

A MV DIY ZNE DER by a GEEK, Part 2



Marc Rosenbaum, P.E. South Mountain Company West Tisbury, MA

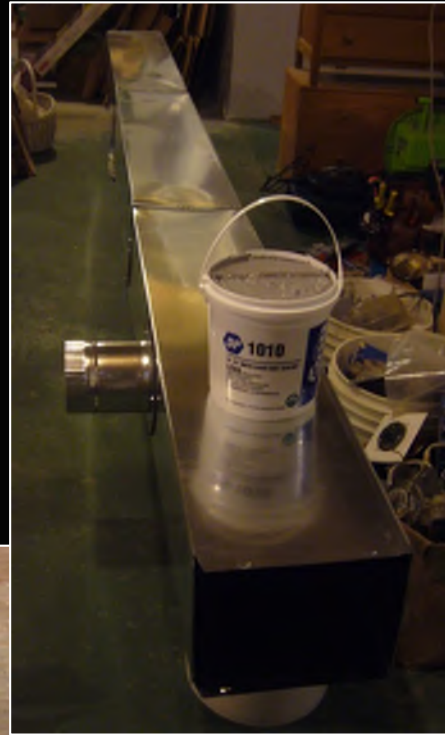
Systems

- For ZNE, all-electric home
- Minisplit heat pump (HP) for heating and cooling
- Heat pump water heater (HPWH)
- Heat recovery ventilation (HRV)
- Solar electric system (PV)
- Wood stove for power outages and ambiance

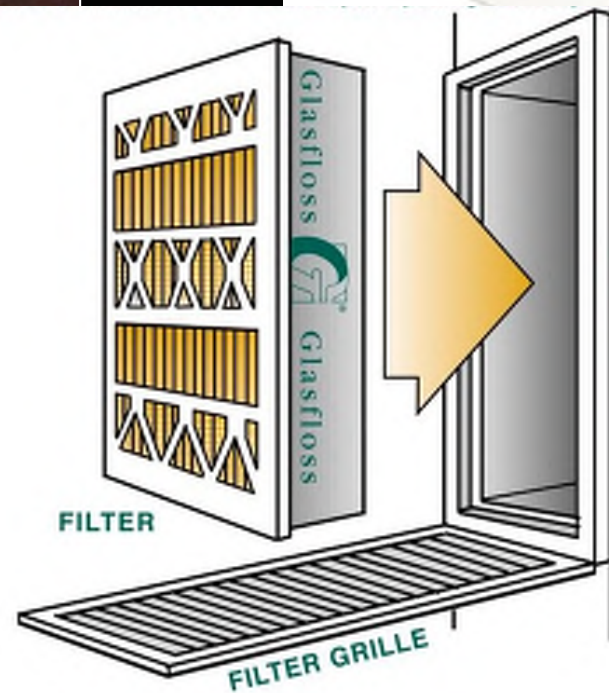
Fujitsu Heat Pump



Sealing and Insulating Ducts



Filter Grille



ERV

- Unit is a Zehnder ComfoAir 200 ERV



Homerun Ducting



Homerun Ducting



HRV Details

- Unit has a 800W preheater for defrost conditions
- Blowers are variable speed and separately speed controllable
- Open Fire Mode precludes an exhaust-only condition
- Possible to run just the exhaust blower in the summer
- Balanced to 50 CFM the unit draws 18-20W, very quiet
- High speed is 135-140 CFM, noisy
- Locating exhausts high and near showers keeps mirrors clear

Range Hood

- Broan 30" under cabinet model, rated 220 CFM, vented out
- Installed as 7" round top take-off with a backdraft damper
- Used LED PAR20 lamps instead of halogens
- Works poorly!



Dryer

- Dryer also vented to outdoors
- As it is rarely used, it is installed with a blast gate

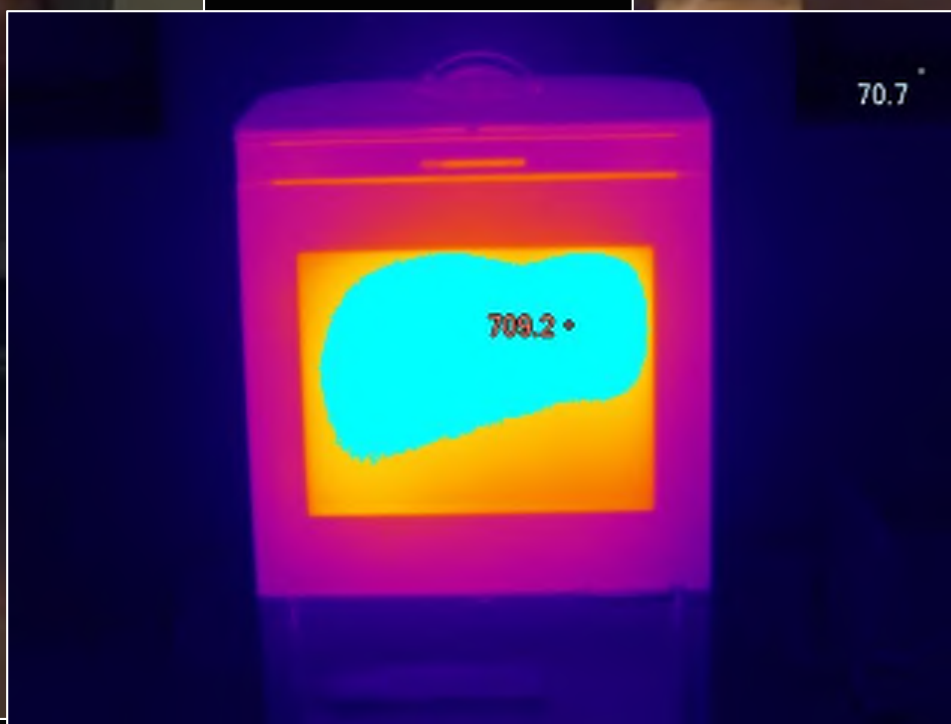
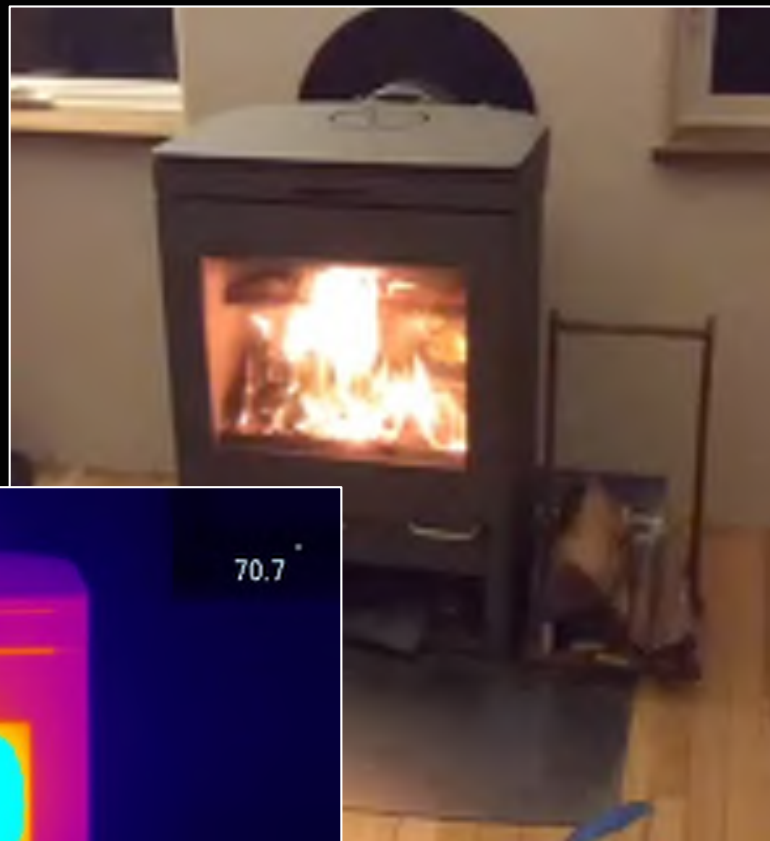


Woodstove and Chimney

- SCAN 60 (Krog Iversen) stove
- Stainless steel chimney – wall exit and tee



Woodstove and Chimney



Domestic Hot Water

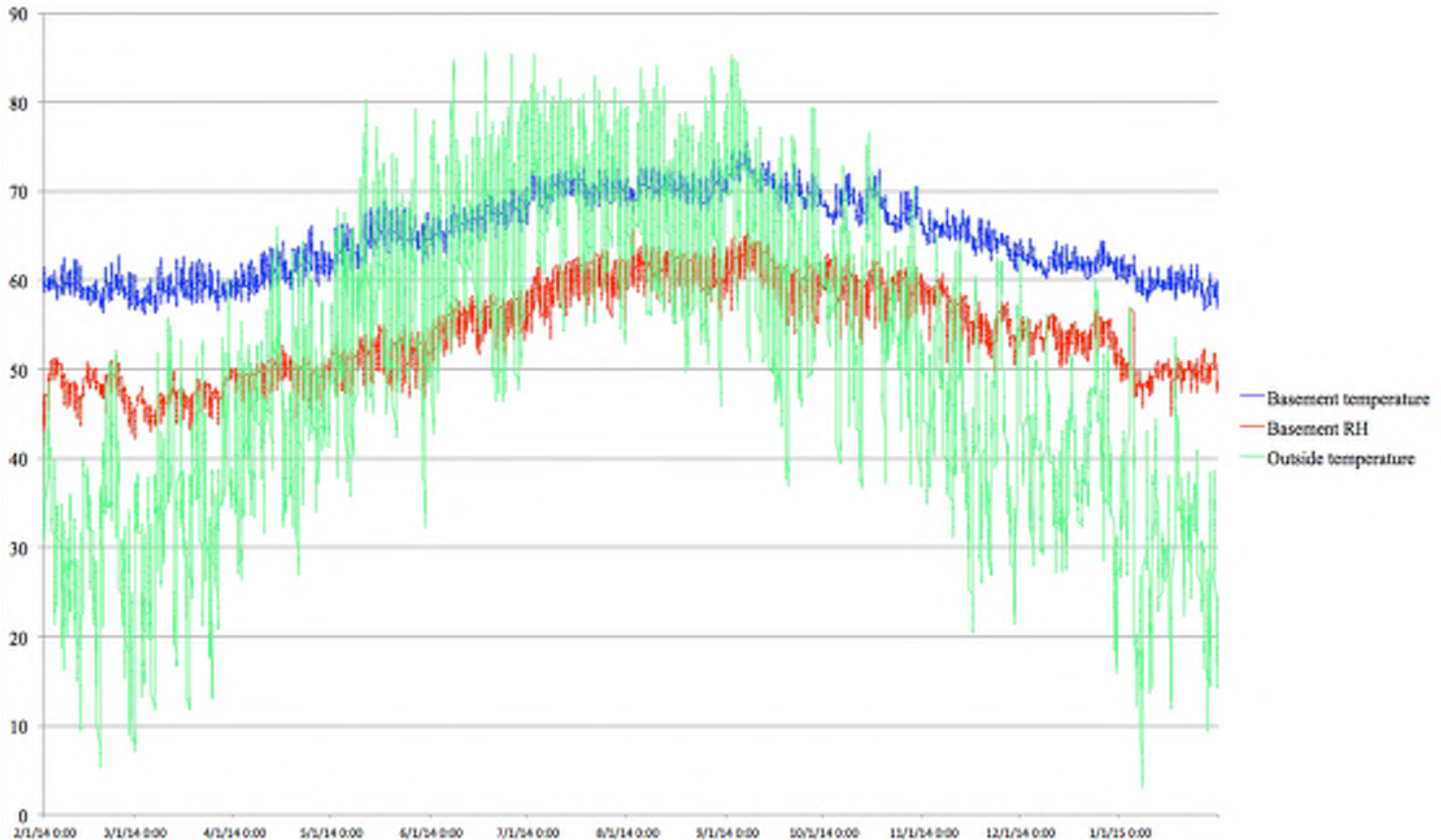
- Previous data showed 14-15 gpd DHW usage
- Very small load for solar DHW
- HPWH makes sense with the large basement
- HPWH also provides some dehumidification
- At 40 gpd SMC measured 2/3 energy savings vs. an electric water heater
- Stiebel Eltron Accelera – 80 gallons, EF 2.5

HPWH



Water meter

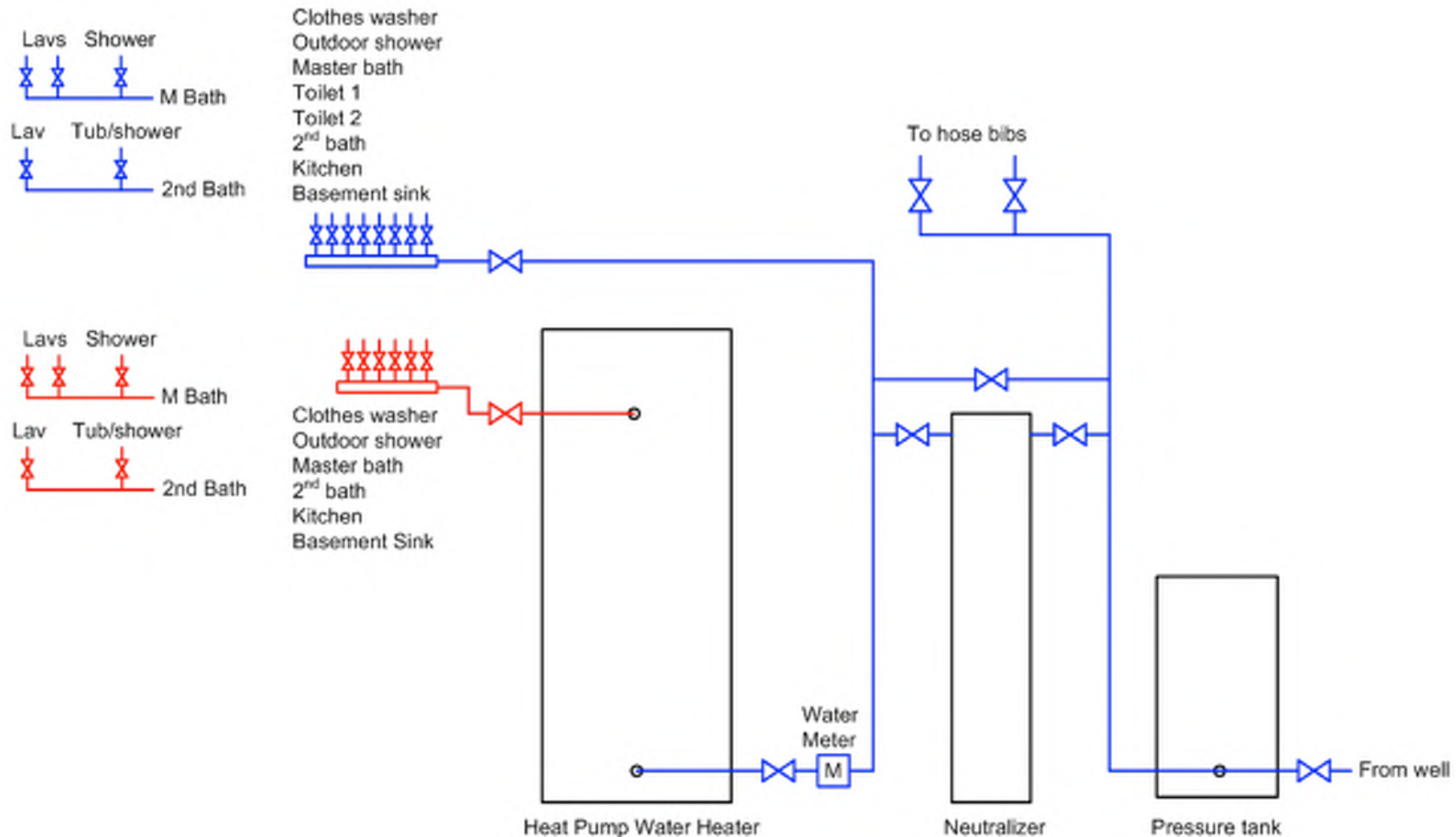
Effect on Basement



Hybrid Home Run Distribution



Hybrid Home Run Distribution



Water Conservation



Front Loader



Niagara Stealth
0.8 Gallon Flush



Delta H2OKinetic

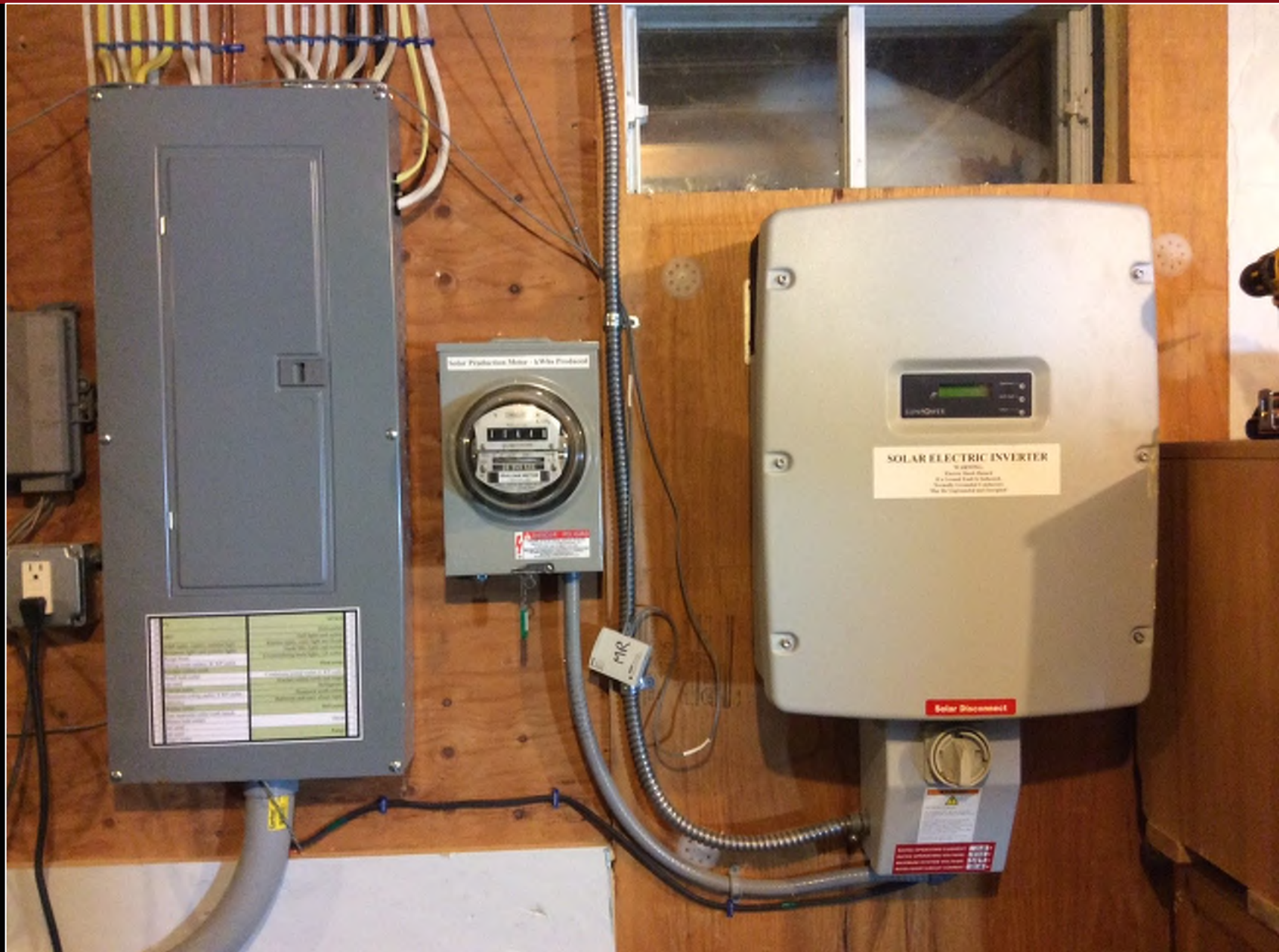
Water use about 33 gpd, or 12,000 gallons/year
Except an additional 52,000 gallons for irrigating new trees,
shrubs, and bushes

Solar Electric System

- Moved PV system from previous house!
- 4.76 kW Sunpower modules, SMA 5 kW inverter



Solar Electric System



Electrical Conservation



Induction Range w/Convection Oven

Green Creative LED lamps



Data

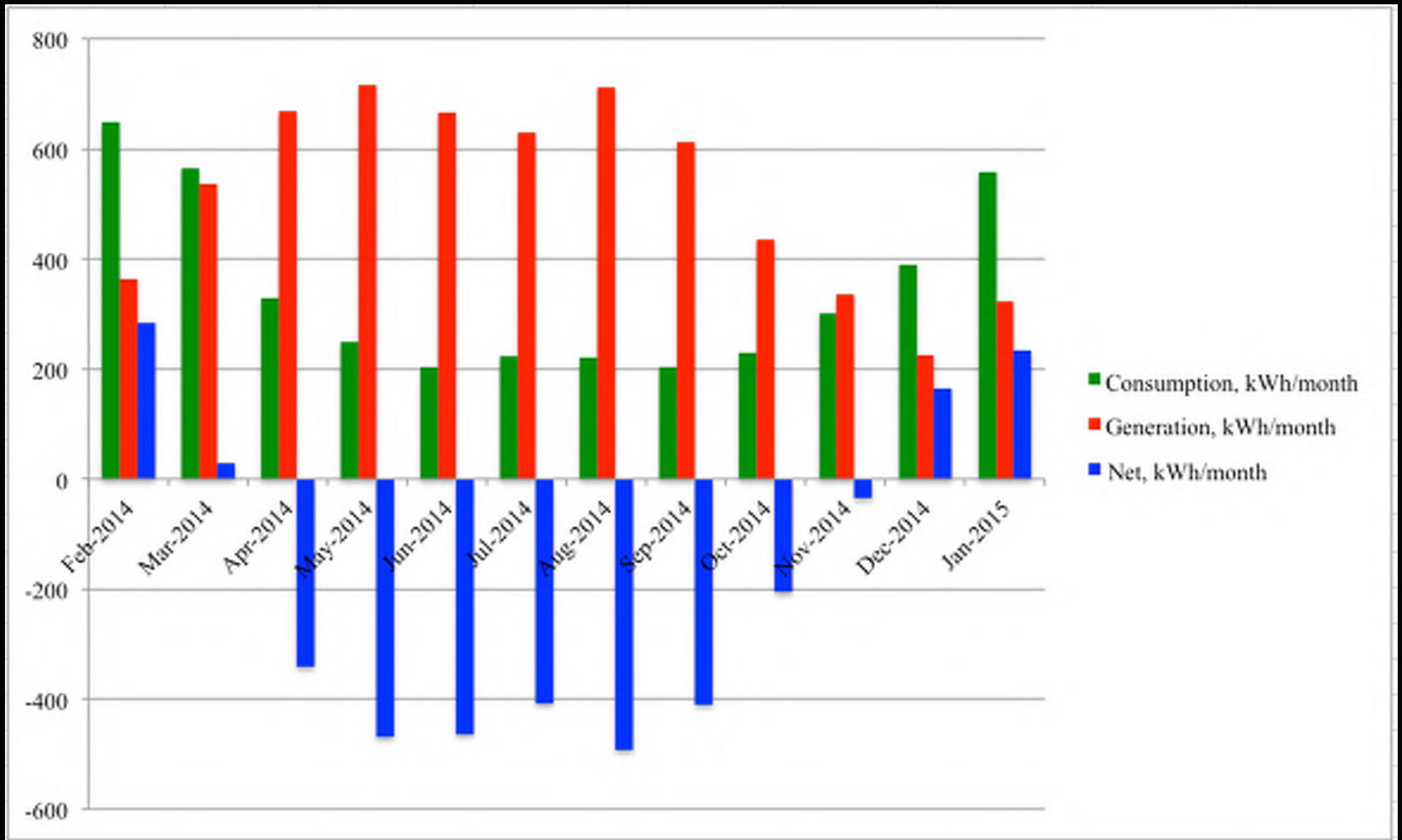
- A Powerhouse Dynamics eMonitor measures most circuits
- A glass front meter measures PV output (Hialeah Meter)
- A DLJ water meter measures cold water into the HPWH
- Onset Computer Hobo dataloggers measure indoor, outdoor, and basement temperatures and RH



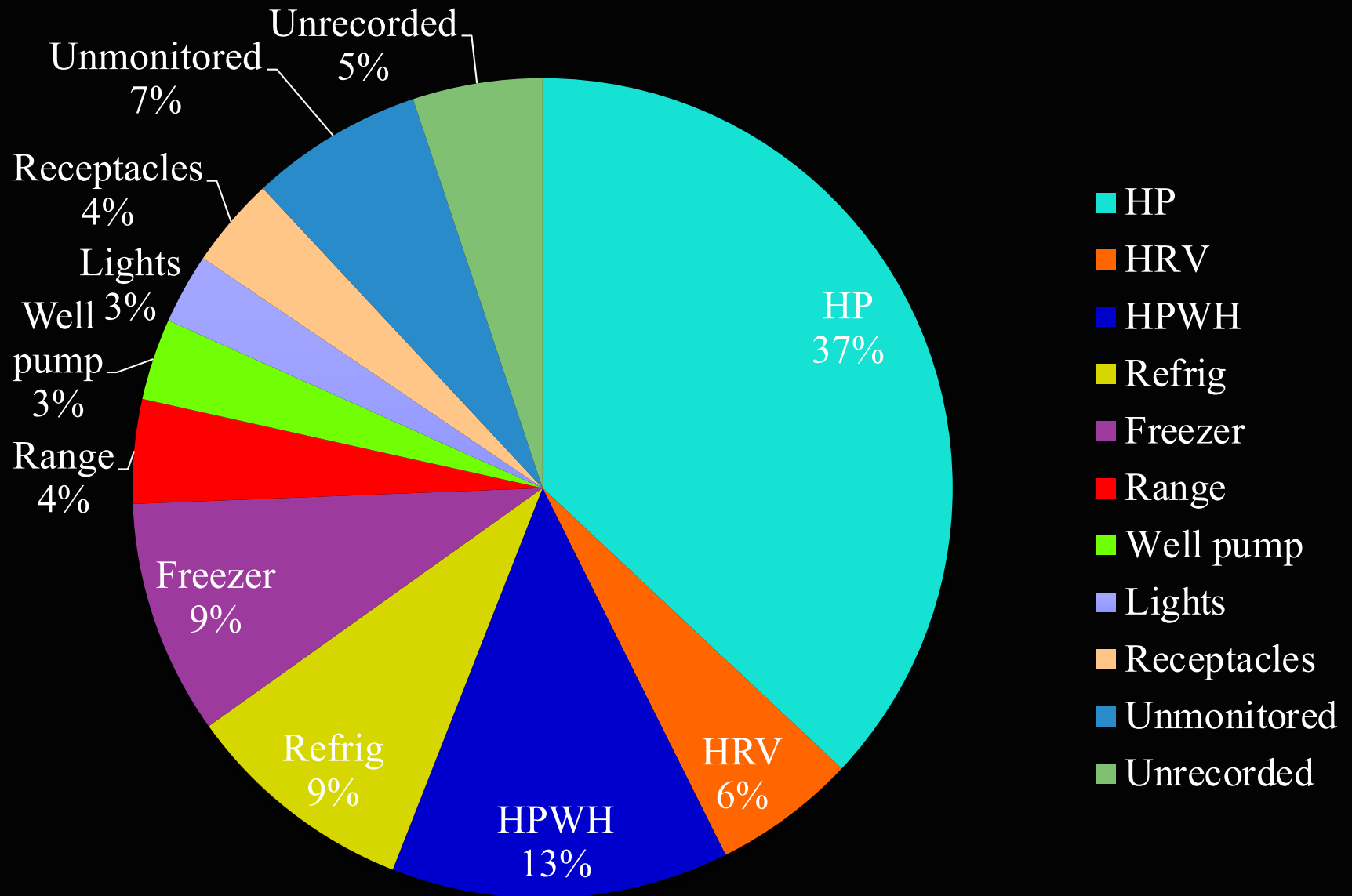
One Year's Energy Flows

	Consumption, kWh/month	Generation, kWh/month	Net, kWh/month
Feb-2014	649	364.5	284
Mar-2014	565	536	29
Apr-2014	328	669	-341
May-2014	248	716	-468
Jun-2014	203	666	-463
Jul-2014	223	630	-407
Aug-2014	220	712	-492
Sep-2014	203	612	-409
Oct-2014	229	434	-205
Nov-2014	302	336	-34
Dec-2014	390	226	164
Jan-2015	558	323	235
	4118	6225	-2107

One Year's Energy Flows



Breakdown by End Use



Radon

	Radon Level, pC/l
Existing house before purchase, basement	5
After move-in, HRV excess supply	1-2
After HRV balanced	11-12
MBR after HRV balanced	1.3

