

Electrifying "Weird" Loads

Webinar – February 25, 2025

nbi new buildings
institute



This webinar was developed in partnership with the LEARN Program.

The LEARN Program is a San Diego-based workforce education and training program that has partnered with New Buildings Institute to offer free energy efficiency and electrification webinars. Please visit the LEARN website for more information: www.sandiegolearn.com

nbi new buildings
institute

Electrifying "Weird" Loads

In today's webinar we'll discuss:



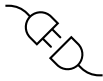
Electrifying residential and commercial pools with **heat pumps**



How to **size** pool heat pumps



Switching from gas to electric **leaf blowers and lawnmowers**



Available **technologies, benefits,** and real-world **challenges**

Today's Panelists



Dylan Anderson
Redwood Energy



Brian Stewart
Electrify Now



Breshin Billingsley
Stihl

Heat Pumps and Pool Heaters Overview

- Introduction
- What is a Heat Pump?
- Role of Heat Pump Water Heaters
- Residential Grade Heat Pump Pool Heaters
- Hot Tub Heat Pumps
- Commercial Grade Heat Pump Pool Heaters
- Case Study - Tamarack Slope Side Hotel
- Affordability Argument



Dylan Anderson

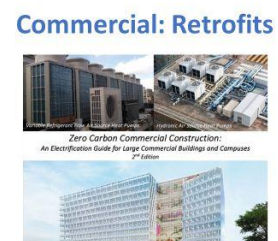
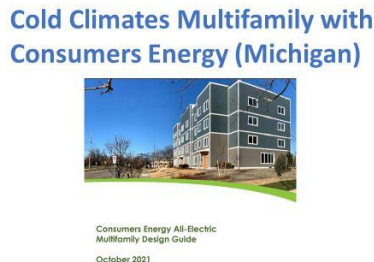
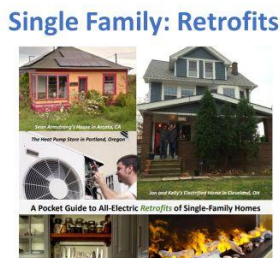
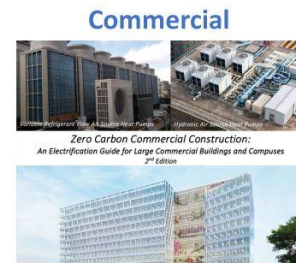
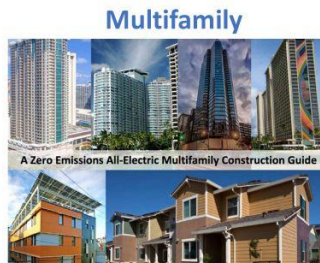
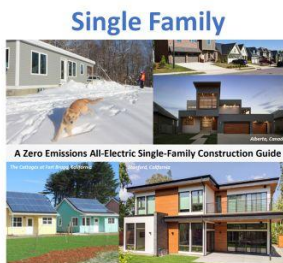
Electrification
Analyst at
Redwood Energy



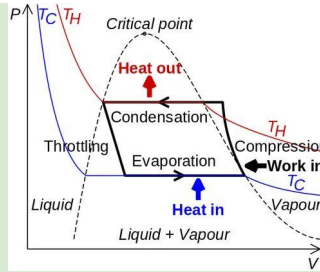
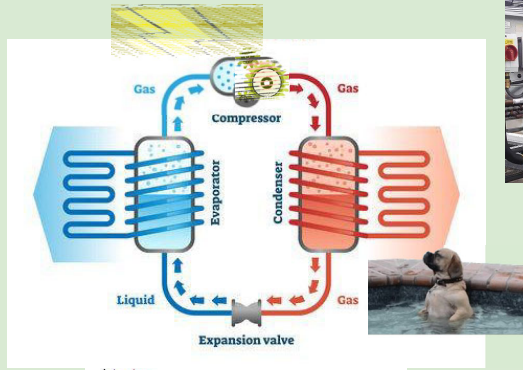
redwoodenergy.net

All-Electric Zero Emissions Building Construction Series

free to download at <https://redwoodenergy.net/research/>



What is a Heat Pump?



Heat
Pump
Water
Heaters



**ProTerra Plug-in
Heat Pump
(120V Dedicated Circuit)**
40 and 50 Capacities
120 Volt / 1 PH
Electric








Residential-Grade Heat Pump Pool Heaters

- Inverters improve efficiency in cold weather and smooth power demand
- These heat pumps serve a typical residential pool

	AquaCal HeatWave SuperQuiet SQ166R ICEBREAKER	Raypak Crosswind V 8550EHC	Hayward HeatPro VS Variable Speed	Pentair UltraTemp 110 Heat Pump
				
Unit Price	\$4,800	\$5,000	\$3,000	\$3,270
Heating Capacity (BTU/h)	126,000	129,000	90,000	108,000
Inverter-driven compressor	<u>YES</u>	<u>NO</u>	<u>YES</u>	<u>NO</u>
Heating COP	5.6	5.7	5.1	5.8
Lowest Operating Weather Condition	25°F Air	30°F Air	30°F Air	45°F Water

Hot Tub Heat Pumps!

- Inverters are crucial here, for low outdoor temps and hotter water
- These heat pumps serve a typical hot tub, in or above ground

Heat Pumps for Hot Tubs				
	Jandy VersaTemp™ JRT Series Heat Pump	Doheny's Economy Side Vent HP	Swimmax Inverboost	Northern Lights Arctic Heat Pump 25ZA/B
				
Price	<u>\$5,500*</u>	\$1,800*	\$3,500*	\$4,300 *
Heating Capacity (BTUh)	103,000	51,000	37,500	37,500
Inverter Driven?	Yes	No	Yes	Yes
Heating COP	6.2	6.3	5.9	6.2
Op. Temp. Range	32 F Air	42 F Air	10 F Air	20 F air
Water output Temp.	104 F	104 F	104 F	104 F

Commercial-Grade Heat Pump Pool Heaters

- Growing market
- Design-build is typical scenario
- Very large pools upwards of olympic-size (800,000 gal+) often look into cascading systems and stringing multiple heat pumps

	AquaCal Great Big Bopper	Raypak Professional Series PS10353ti-E-HC	Lync Aegis A - CO2
Unit Price	\$45,000	\$7,000	Design-build
Heating Capacity (BTU/h)	530,000	154,000	500,000
Inverter-driven compressor	YES	NO	YES
Heating COP	6.3	5.3	4.0
Lowest Operating Weather Condition	25°F Air	30°F Air	-4°F Air

Commercial HPPH Case Study

- Gas retrofit, Cascade system, Air-Source Heat Pump feeds a Water Source Heat Pump, 103F hot tubs

Case Study: Hot Pools at Tamarack Club Slope Side Hotel, Ellicottville, New York



Heat Pump Affordability - COP drives cost-benefit

- Depends on local gas and electric rates, ambient temperatures and efficiency of equipment (COP)
- **Always** saves money (10x) versus propane
- Even in California with high electric rates and lowish natural gas rates, a heat pump pool heater is 23% less expensive to operate, driven by the COP of the product
- Paired with solar PV or solar thermal, HPPH are always less expensive to operate than gas



SQ200R - HeatWave SuperQuiet®

	Heat Pump	Gas
Blanket	\$ 3,762.99/yr	\$ 4,870.71/yr
Aqua Blanket	\$ 5,644.48/yr	\$ 7,306.06/yr
No Blanket	\$ 9,407.47/yr	\$ 12,176.77/yr

Average Savings of Heat Pump vs. Gas Heating: **23 %**

Table above estimates running an 17,000 gallon outdoor heated pool in the Bay Area of California, all seasons and 24/7, at a setpoint of 80F, with or without a pool cover (blanket)

A pool cover cuts energy use down to a third if used properly!

Calculator: <https://sizing.aquacal.com/>

Future recommendations

- Incentives need to be available:
- Approximately 16% of California homes have a pool
 - Approximately 50% of those pools are heated
 - Approximately 90% of those heated pools are heated with gas
 - Thus approximately 7% of California single-family homes have a gas pool heater
- Difficult (but possible!) to transition an existing gas commercial pool to a heat pump system
 - The technology exists, but usually power capacity (as calculated by code) is less than sufficient
 - However, the code calculations are very conservative
 - With devices that share or split circuits, you can turn off the pool heat pump for the 15 minutes or so when electrical capacity on the breaker box is impacted



Electric Yard Care

Ditch the Gas

Brian Stewart - Electrify Now
Breshin Billingsley - Stihl
Doug Gannon - Stihl

 electrifynow.net  [@electrify_now](https://www.instagram.com/electrify_now)  [@ElectrifyNowUsa](https://www.youtube.com/ElectrifyNowUsa)



Why Yard Care?

~650 M gas powered outdoor tools in use in the US

These tools are a significant source of
Carbon Pollution
Air Pollution
Dangerous Noise
Toxic Solid Waste



From: Consumer Reports



Carbon Pollution

Over 1.2 Billion gallons of gasoline is burned/yr for mowing

~14.4M Tons of CO₂e/yr
Equivalent carbon emissions to 2,400,000 Cars



From: US Department of Energy, Frontier Group, US PIRG, Environment America

Air Pollution

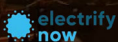
Gas powered tools produce far more air pollution than cars



Pollution from gas power tools per year:

- 21,800 tons of PM_{2.5} – more than 234M cars
- 68,000 tons of NO_x – more than 30M cars
- 20 Million pounds of Benzene
- 7 million pounds of Formaldehyde

These pollutants are linked to cancer, asthma, heart and lung disease



From: Frontier Group, US PIRG, Environment America, CARB

Air Pollution

A typical weekly yard maintenance job creates more air pollution than a car revving in your driveway for 10 hours



California has banned the sale of small gas engines starting in 2024

From: California Air Resources Board – Small Engine Fact Sheet

Dangerous Noise

Gas powered tools can cause permanent hearing loss

NOISE LEVEL dBA

110

EXTREMELY LOUD – jackhammers, jet takeoff, sirens
Dangerous over 30 minutes, wear ear protection
@85-90 dBA permanent hearing loss can happen in minutes

100

90

80

VERY LOUD – highway traffic, vacuum cleaner
Dangerous to hearing over time, wear ear protection

70

60

MODERATE – normal conversation
Safe for any time period

50

40

SOFT – quiet library

30

20

10

FAINT – leaves rustling

0

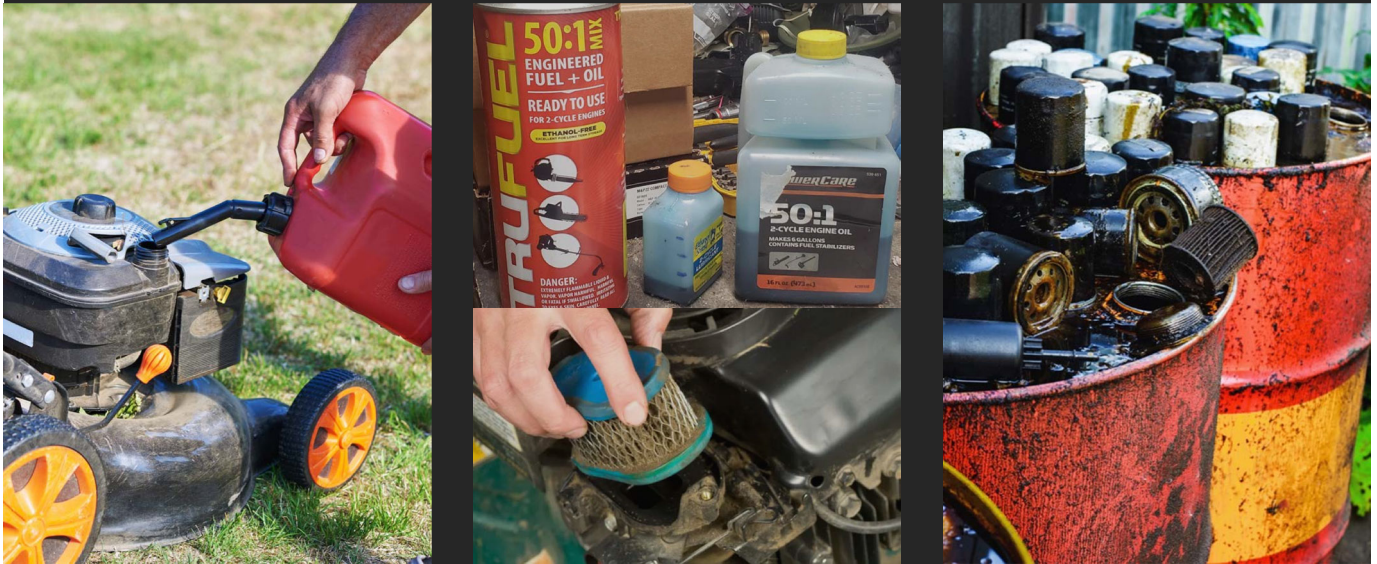


GAS POWERED TOOLS

Over 100 cities have banned or restricted gas leaf blowers

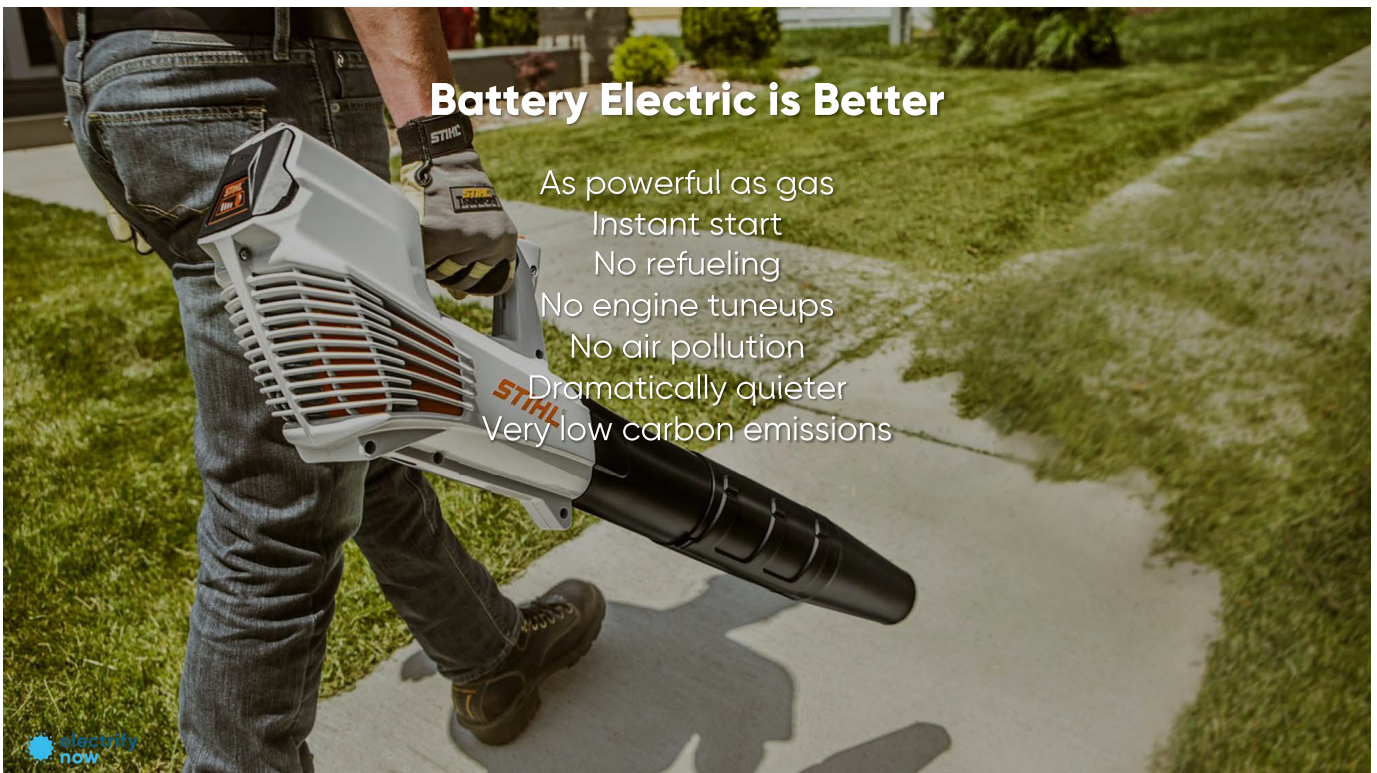
Toxic Solid Waste

Millions of lbs of oil cans, air/fuel filters, spark plugs sent to land fill every year



Battery Electric is Better

As powerful as gas
Instant start
No refueling
No engine tuneups
No air pollution
Dramatically quieter
Very low carbon emissions



Plenty of Power and Durability

"The best battery-powered electric lawn mowers now have legit gas-replacement performance, better runtime, and more innovative features than any lawn mower available a few years ago."

Pro Tool Review

"Battery trimmers and leaf blowers are more reliable than gas ones."

Consumer Reports



Battery Electric Tools are Quieter

One quarter to one half the noise of gas tools

NOISE LEVEL dBA

110

EXTREMELY LOUD – jackhammers, jet takeoff, sirens
Dangerous over 30 minutes, wear ear protection
@85-90 dBA permanent hearing loss can happen in minutes

90

VERY LOUD – highway traffic, vacuum cleaner
Dangerous to hearing over time, wear ear protection

80

MODERATE – normal conversation
Safe for any time period

70

SOFT – quiet library

60

50

FAINT – leaves rustling

40

30

20

10

0



GAS POWERED TOOLS



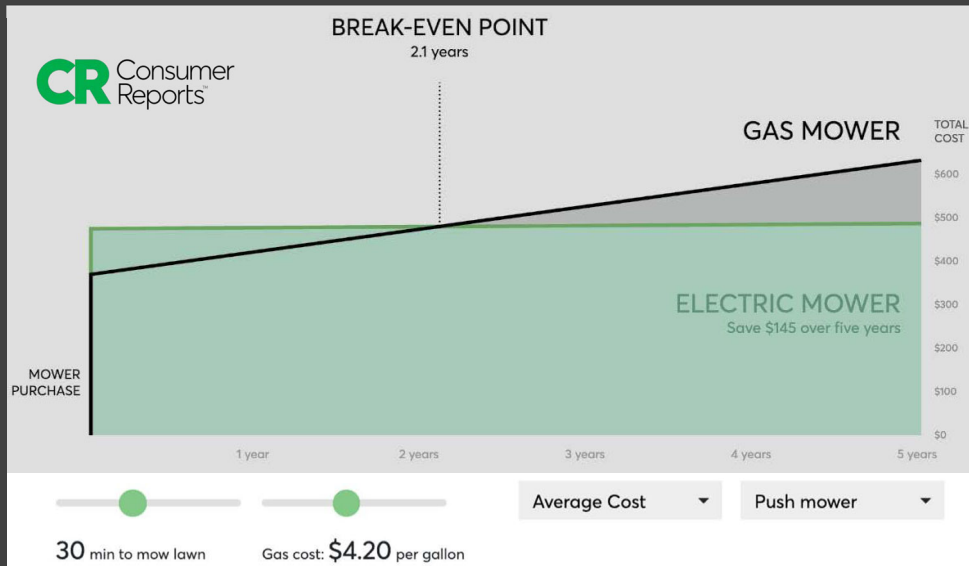
BATTERY ELECTRIC TOOLS



Humans perceive a doubling of "loudness" every 10dBA
From: American Academy of Audiology and American Speech-Language-Hearing Association (ASHA) and US Federal Highway Administration

Lower Operating Costs

Fuel and maintenance savings outweigh higher upfront costs



Lower Carbon Emissions

Electric tools produce virtually zero emissions

Gas



5 lbs/hr
CO₂e

Electric



0.5 lbs/hr
CO₂e



10 lbs/hr
CO₂e



0.5 lbs/hr
CO₂e



From: US Energy Information Administration, Manufacturer data on fuel consumption, Consumer Reports

