

CONTINUOUS HOT WATER RECIRC PUMPS

*THE BIGGEST ENERGY HOG
IN SINGLE FAMILY HOMES?*



Presentation to the CEC by Steve Schmidt
High Energy Audits, Inc.
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AGENDA



Who am I?

What are they?
(Continuous Hot Water Recirc Pumps)

Where and How Many?

Energy Use Analysis

Mitigation Options

ABOUT STEVE SCHMIDT

○ Career:

- Mechanical Engineer (Stanford '83)
- Business Degree (Stanford '92)
- 25+ years in Software Industry

○ I was a Climate Change **Denier** (prior to 2005)

○ Climate Change **Believer** (2005 – present)

- Spearheaded my town's GHG Inventory (as volunteer)

○ Residential Energy Research (since 2002)

- My home & friends' homes (as hobby)
- Industry Research (hardware, software, social issues, trends)
- Training (PEC Audit Training, HOBO loggers, eQuest, HERS)
- Detailed “high energy” home audits using homegrown approach

○ Architect of two EECBG Programs

- New company: High Energy Audits, Inc.
- Collaboration of 5 Bay Area towns & Acterra (“High Energy Homes”)
- “EnergyUpgradeMountain View”



WHAT ARE THEY?



Continuous Hot Water Recirculation Pumps

WHERE AND HOW MANY?

- Most big (>3,000 sf) modern homes have them
 - Los Altos Hills Building Inspector:
Continuous recirc pumps have been installed in 90% of the homes built in our town over the past 10 years.
 - Building inspector for Portola Valley concurred.
- Installed in many other homes too
 - Quite a few ~2,000 sf homes have them (*one since 1961!*)
 - A 1,400 sf home used for HERS training had one
 - Many homeowners don't know they have them
- Current Stock
 - More recirc pumps than pool pumps.
 - Guesstimate: **Over 700,000 installed.**
 - 7M single family homes in California (*source: web search*)
 - 11% over 3000sf; 7% between 2500-3000sf (*DOE Bldngs Databook*)
 - 75% of homes over 3000sf + 40% of homes between 2500-3000sf

ENERGY USE ANALYSIS

- Tested 7 Single Family Homes(November 2009):
 - Electricity:**650 kWh**(~\$250/year at top tier rates)
 - Demand: **0.075 kW**
 - Natural Gas:**200 therms**(~\$250/year at top rates)
- Total energy cost to homeowner of ~\$500/year
- Rough calibration --
 - Data from recent Multifamily study (low rise):
 - Electricity: 1,228 kWh
 - Demand: 0.139 kW
 - Natural Gas: 1,083 therms

MF DHW Improvement

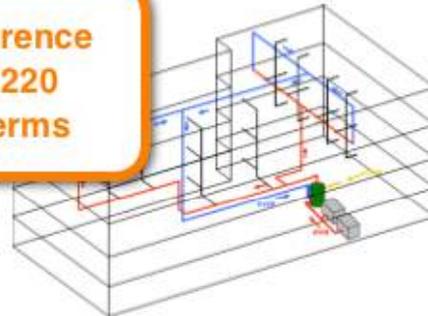
Data / Findings – Model Validation Results

Recirculation loop loss represents 34% of total hot water energy

	Recirculation Flow Heat Loss				Recirculation Loop Heat Loss				Total Hot Water Energy			
	Measured (Btu/day)	Modeled (Btu/day)	Measured reduction (%)	Modeled reduction (%)	Measured (Btu/day)	Modeled (Btu/day)	Measured reduction (%)	Modeled reduction (%)	Measured (Btu/day)	Modeled (Btu/day)	Measured reduction (%)	Modeled reduction (%)
SFD												
CONT Pump	608,711	608,711	-	-	639,732	643,487	-	-	1,875,663	1,879,417	-	-
Temp Mod	600,697	582,695	1.3%	4.3%	635,433	616,266	1.0%	4.2%	1,958,764	1,941,597	-4.4%	-3.3%
Timer	507,048	461,656	17%	24%	600,803	52,822	6.1%	13%	1,732,428	1,694,446	7.6%	10%
Demand	215,483	191,328	65%	69%	411,903	411,556	36%	30%	1,423,628	1,465,281	24%	22%

	w/o Flow Variation		HW Draw
	Hot Water Energy (Btu/day)	Modeled savings (%)	Measured (Btu/day)
SFD			
CONT Pump	1,879,417	-	1,235,931
Temp Mod	1,871,511	0.4%	1,325,331
Timer	1,816,132	3.4%	1,131,625
Demand	1,749,959	6.9%	1,011,725

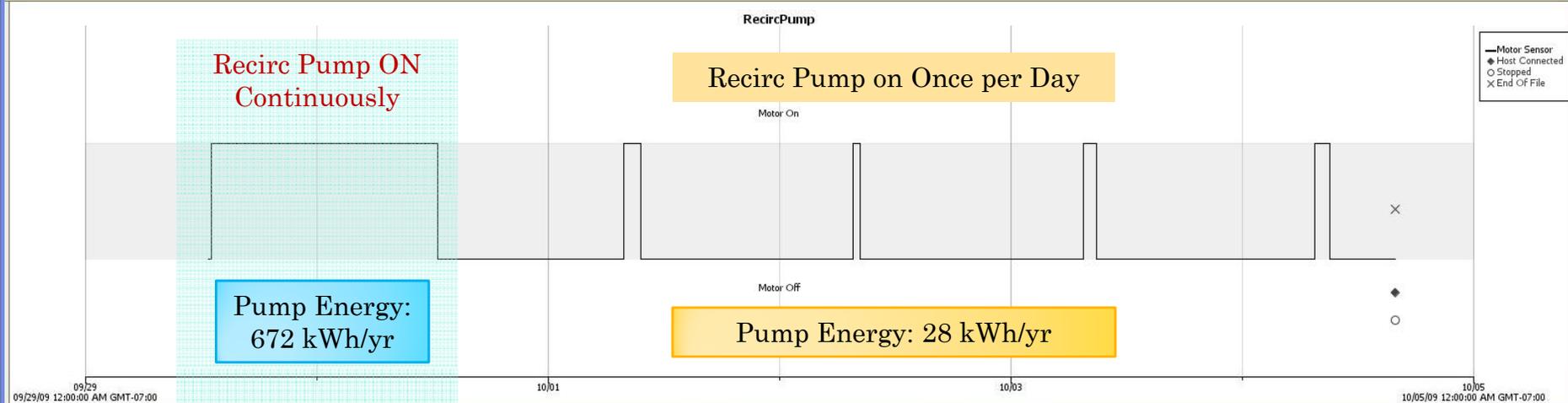
Difference of 220 Therms



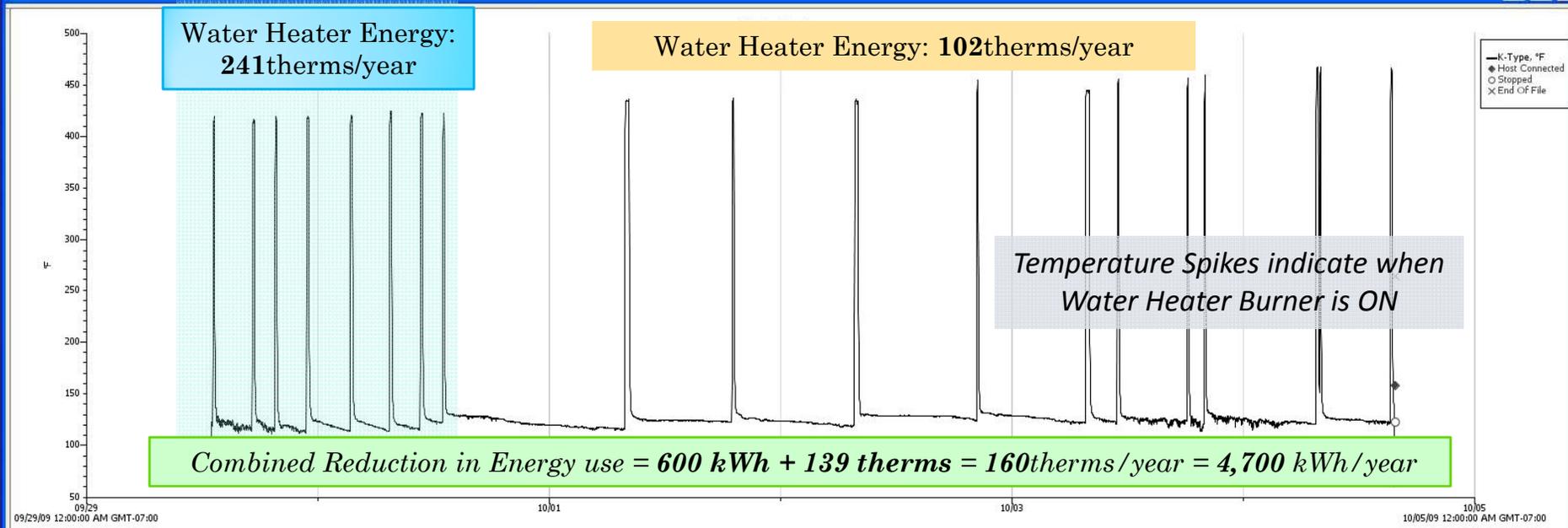
Total hot water energy = Hot water draw + recirculation loop loss

Facility: 2300 sf home

RecircPump (OS).hobo

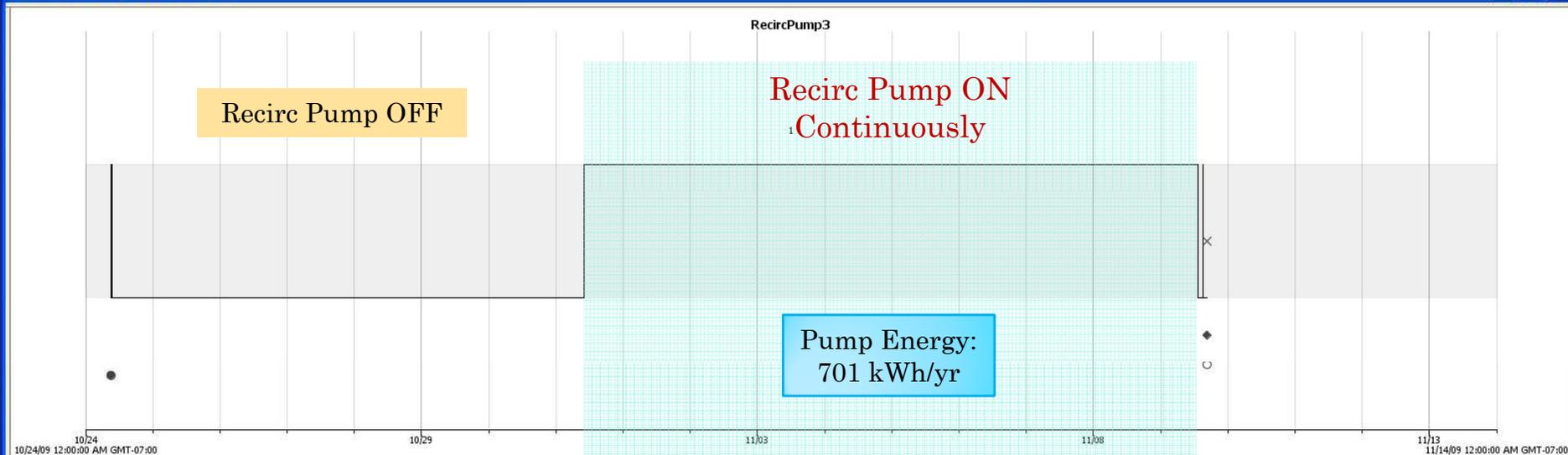


WaterHeater (OS).hobo

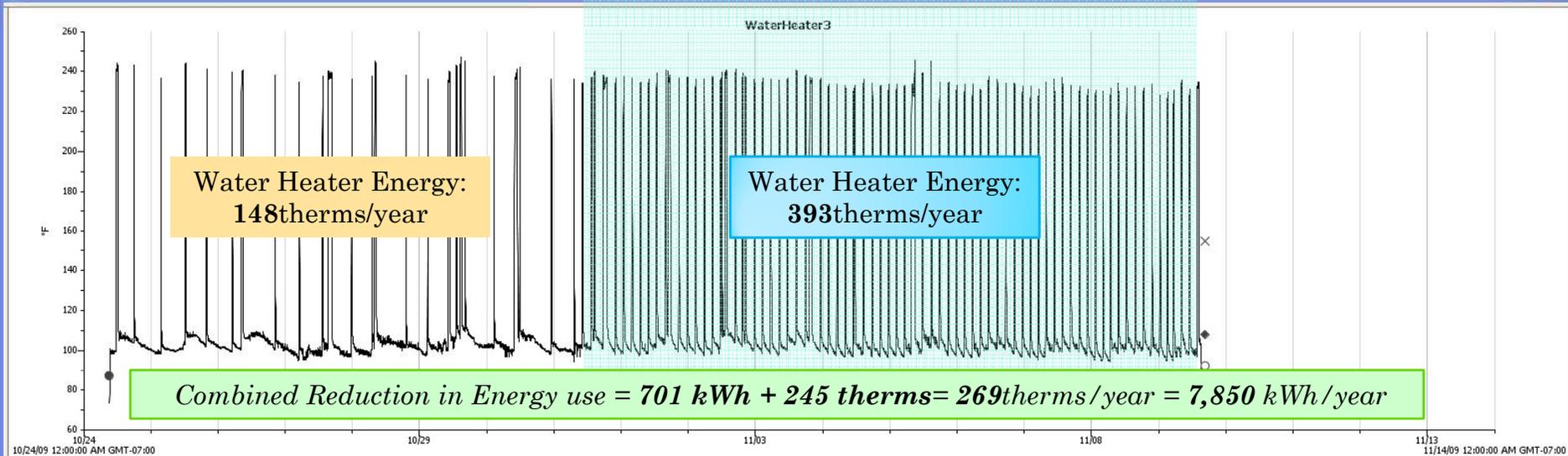


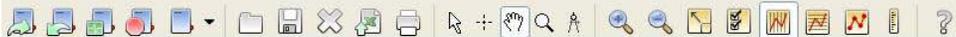
Facility: 4000 sf home

RecircPump (PE).hobo



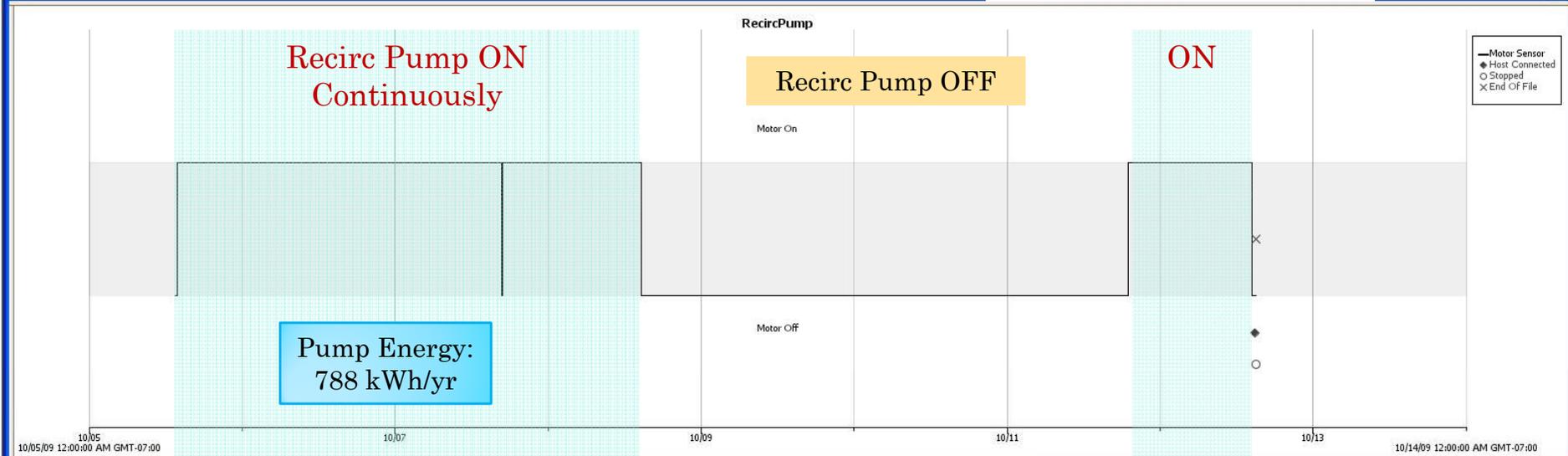
WaterHeater (PE).hobo



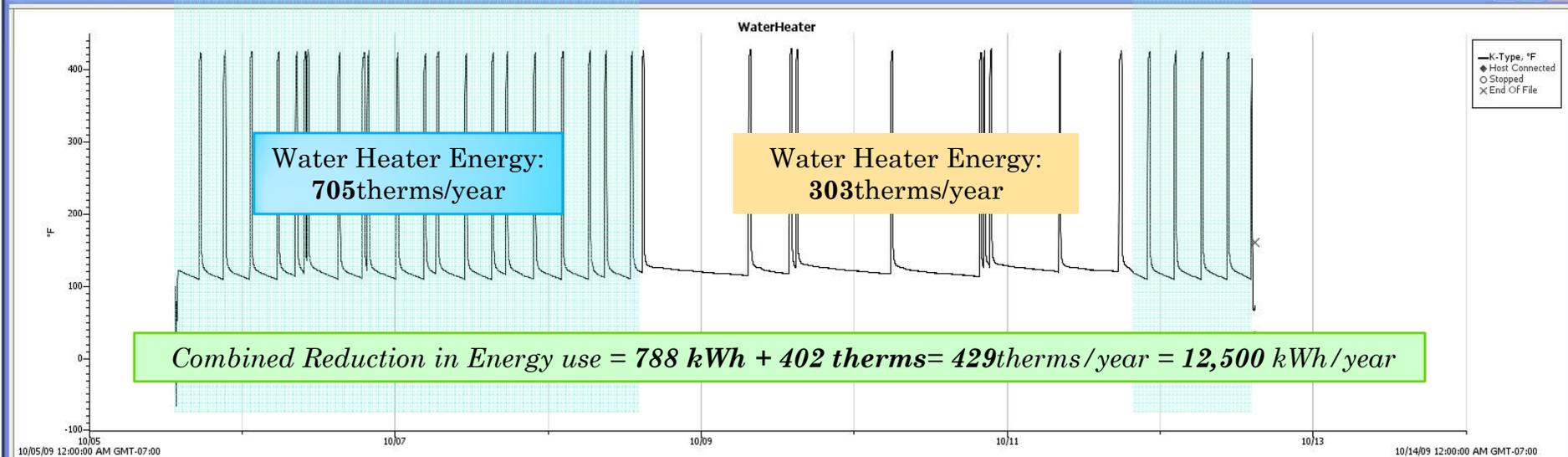


Facility: 6000 sf home

WW RecircPump.hobo



WW WaterHeater.hobo



MITIGATION OPTIONS

- For New Construction (*Not my focus*)
 - Ban them? Require timers or demand?
 - Same as multifamily.
- For Existing Single Family Residences

1. Unplug it for a week
2. Add a cheap digital timer (\$25) 
3. Replace or upgrade with “on-demand” model (\$200)



BONUS: OFTEN CAN BE IDENTIFIED VIA UTILITY BILL DISAGGREGATION

Likely!

