Results from a Flight Conveyor Monitoring Project

Fisher-Nickel, a division of Frontier Energy, Inc.

Outline

- Overview, Site Descriptions
- Water Consumption
- Energy Consumption
- Technology comparison
- Cost comparison

Overview

Project Scope

- Facebook
  - Monitor employee café's Hobart FT1000 ER
  - Evaluate utility cost

- Gate Gourmet
  - Monitor Meiko MiQ (current best in class technology)
  - Hobart FT900 Advansys
  - Evaluate utility cost

Cost comparison of all 3 machines yields actionable results for the foodservice operator, and a market characterization study will show the value of new technologies for the utility.

What we're looking at

Temperatures:

- HX in/out
- Booster Inlet
- Final Rinse

Cold Water

Hot Water

Electricity kWh

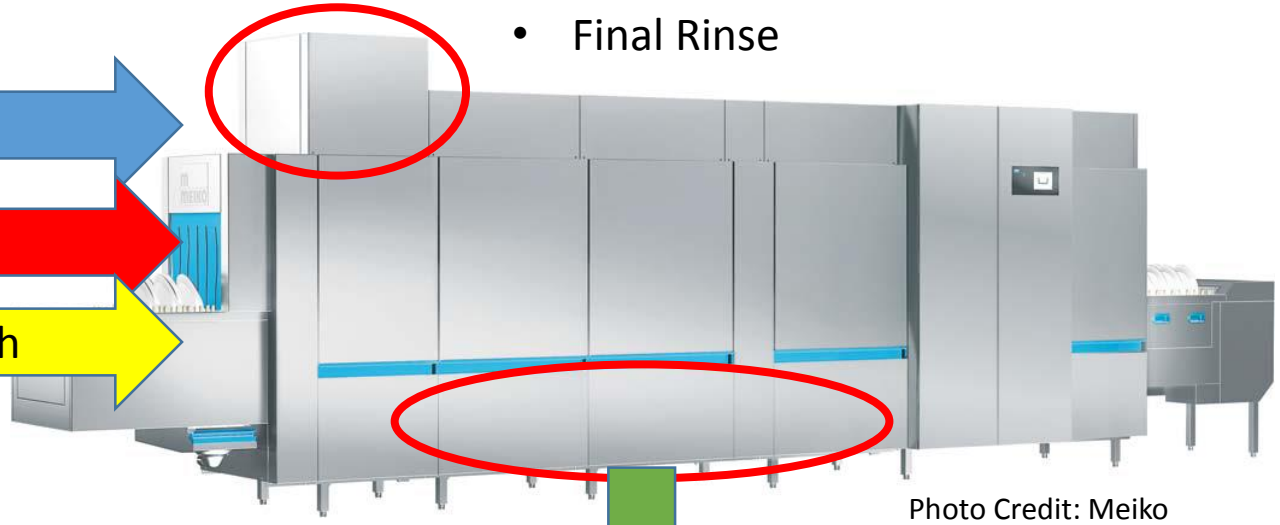


Photo Credit: Meiko

Drain T

Tank Temperatures:

- PreWash
- Wash
- Rinse
- Dual Rinse

…And On/off sensors:

- Rinse solenoid
- Rinse Pump
- Machine Status
- Wash Status
- Blowers
- Tank Heaters

Gate Gourmet SFO Dishroom

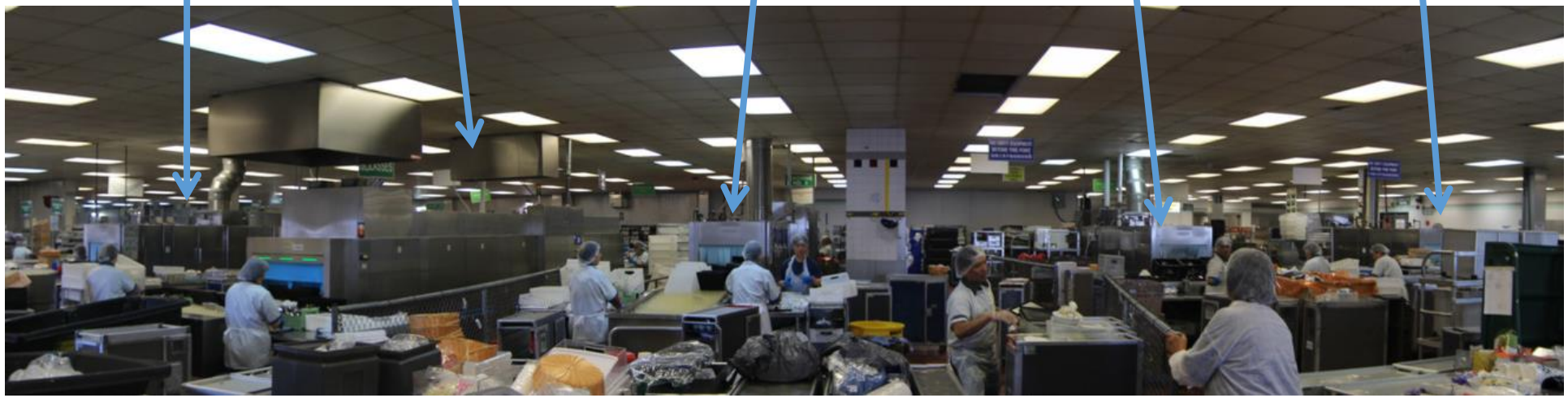
#1 Hobart FT900D BD Advansys
Domestic and International Cups and Mugs

#2 Meiko B-L94 V8 4BD
Domestic Mixed Ware

#3 Hobart FT900D BD
20% Domestic and 80% International Mixed Ware

#4 Hobart FT900D BD Advansys
International Mixed Ware

#5 Hobart FT900D BD
International Mixed Ware



So, what are we washin'?

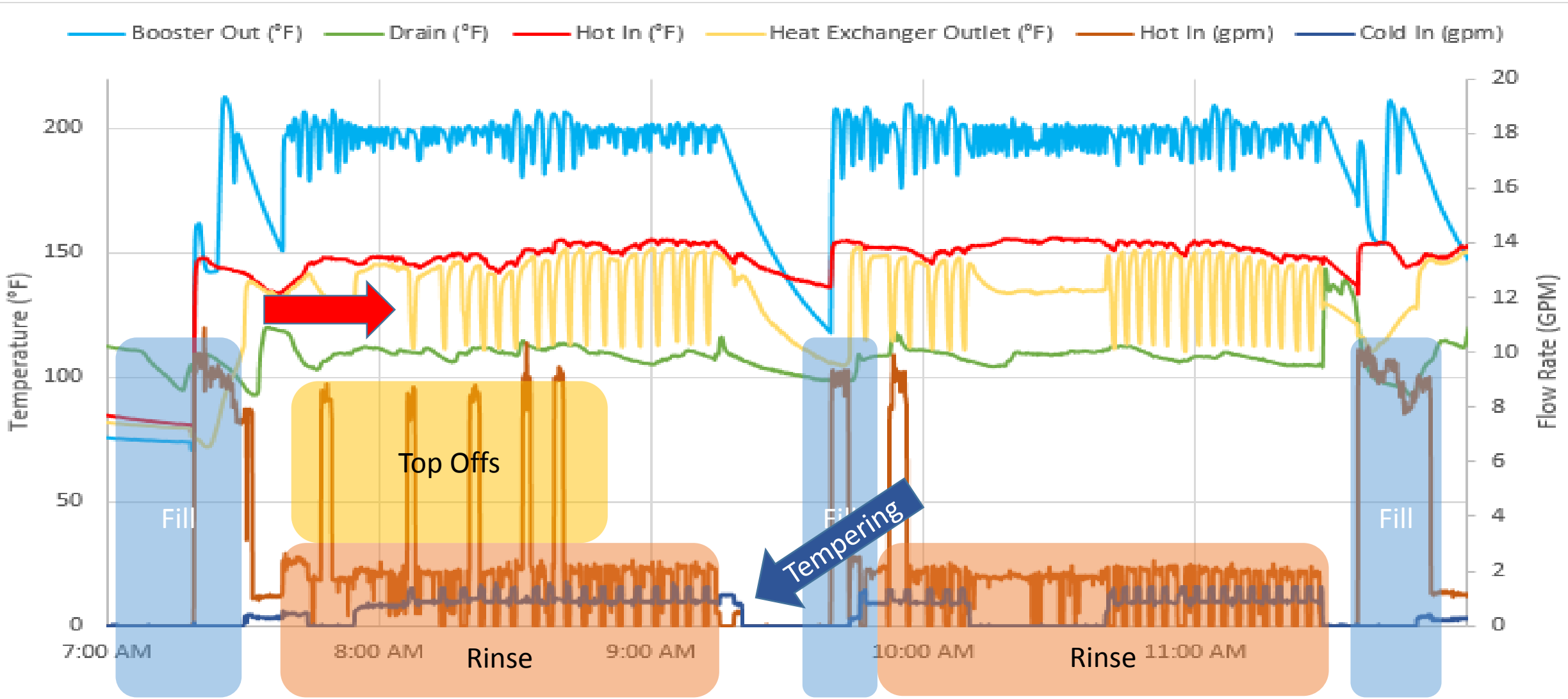
- 50% ceramic
  - Small ceramic plates were most common
- 40% Plastic
  - Plastic trays were common
- Misc. wares include stainless steel utensils, tongs, carafes
- Cups were mostly glassware, either stemless or stemmed, mugs were also washed

Facebook Dishroom

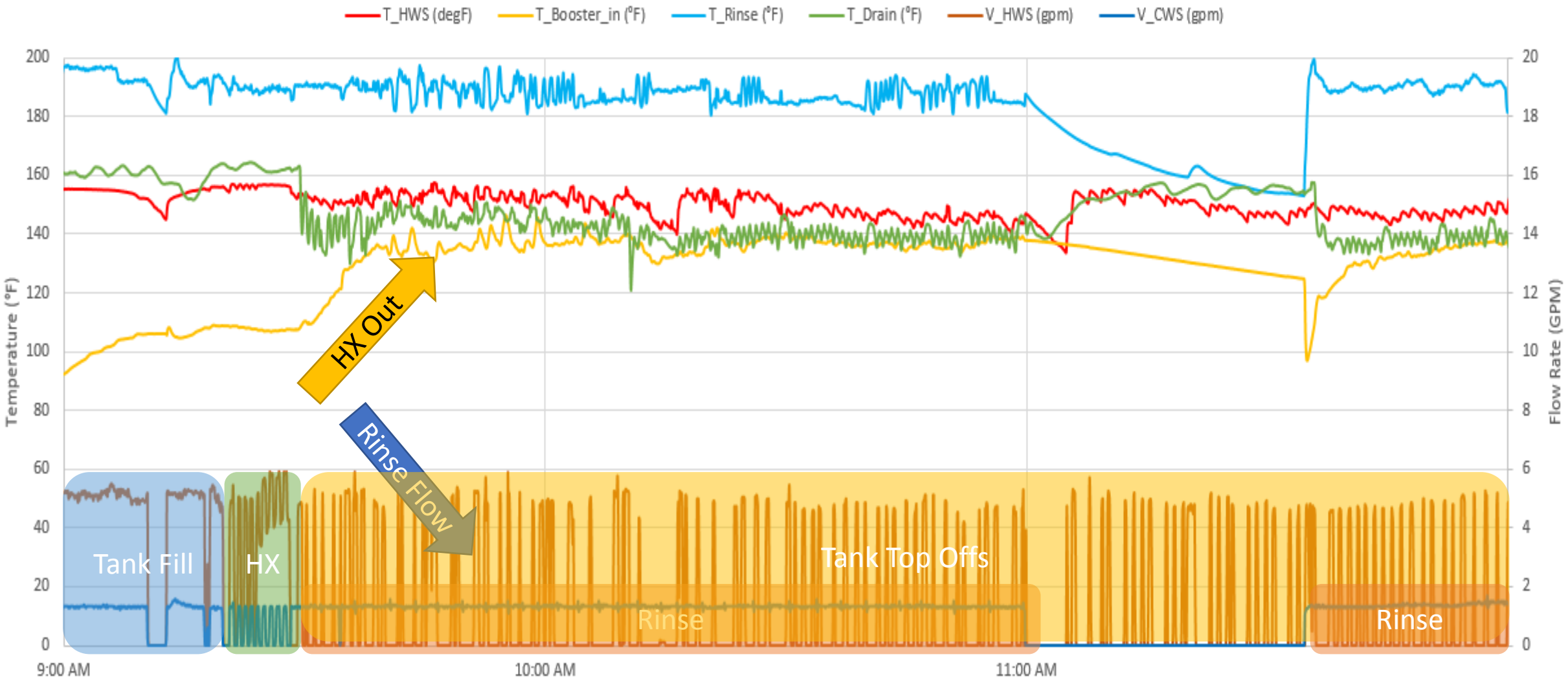
- Facebook EPIC Café serves ~10,000 meals per day with mixed wares
- Dishroom also handles wares from 10 small FS facilities on campus
- Very high traffic dishroom operates from 8AM to 8PM
- More food debris enters machine
- Oversized wares are placed in machine

Water Consumption

Hobart FT900 Water Consumption Profile



Meiko Water Consumption Profile



Average Daily Water Consumption

- Meiko is using least amount of total water, most importantly hot water
  - Direct energy savings at the boiler
  - Indirect energy savings at the tank heaters b/c less dump and fills
- Note: data presented are daily totals normalized to hours of rinse time

Machine	Rinse Time (hR/d)	Hot Water (gal/hR)	Cold Water (gal/hR)	Total Water (gal/hR)
Hobart FT1000	7.4	192	140	332
Hobart FT900	14.5	171	80	250
Meiko	15.7	49	89	138

Dumps and Fills

- Hobarts are dumping and filling much more than Meiko
- Meiko uses more top-off water

Machine	Rinse Hours per day	# Dumps /Fills per day	Tank Fill water per day (gal)	Top Off water per day (gal)
FB FT1000	7.4	5	480	650
GG FT900	14.5	7	1010	121
GG Meiko	15.7	3	424	258

Meiko active tank filtering system

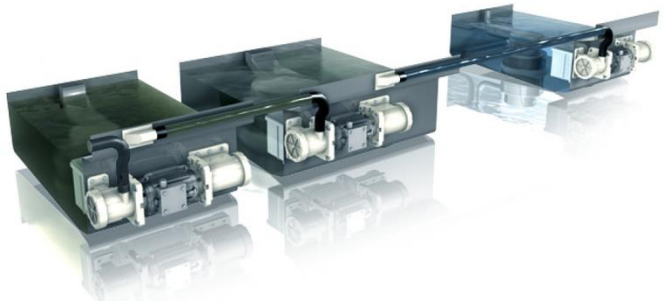


Photo Credit: Meiko

Hobart automatic soil removal system

Photo Credit: Hobart

Measured vs. specified rinse flow rates

Machine	Width (in)	Measured Rinse Flow Rate (gpm)	Manufacturer Rated Rinse Flow Rate (gpm)
Hobart FT1000	30.0	1.2	0.97
Hobart FT900	30.5	3.0	2.2
Meiko	38.6	1.3	1.3

- Energy Star program based on final rinse flow rate
- Field measured rinse flow rates usually higher than MFR's spec
  - Commissioning, actual rinse pressure vs. manufacturer's lab pressure
  - Higher flow rates over time due to wear and tear/maintenance

Energy Consumption

Average Daily Energy Consumption

Machine	Rinse Hours per day	Dishwasher electric use per hR, excl. booster (kWh/hR)	Booster electric use per hR (kWh/hR)
FT1000	7.4	169	10
FT900	14.5	130	14
Meiko	15.7	80	12

- Meiko and Hobart FT900 use almost the same amount of booster energy, but FT900 uses much more hot water

Average Daily Energy Consumption

Machine	Total Electric use per day including booster (kWh)	Est. building water heater energy use per day (therm)	Total Electric per hour rinse including booster (kWh/h)	Building water heater use per hour rinse (therm/h)
FT1000	1328	12	189	1.7
FT900	2098	30	150	2.1
Meiko	1440	10.5	91	0.7

- Meiko uses energy at roughly half the rate of either of the Hobart machines
  - Overall energy savings per hour rinse = 47%

Technology Comparison

Exhaust Heat Recovery

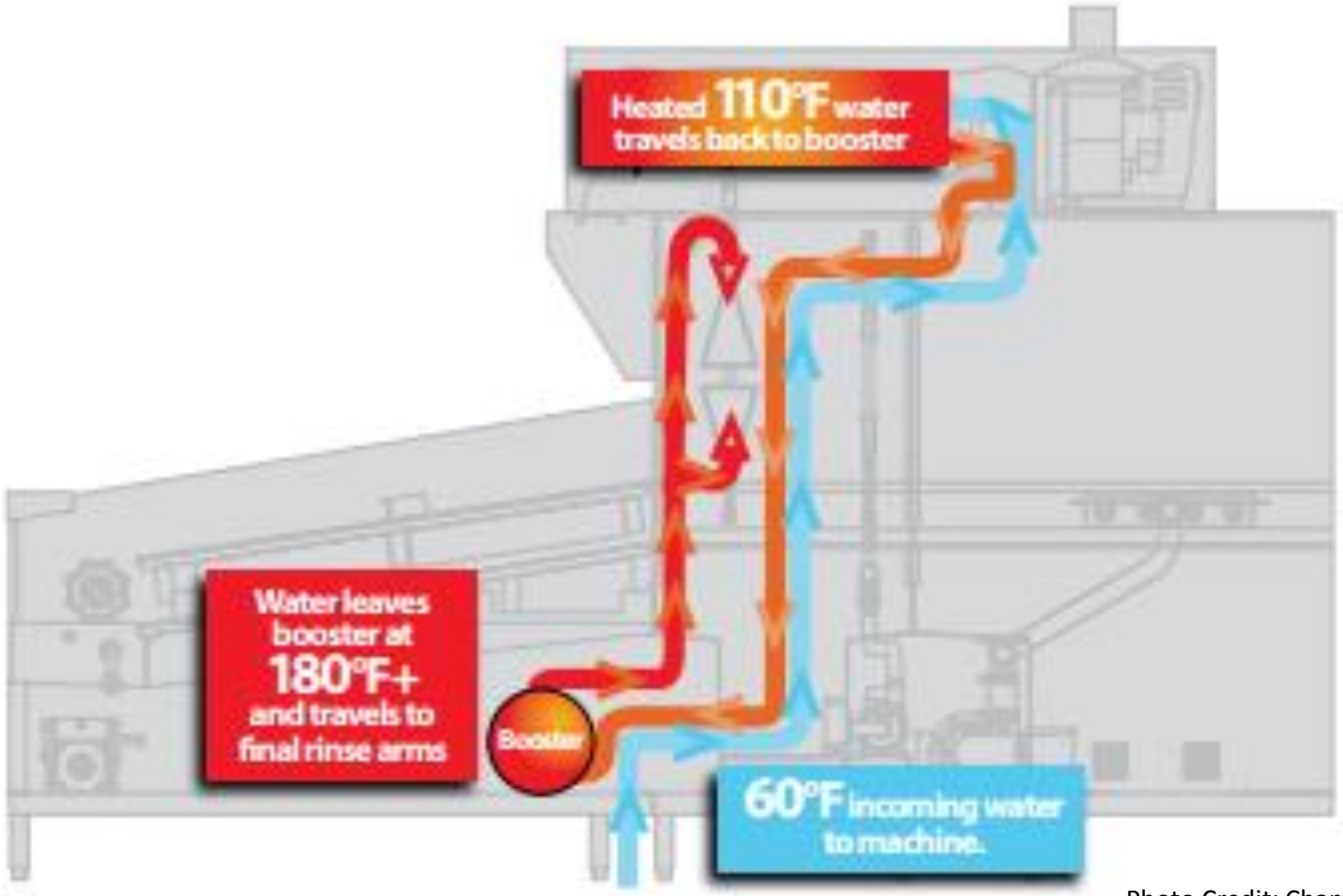
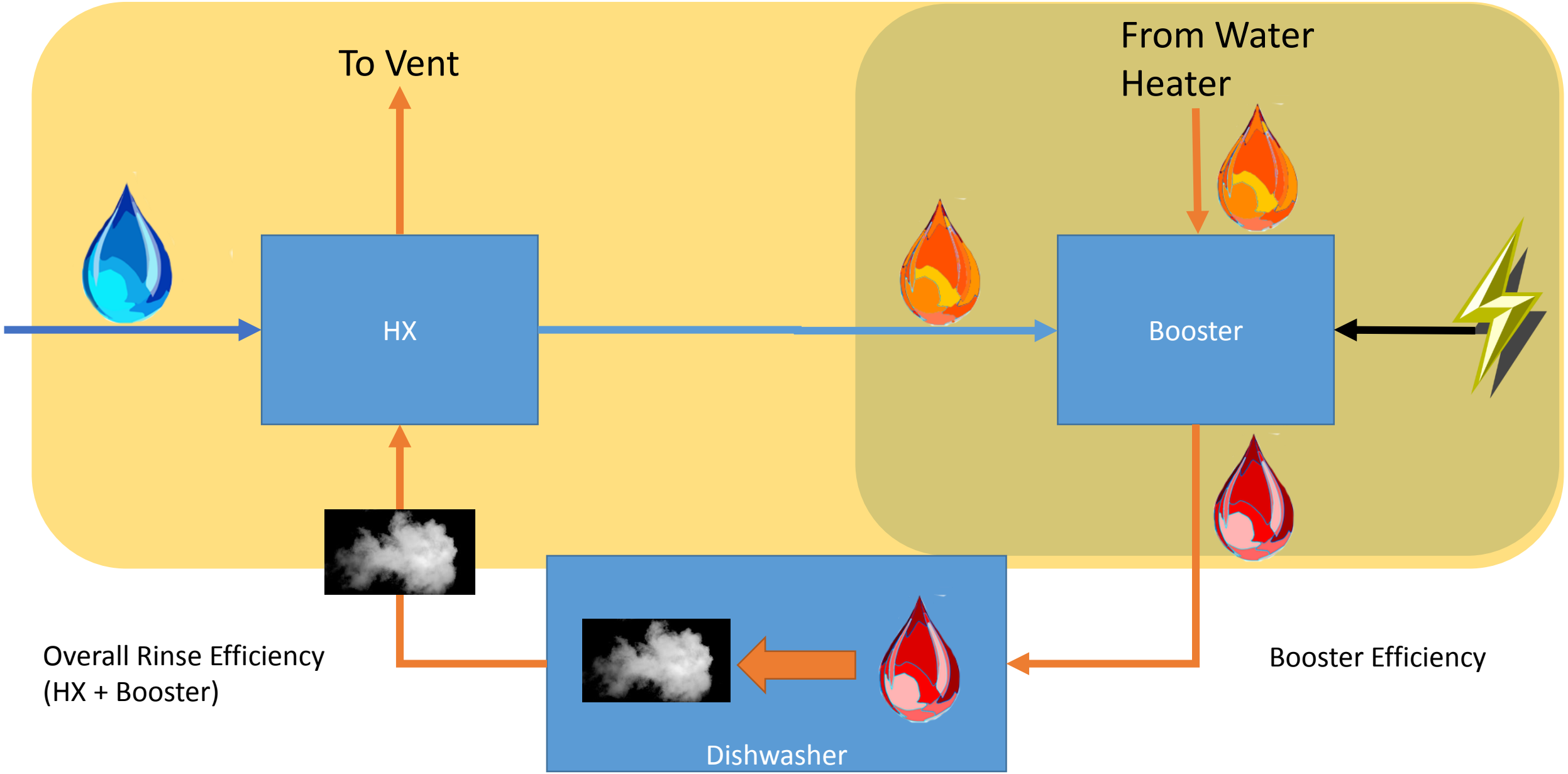


Photo Credit: Champion

Heat Exchanger and Booster Efficiency



Booster Efficiency vs. Overall Rinse Efficiency

$$\eta_{Booster} = \frac{E_{WBO} - (E_{HXO} + E_{WBIHOT})}{E_{Boost}}$$

$$\eta_{Overall\ Rinse} = \frac{E_{WBO} - (E_{WBIHOT})}{E_{Boost}}$$

$$E_{WBO} = Energy\ in\ water\ at\ the\ booster\ outlet = m_{out} * C_P * \left(T_{Boost,out} - T_{Cold,in}\right)$$

$$E_{HXO} = Energy\ at\ HX\ outlet = m_{cold,in} * C_P * \left(T_{Boost,in} - T_{Cold,in}\right)$$

$$E_{WBIHOT} = Energy\ in\ hot\ water = \ m_{hot,in} * C_P * (T_{Hot} - T_{Cold,in})$$

$$E_{Boost} = Electric\ or\ gas\ energy\ supplied\ to\ the\ booster\ heater$$

HX and Booster Efficiency Comparison

	Booster Efficiency (%)	Overall Rinse Efficiency (%)	ORE – BE (%)
Hobart FT900	88	89	1
Meiko	98	199	101

Energy seen at Booster Heater:

	% Energy from HX	% Energy from Domestic Boiler
Hobart FT900	2.5%	97.5%
Meiko	95.4%	4.6%

Hobart FT900 may not be operating as designed

Gate Gourmet has a high level of maintenance

- Maintenance contract with Hobart
- In-house techs
- Almost daily maintenance during off periods
- **Need to talk to Hobart about retro-commissioning FT900**

Heat Exchanger issue hasn't been diagnosed by current maintenance practices

- Submetering will be an important technology going forward

Cost Comparison

Utility Operating costs (not including chemicals)

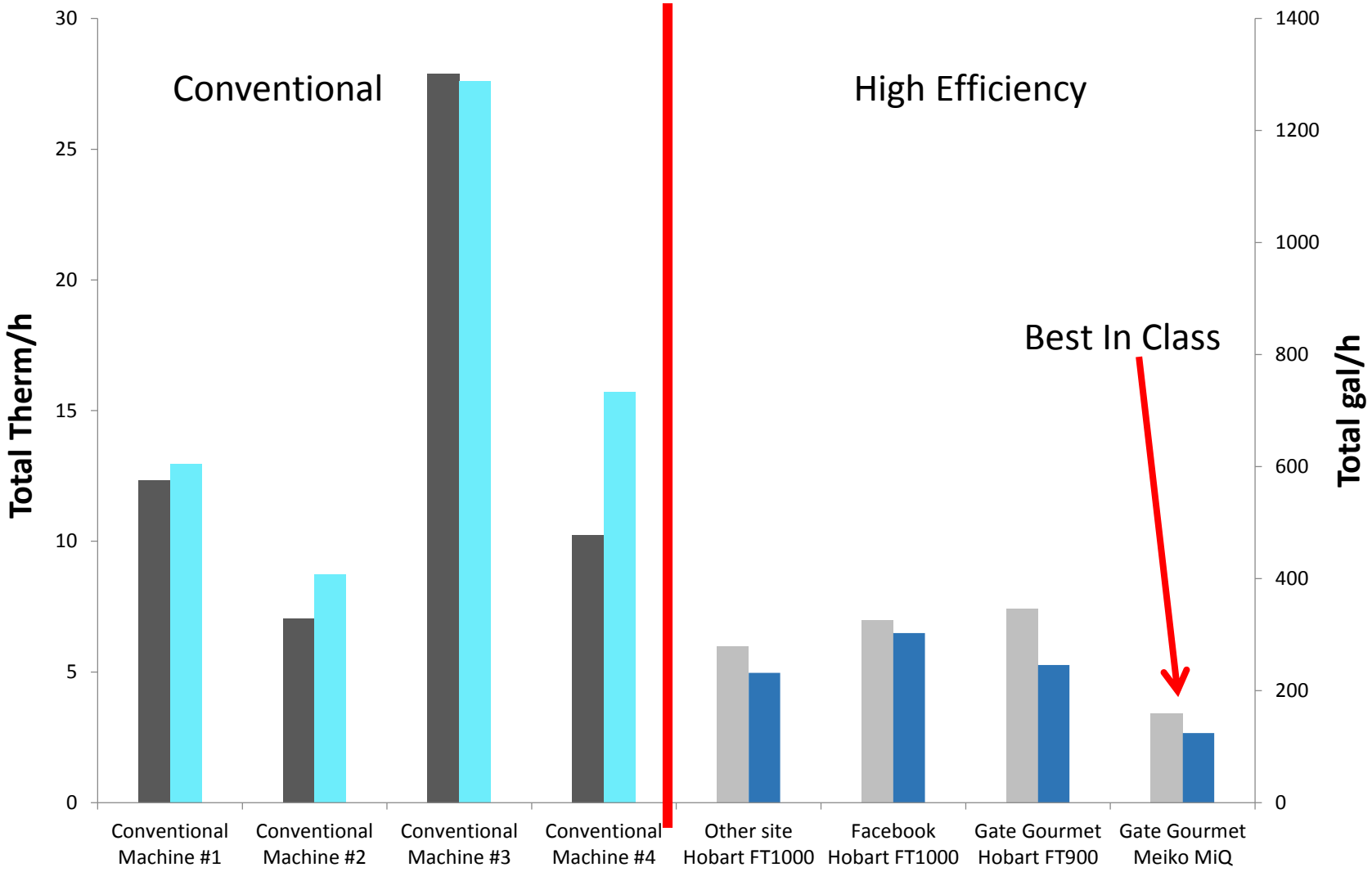
- Meiko:
  - Total: $306/d
  - Per hour of rinse time: $19/hr
- Hobart FT1000:
  - Total: $250/d, ~7.5 h/d
  - Per hour of rinse time: $38/hr
- Hobart FT900:
  - Total: $497/d
  - Per hour of rinse time: $35/hr

Annual Utility Savings if all 5 Gate Gourmet Machines were Meikos

	Daily Cost	Yearly Cost
1 Hobart	560	204,400
4 Hobarts	2240	817,600
1 Meiko	306	111,690
Current Utility Cost	2,546	929,300
Utility Cost for 5 Meikos	1,530	550,800
Savings	1,016	378,500

- This analysis does not include chemical costs, and assumes all 4 Hobarts use roughly the same amount of water and energy per day and assumes an average daily rinse time of 16 hours.

Flight Conveyor Normalized Utility Usage



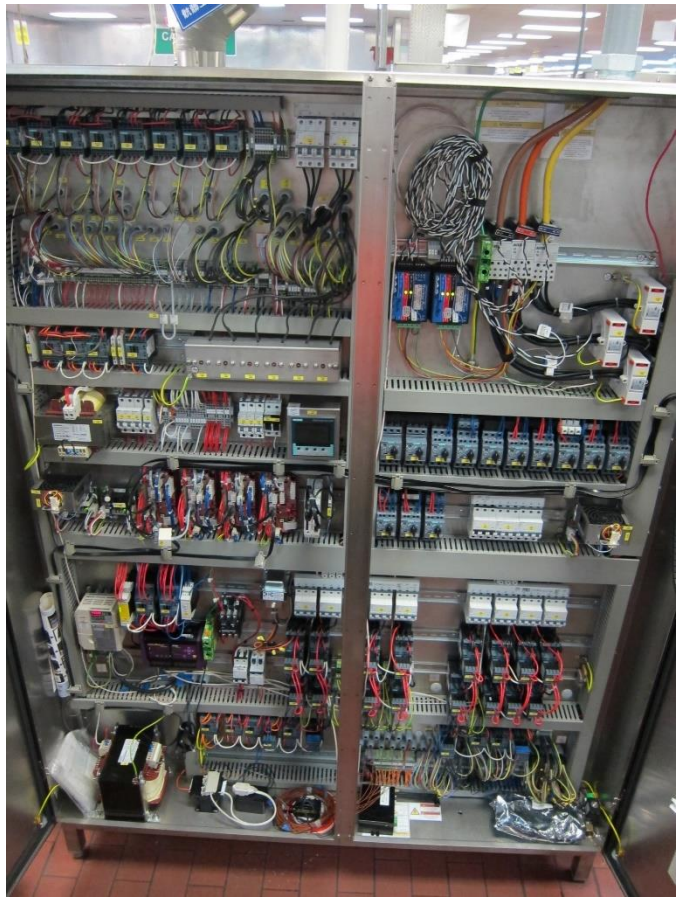
To Recap (1/2):

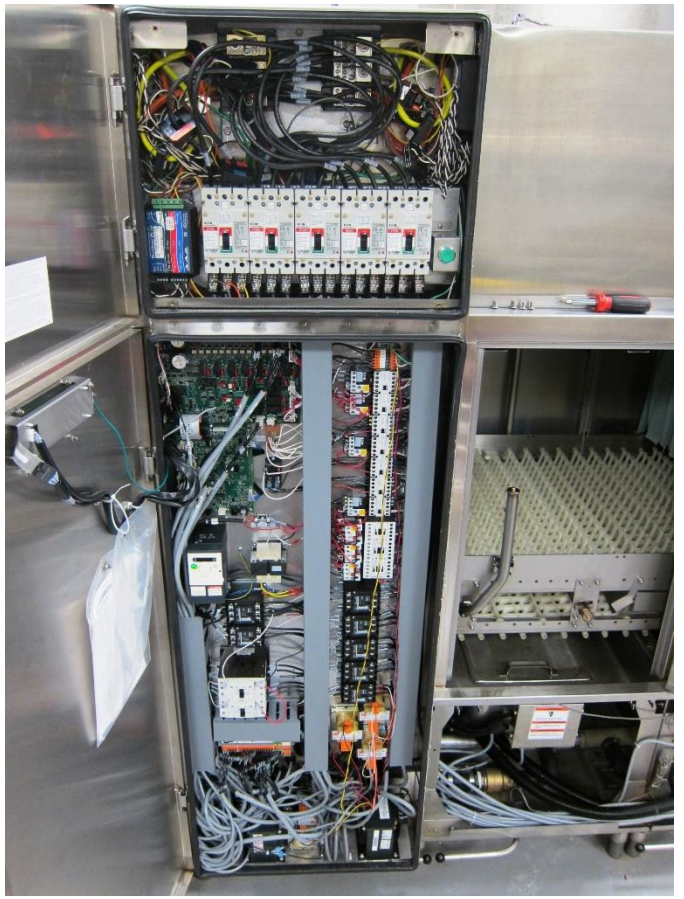
- HX/Maintenance
  - Submetering/internal submetering is the only way to diagnose some problems, so this technology is going to be very important going forward
- Utility costs
  - High efficiency units can still cost twice as much as best-in-class units
  - We can make a business case for early retirement of older ESTAR units
- Technology to support less tank fills

To Recap (2/2):

- Meiko is the full-systems approach with fine tuned controls
- Integrated submetering/advanced diagnostics
- Gate Gourmet is a unique operating case with long operating hours and 4 dedicated staff at all times, hence load-sensing technology was not really utilized

Meiko control board





Hobart control board

Thank You!

Questions?

mslater@fishnick.com

FRONTIER energy