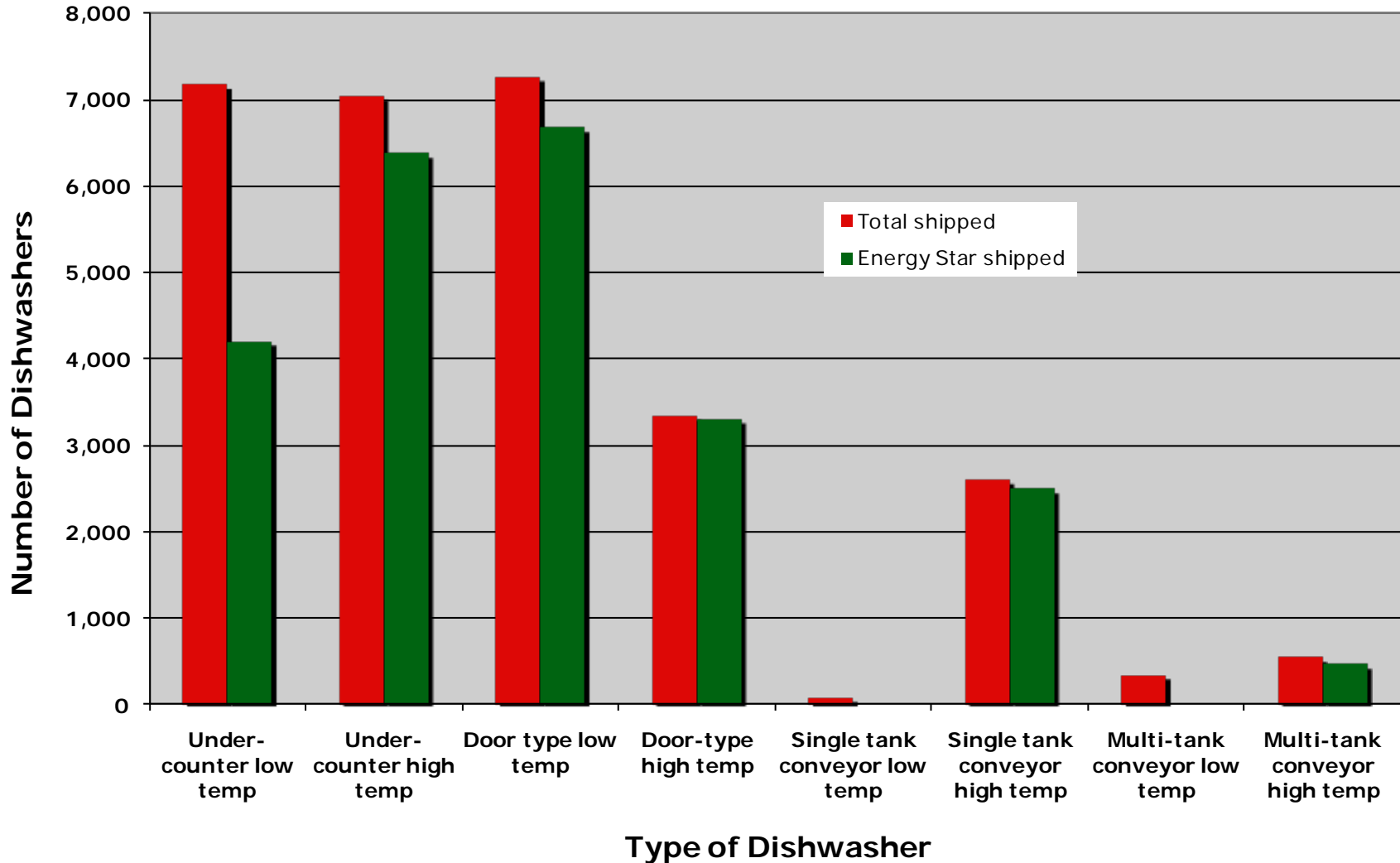
| <b>Dishwasher Type</b>       | <b>Numbers in California</b> |
|------------------------------|------------------------------|
| <b>Under-counter</b>         | <b>7,900</b>                 |
| <b>Door-Type – High Temp</b> | <b>26,300</b>                |
| <b>Door-Type – Low Temp</b>  | <b>16,500</b>                |
| <b>Conveyor- Type</b>        | <b>11,900</b>                |
| <b>Flight Type</b>           | <b>3,300</b>                 |
| <b>Total</b>                 | <b>65,900</b>                |

# Cost Difference for Energy Star<sup>®</sup> Commercial Dishwashers

| Dishwasher Type                              | Number of CEE/ENERGY STAR Qualified Products Offered | Estimated Standard Equipment Cost | Estimated CEE High Efficiency /ENERGY STAR Equipment Cost | Estimated Incremental Cost |
|----------------------------------------------|------------------------------------------------------|-----------------------------------|-----------------------------------------------------------|----------------------------|
| High Temperature, Multiple Tank Conveyor     | 23                                                   | \$20,000                          | \$24,000                                                  | \$4,000                    |
| High Temperature, Single Tank Conveyor       | 41                                                   | \$12,000                          | \$15,000                                                  | \$3,000                    |
| High Temperature, Door Type                  | 24                                                   | \$6,900                           | \$9,000                                                   | \$2,100                    |
| High Temperature, Under Counter              | 6                                                    | \$5,000                           | \$6,000                                                   | \$1,000                    |
| Low Temperature, Multiple Tank Conveyor      | 0                                                    | \$18,000                          | \$22,000                                                  | \$4,000                    |
| Low Temperature, Single Tank Conveyor        | 3                                                    | \$11,000                          | \$14,000                                                  | \$3,000                    |
| Low Temperature, Door Type                   | 11                                                   | \$6,500                           | \$8,500                                                   | \$2,000                    |
| Low Temperature, Under Counter               | 19                                                   | \$4,800                           | \$5,800                                                   | \$1,000                    |
| High/Low Temperature, Multiple Tank Conveyor | 7                                                    | Use high temp cost                | Use high temp cost                                        | Use high temp cost         |
| High/Low Temperature, Single Tank Conveyor   | 15                                                   | Use high temp cost                | Use high temp cost                                        | Use high temp cost         |
| High Low Temperature, Door Type              | 4                                                    | Use high temp cost                | Use high temp cost                                        | Use high temp cost         |



# Commercial Dishwashers - 2008 Unit Shipments (Total shipped and Energy Star® shipped)





# Reaching Limits

- The U.S. EPA Energy Star<sup>®</sup> criterion represents the lower end of water use and, in fact, may have already approached what is technologically feasible. For example, consider the multi-tank conveyor maximum water use threshold level of 0.54 gallons per rack. A rack holds 14 plates, so this is equal to about half cup of water per plate to thoroughly wash, rinse and heat the plate to the sanitation temperature.

# Drain Water Temperature

- **Although not common now, temperature of discharge water may require additional water use in some codes**
- **Keep it under 140 degrees F.**

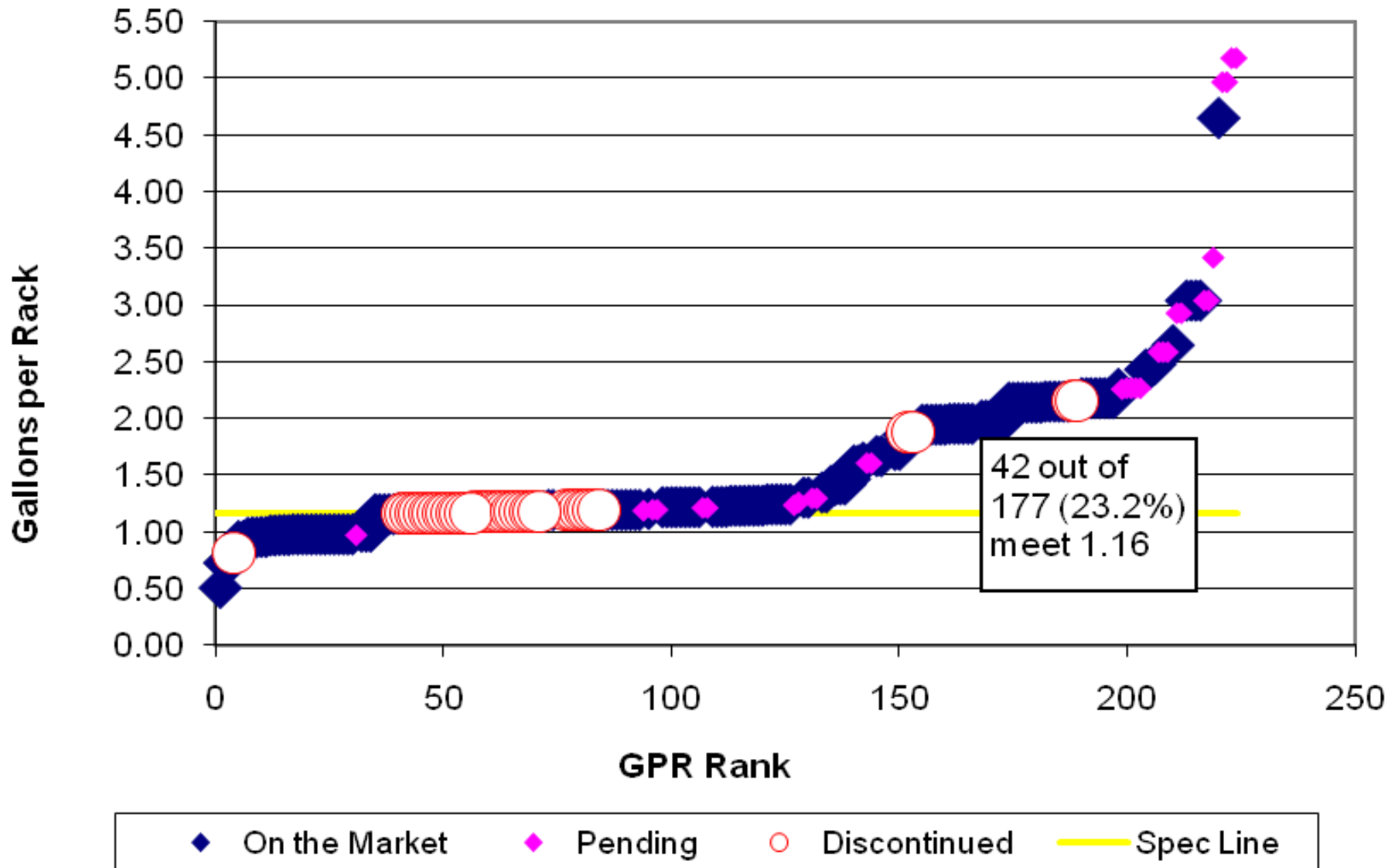
# Energy Star® Efficiency Requirements for Commercial Dishwashers

| Dishwasher Type          | High Temperature<br><u>Machine Requirements</u> |                     | Low Temperature<br><u>Machine Requirements</u> |                     |
|--------------------------|-------------------------------------------------|---------------------|------------------------------------------------|---------------------|
|                          | Idle Energy<br>Rate*                            | Water Use**         | Idle Energy<br>Rate*                           | Water Use**         |
| Under-Counter            | <= 0.9kW                                        | = 1.00<br>gal/rack  | <= 0.50kW                                      | = 1.70 gal/rack     |
| Stationary Single Tank** | <= 1.0 kW                                       | <=0.90<br>gal/rack  | <= 0.6 kW                                      | <=1.18 gal/rack     |
| Single Tank Conveyor     | <= 2.0 kW                                       | <= 0.70<br>gal/rack | <= 1.6 kW                                      | <= 0.79<br>gal/rack |
| Multi Tank Conveyor      | <= 2.6 kW                                       | <= 0.54<br>gal/rack | <= 2.0 kW                                      | <= 0.54<br>gal/rack |

\*Idle energy rate measured with door closed and representative of the energy used by the tank heater only.

\*\* Includes pot, pan, and utensil machines.

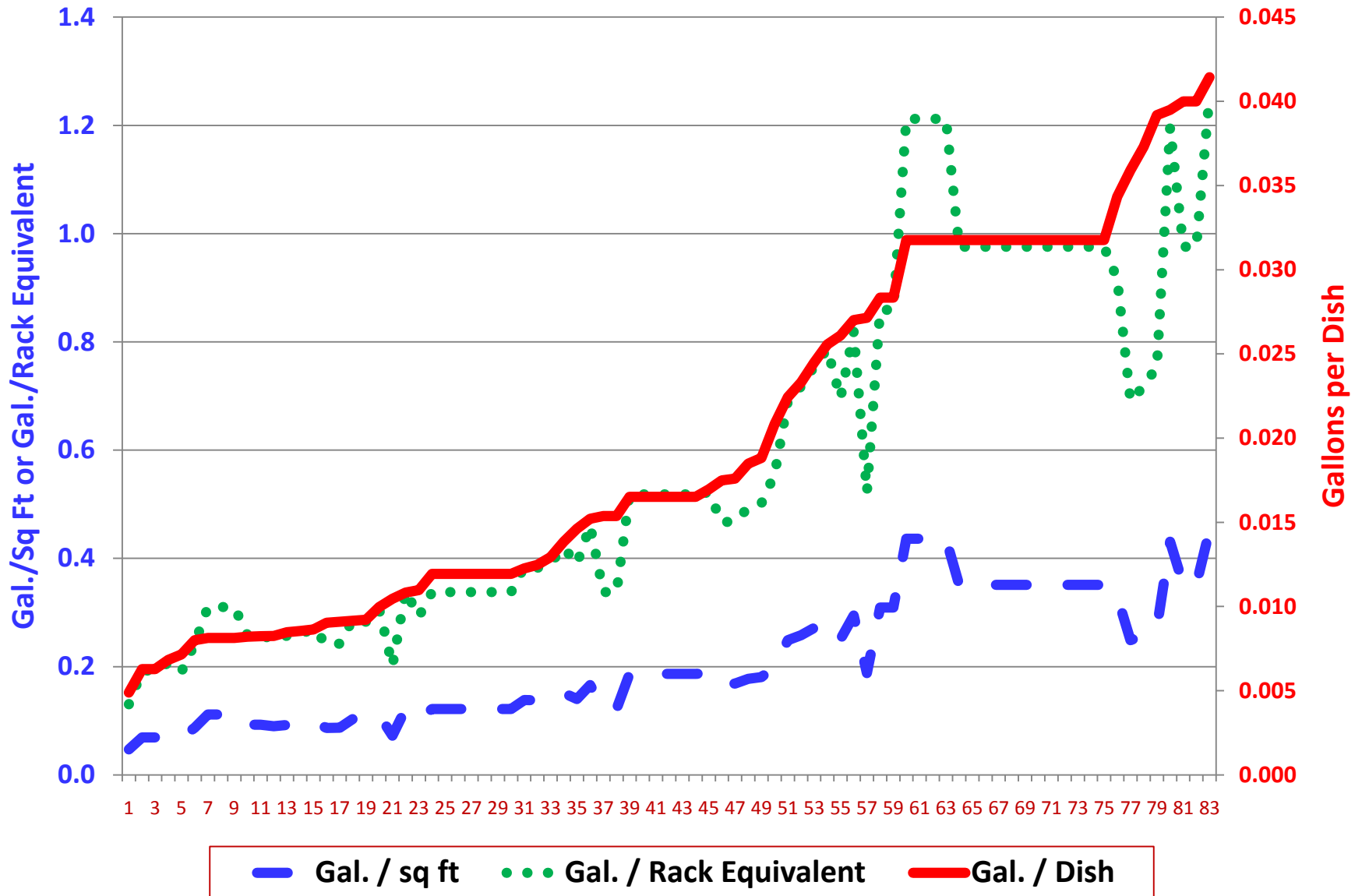
Figure 4. Door-Type Chemical Commercial Dishwasher Gallons per Rack  
From 2006 Consortium for Energy Efficiency Study



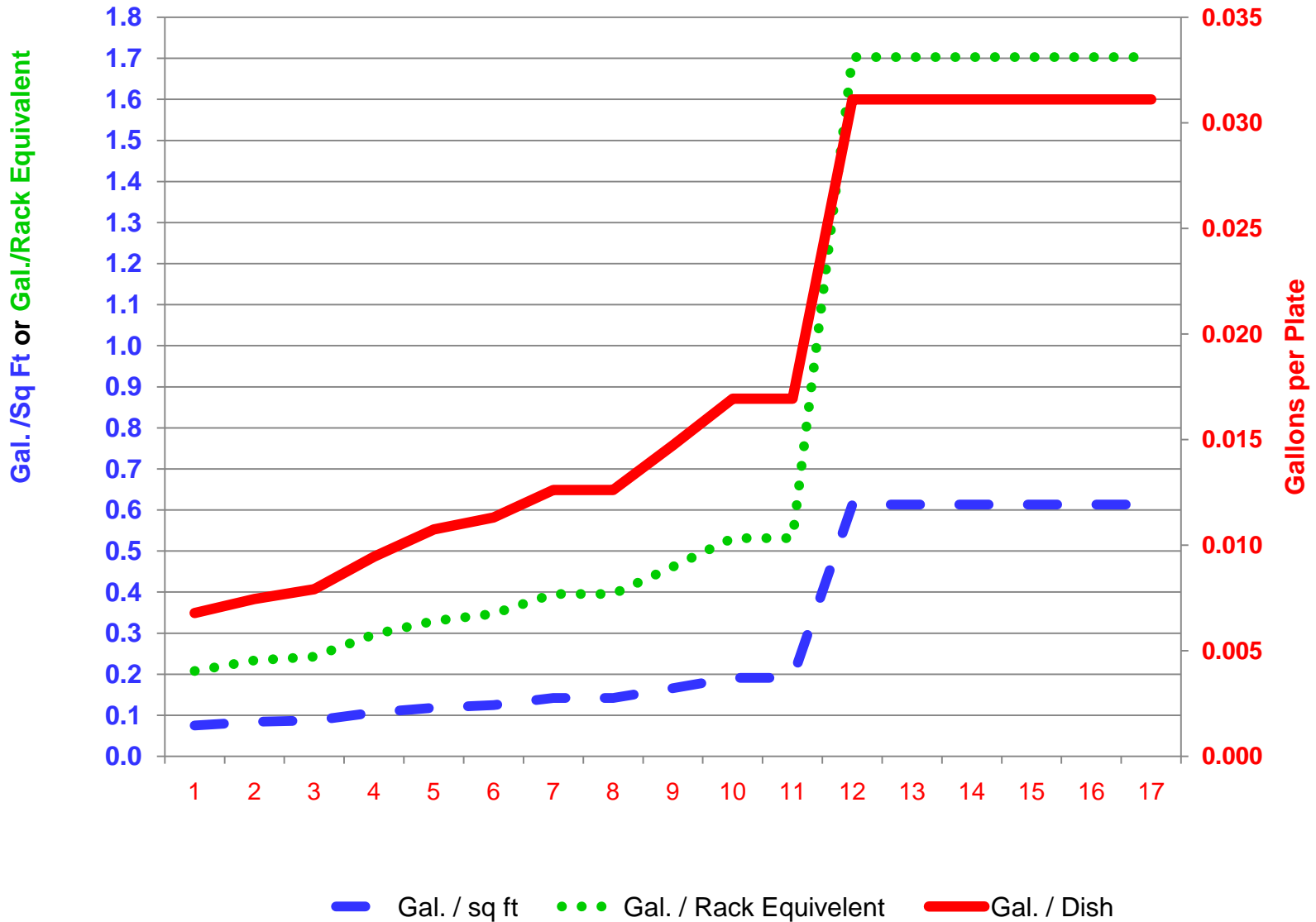
# How a Flight Type Dish Washer Works



# Multi Tank Hot Water Flight Type Water Use Characteristics for 83 models



# Single Tank Hot Water Flight Type Water Use Characteristics for 17 models



# Multi Tank Hot Water Flight Type Dishwashing Machine Water Using Characteristics

*83 machines*

| <b>Range</b>           | <b>Gal. /<br/>Sq. Ft.</b> | <b>Gal. /<br/>Dish</b> | <b>Gal. / Rack<br/>Equivalent</b> |
|------------------------|---------------------------|------------------------|-----------------------------------|
| <b>Maximum</b>         | <b>0.45</b>               | <b>0.041</b>           | <b>1.26</b>                       |
| <b>Average</b>         | <b>0.21</b>               | <b>0.020</b>           | <b>0.58</b>                       |
| <b>Median</b>          | <b>0.19</b>               | <b>0.017</b>           | <b>0.52</b>                       |
| <b>Lowest Quartile</b> | <b>0.07</b>               | <b>0.010</b>           | <b>0.20</b>                       |
| <b>Lowest</b>          | <b>0.05</b>               | <b>0.005</b>           | <b>0.13</b>                       |



# Single Tank Hot Water Flight Type Dishwashing Machine Water Using Characteristics

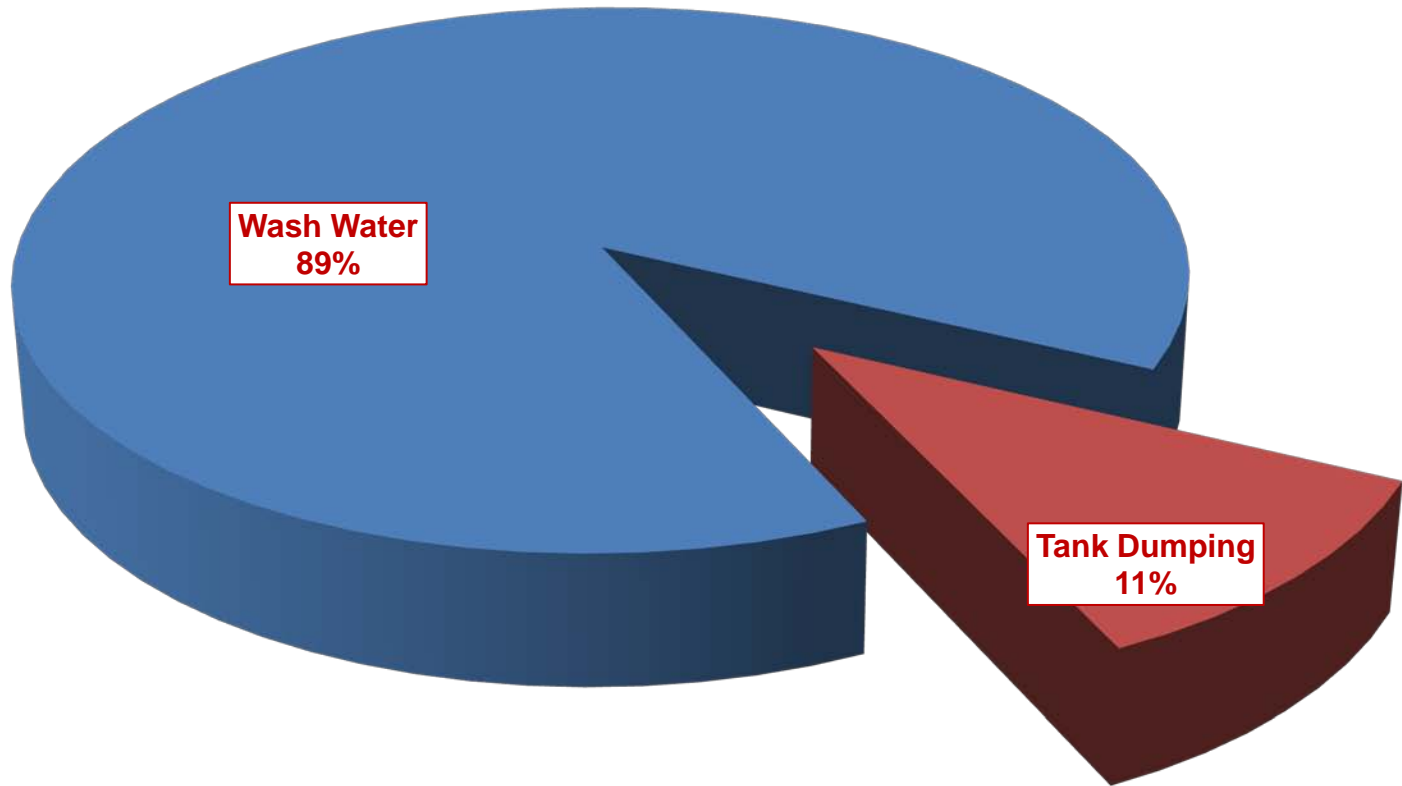
*17 machines*

| <b>Range</b>           | <b>Gal. /<br/>Sq. Ft.</b> | <b>Gal. /<br/>Dish</b> | <b>Gal. / Rack<br/>Equivalent</b> |
|------------------------|---------------------------|------------------------|-----------------------------------|
| <b>Maximum</b>         | <b>0.61</b>               | <b>0.031</b>           | <b>1.70</b>                       |
| <b>Average</b>         | <b>0.30</b>               | <b>0.0185</b>          | <b>0.83</b>                       |
| <b>Median</b>          | <b>0.14</b>               | <b>0.013</b>           | <b>0.40</b>                       |
| <b>Lowest Quartile</b> | <b>0.11</b>               | <b>0.009</b>           | <b>0.30</b>                       |
| <b>Lowest</b>          | <b>0.07</b>               | <b>0.007</b>           | <b>0.21</b>                       |

# Dishwasher Dump Use

- Water is also used when the tanks are dumped at the end of each wash period.
- Dumping necessary to keep water clean and avoid excess chemical use.
- For door machines, this is every 2 hours.
- For all other machines, it is either after each meal period or set to fit the situation.
- Volumes range for a few gallons for under counter machines to over 65 gallons for flight machines.

# Total Dishwasher Water Use



***Estimating  
Water  
Savings  
Potential***

# Hot Water Type Dishwashing Machines

| Type                 | Market Median | Energy Star <sup>®</sup> Median | Savings | Measurement       |
|----------------------|---------------|---------------------------------|---------|-------------------|
| Under- Counter       | 1.20          | 0.79                            | 0.410   | Gallons per rack  |
| Door                 | 1.18          | 0.79                            | 0.390   | Gallons per rack  |
| Single Tank Conveyor | 0.94          | 0.51                            | 0.430   | Gallons per rack  |
| Multi-Tank Conveyor  | 0.77          | 0.39                            | 0.380   | Gallons per rack  |
| Single Tank Flight   | 0.015         | .010                            | 0.005   | Gallons per plate |
| Multi-Tank Flight    | 0.017         | .009                            | 0.008   | Gallons per plate |

# Chemical Type Dishwashing Machines

| Type                 | Market Median | Energy Star <sup>®</sup> Median | Savings | Measurement       |
|----------------------|---------------|---------------------------------|---------|-------------------|
| Under- Counter       | 1.75          | 1.18                            | 0.570   | Gallons per rack  |
| Door                 | 1.22          | 1.09                            | 0.130   | Gallons per rack  |
| Single Tank Conveyor | 0.95          | 0.49                            | 0.460   | Gallons per rack  |
| Multi-Tank Conveyor  | 0.53          | 0.49                            | 0.040   | Gallons per rack  |
| Multi Tank Flight    | 0.012         | 0.009 equivalent                | 0.003   | Gallons per plate |

# Estimated Total Annual Potential Water Savings in California

| Dishwasher Type | Estimated Number in California | Saving per Operation*<br>(gallons) | Operations*<br>per day | Market Medial<br>(acre-feet per year) | Energy Star®<br>Median<br>(acre-feet per year) | Annual Savings<br>(acre-feet per year) |
|-----------------|--------------------------------|------------------------------------|------------------------|---------------------------------------|------------------------------------------------|----------------------------------------|
| Under-counter   | 7,900                          | 0.49                               | 88                     | 1,149                                 | 767                                            | 382                                    |
| Door-Type       | 42,800                         | 0.26                               | 313                    | 18,007                                | 14,106                                         | 3,905                                  |
| Conveyor-Type   | 11,900                         | 0.328                              | 1,125                  | 11,959                                | 7,048                                          | 4,895                                  |
| Flight Type*    | 3,300                          | 0.005                              | 25,000                 | 1,355                                 | 863                                            | 493                                    |
| <b>TOTAL</b>    |                                |                                    |                        | <b>32,470</b>                         | <b>22,783</b>                                  | <b>9,674</b>                           |

\* For flight machines one operation is one dish washed. For all others, it is one rack washed.

**Rebate**  
**Examples for**  
**both Energy &**  
**Water**



# Seattle Washington Area Commercial Dishwasher Rebates (\$/Unit)

| Dishwasher Type                                                | Puget Sound Electric | Snohomish County PUD | Tacoma Power   | Seattle City Lights | Cascade Natural |
|----------------------------------------------------------------|----------------------|----------------------|----------------|---------------------|-----------------|
| <b>ENERGY STAR® Dishwasher, Under-Counter, Low Temp</b>        | <b>\$250</b>         | <b>\$250</b>         | <b>\$250</b>   | <b>\$250</b>        | <b>\$100</b>    |
| <b>ENERGY STAR® Dishwasher, Under-Counter, Hi Temp *</b>       | <b>\$500</b>         | <b>\$500</b>         | <b>\$400</b>   | <b>\$500</b>        | <b>\$500</b>    |
| <b>ENERGY STAR® Dishwasher, Door Type, Low Temp</b>            | <b>\$1,000</b>       | <b>\$1,000</b>       | <b>\$650</b>   | <b>\$1,000</b>      | <b>\$1,000</b>  |
| <b>ENERGY STAR® Dishwasher, Door Type, Hi Temp*</b>            | <b>\$1,000</b>       | <b>\$1,000</b>       | <b>\$1,000</b> | <b>\$1,000</b>      | <b>\$1,000</b>  |
| <b>ENERGY STAR® Dishwasher, Single Tank Conveyor, Low Temp</b> | <b>\$1,000</b>       | <b>\$1,000</b>       | <b>\$1,000</b> | <b>\$1,000</b>      | <b>\$1,500</b>  |
| <b>ENERGY STAR® Dishwasher, Single Tank Conveyor, Hi Temp*</b> | <b>\$1,500</b>       | <b>\$1,500</b>       | <b>\$1,500</b> | <b>\$1,500</b>      | <b>\$1,500</b>  |
| <b>ENERGY STAR® Dishwasher, Multi-Tank Conveyor, Low Temp</b>  | <b>\$1,500</b>       | <b>\$1,500</b>       | <b>\$1,500</b> | <b>\$1,500</b>      | <b>\$2,500</b>  |
| <b>ENERGY STAR® Dishwasher, Multi-Tank Conveyor, Hi Temp*</b>  | <b>\$2,000</b>       | <b>\$2,000</b>       | <b>\$2,000</b> | <b>\$2,000</b>      | <b>\$2,500</b>  |

# **Southern Minnesota Municipal Power Agency Dishwasher Rebates**

*<http://www.smmpa.org/members.asp>*

| <b>Dishwasher Type</b>                    | <b>Rebate Amount</b> |
|-------------------------------------------|----------------------|
| <b>Undercounted dishwashers</b>           | <b>\$300</b>         |
| <b>Single tank door dishwashers</b>       | <b>\$600</b>         |
| <b>Single tank conveyor dishwashers</b>   | <b>\$800</b>         |
| <b>Multiple tank conveyor dishwashers</b> | <b>\$1,000</b>       |

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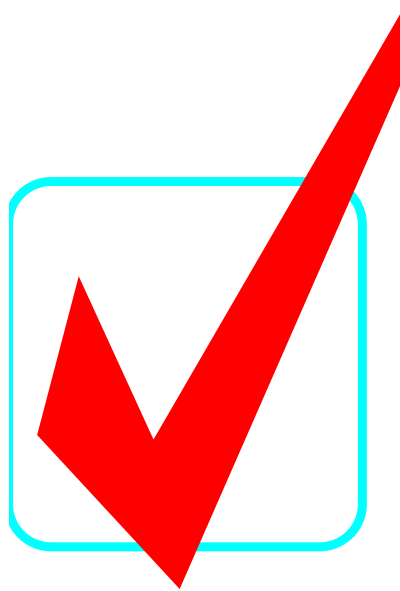
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*The*



*End*