



Pumped Rinse Dishmachines

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Acknowledgements



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Learning Objectives

- Why are dishmachines important to restaurants? How do they work?
- What is a pumped rinse and why is it important?
- Field monitoring results
 - Baseline sites
 - Replacement sites
- Savings potential, next steps and recommendations

But first, a little motivation...



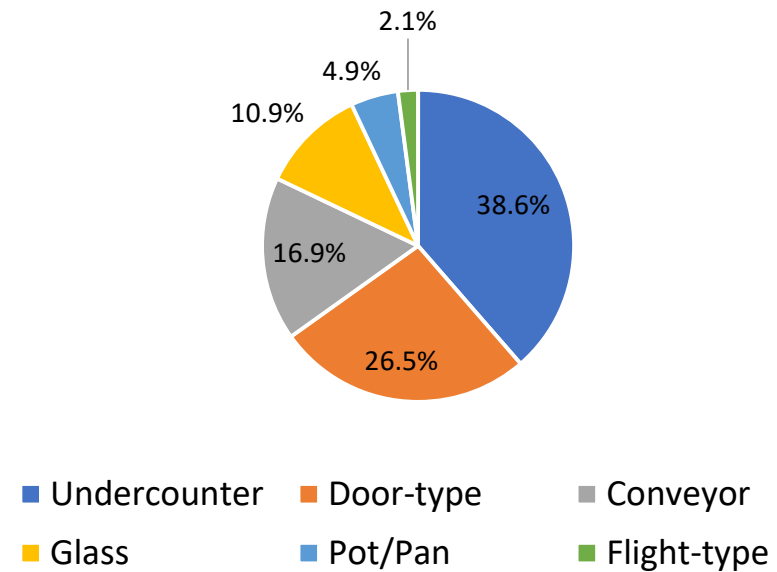
Why do people even use dishmachines?

- Labor savers
- NSF Standards
 - Tank Temperature
 - Chemical Rinse Temp = 140°F
 - High Temp Rinse = 180°F
- Multiple types for multiple applications

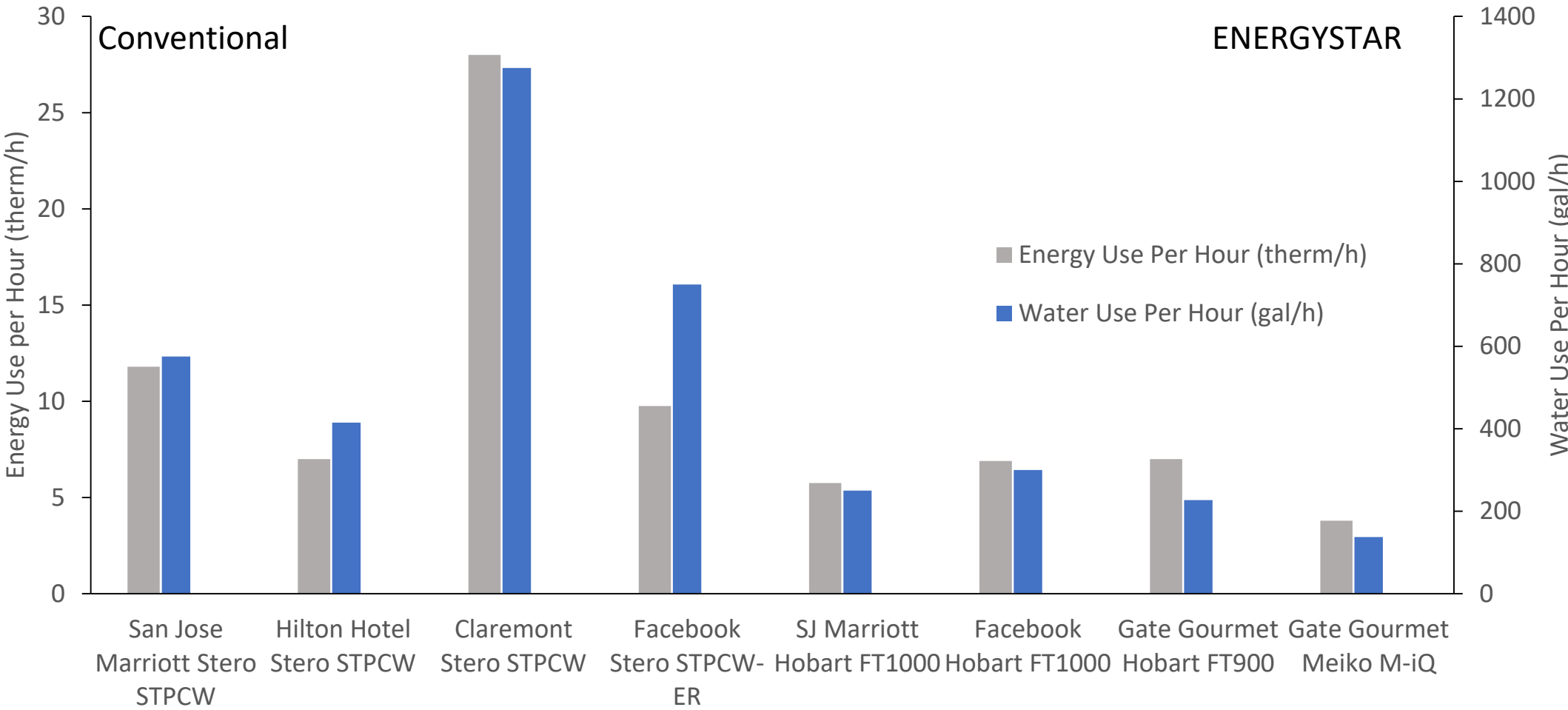


Dishmachines are Ubiquitous in CFS

Source NAFEM data 2010	
Warewashing Machine Type	2009 Units sold
Undercounter	9647
Door-type	6631
Conveyor	4240
Glass	2731
Pot/Pan	1228
Flight-type	519
Rack/Cabinet/Tray	25
Total	25021



Dishmachines use a lot of Water and Energy



How is so much energy being used?

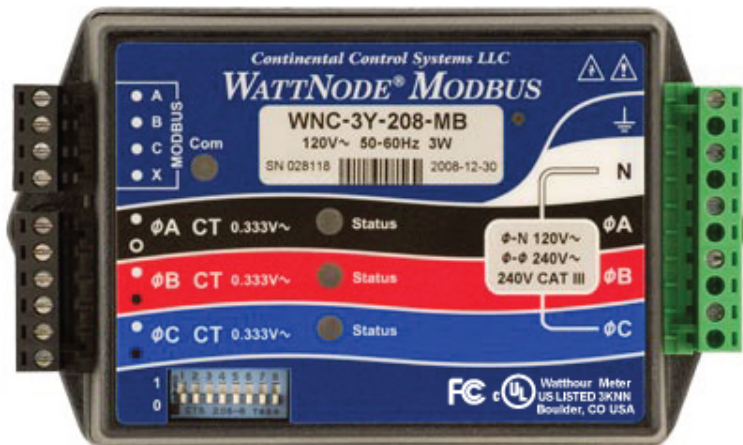
- Wash
 - Removes debris from the surface of the dishware; filters/recirculates water in tank
- Rinse
 - Uses either chemical-assisted water or very hot water to sanitize dishware; uses new hot water for each rinse
- Tank Heater
 - Replenishes heat lost in rinsing process
- Booster Heater
 - Boosts inlet hot water from building water heater to desired rinse temperature
- Building Water Heater
 - Supplies 120°F+ water to dishmachine

Project Goals: What We're Trying to Address

- Dishmachines use more water and energy as they age
- Maintenance can increase rinse pressure as a band-aid solution for deeper problems
- Operating staff has a hard time identifying increased water/energy use



Project Setup: What We're Doing & Why



- Field monitor the water and energy consumption of 3 pressure-rinse machines vs. 1 pumped rinse machine
- Document final rinse flow rate against manufacturer's specifications
- Show savings potential of pumped rinse dishmachines

Summary of Data from Past Projects

- 2 low temp machines, 5 high temp machines
- Unsure of average machine age
- Average water use per rack: 1.67 gal/rack
- **Actual vs. Rinse flow rate: 1.5***
- Average Energy use per rack: 3,600 btu/rack
- Average total water use: 260 gal

Danville Brewing Company Results

Daily Water Use	
Rinse Water Use (gal/d)	225.7
Total Water Use (gal/d)	243.8
Rated Water Use Per Rack (gal/rack)	0.83
Actual Water Use per Rack (gal/rack)	1.37
Flow Pressure	
Rinse Pressure (psi)	22.6
Specified Rinse Pressure (psi)	15 - 20
Dishmachine Age (years)	1.5
Water Temperatures	
Heat Exchanger Inlet (°F)	60.2
Heat Exchanger Outlet/Booster Inlet (°F)	121.2
Booster Outlet/Final Rinse (°F)	181.7
Tank (°F)	153.5
Operating Time	
Dishwasher Operating Span (h)	8.7
Number of Racks Per Day	178
Energy Use and Efficiency	
Total Dishwasher Energy (therm/d)	6.2
Booster Heater Efficiency	73%
Overall Dishmachine Efficiency	36%
Energy Use Per Rack (btu/rack)	3,500



Oncoming Site: Catering Company

- CMA180
- Non-Pumped rinse machine, 3 years old
- ~150 racks per day of use
- Previous monitoring of same model revealed:
 - 1.4 gpm rinse flow rate (1.5*spec)
 - 3,000 btu/rack
 - Estimate ~250 gal/day, 4.5 therms/day



Comal Preliminary Results (just a few days of data!)

Daily Water Use	
Rinse Water Use (gal/d)	264.2
Total Water Use (gal/d)	280.8
Rated Water Use Per Rack (gal/rack)	1.09
Actual Water Use per Rack (gal/rack)	1.17
Flow Pressure	
Rinse Pressure (psi)	N/A
Specified Rinse Pressure (psi)	N/A
Dishmachine Age (years)	~5
Water Temperatures	
Cold Water (°F)	58.3
Booster Outlet/Final Rinse (°F)	141.2
Operating Time	
Dishwasher Operating Span (h)	7.2
Number of Racks Per Day	240
Energy Use and Efficiency	
Total Dishwasher Energy (therm/d)	4.5
Booster Heater Efficiency	85%
Overall Dishmachine Efficiency	41%
Energy Use Per Rack (btu/rack)	1,900



Next Steps

- Install metering equipment on 2 additional sites to satisfy project conditions
- Perform a 1:1 replacement with a pumped rinse door-type machine
- Replicate studies for undercounter and rack conveyor machines
- Consider additional dishmachine technologies
- Design mid-life replacement programs for dishmachines
- Eventually regulate?

Future Dishmachine Studies

- Exhaust Heat Recovery
- Drain Water Heat Recovery (ongoing)
- Advanced tank filtering for rack conveyor machines

Questions?

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