

PR FOR PLANET EARTH™

A REPORT ADVOCATING FOR SOCIALLY  
RESPONSIBLE SUSTAINABLE DEVELOPMENT

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# BUDGET HEAT PUMPS CREATE LIFE SAFETY RISK IN WARMING CLIMATE

ENEREF INSTITUTE EXAMINES THE RISKS OF RELYING  
ON LOW-QUALITY HEAT PUMPS AS GLOBAL WARMING  
INTENSIFIES AND TEMPERATURES SOAR

A growing influx of low-quality off-brand heat pumps is making its way into American households. Not surprisingly, subpar heat pump models exhibit higher failure rates than well-known high-quality brands. With global temperatures

on an upward trajectory in the face of climate change, the unreliability of low-end units poses grave health risks, especially for the elderly and those most vulnerable to hyperthermia.

# RACE TO THE BOTTOM AMID RISING GLOBAL TEMPERATURES

Energy-efficient heat pumps are fast replacing traditional air conditioners, whose fundamental components have remained relatively unchanged for a century. While American-made air conditioners were “built to last,” in today’s competitive race-to-the-bottom global marketplace, Enerref Institute found shortcuts in the manufacturing processes of some off-brand models that will severely limit the lifespan of the low-cost units. Although the entire industry value-engineers their technology to lower the selling price, window air conditioner and heat pump manufacturers, as well as through-the-wall manufacturers, have been the most aggressive in their pricing strategies to compete.

## FAILED HEAT PUMPS ELEVATE HEALTH RISKS

This reduction in product quality of low-end product lines coincides with the inflection point of rapid global temperature rise. In other words, just when air conditioning is a life safety issue because of global warming, some consumers who buy on price alone may find that their units fail at the very moment when they need them most.

Tragically, this is exactly what

happened to an elderly couple in Harris County, TX, as reported by *People*, on August 11, 2023, when their air conditioner failed. The couple, highschool sweethearts who had been married for 52 years, died in their home from hyperthermia, according to the Harris County Institute for Forensic Sciences.

Heat stroke is the most serious form of hyperthermia — an increase in body temperature beyond the body’s ability to lose heat. Heat stroke damages the brain, heart, kidneys, and muscles, leading to death if untreated. AccuWeather recorded a high temperature of 93°F on the day the couple died. The failed system was a generic brand air conditioner, whose repair estimate was nearly equal to the cost of the unit. The brand sells only through online retailers, such as Amazon.

## OBESITY AMPLIFIES RISK

While global atmospheric temperatures are expected to climb due to greenhouse gas emissions, heat waves are already a leading cause of weather-related deaths in the United States, according to the US Center for Disease Control.

The interaction of heat and

cardiovascular disease has caused about one-fourth of the heat-related deaths since 1999 according to the EPA. Yet, the EPA reports that many more heat-related deaths likely go unreported. “While dramatic increases in heat-related deaths are closely associated with the occurrence of hot temperatures and heat waves, these deaths may not be reported as ‘heat-related’ on death certificates.”

Yet, there is another trend in America that may further justify the importance of specifying the most well-made heat pump equipment for residences: obesity levels in the United States are quickly rising. While cardiovascular disease is a major risk factor for heat stroke, obesity is a major risk factor for cardiovascular disease.

In just twenty years, from 2000 until 2020, the US Center for Disease Control reports that obesity levels increased from 30.5% to 41.9% in the US, while severe obesity increased from 4.7% to 9.2%. Today, it is estimated that more than two-thirds of adults in the United States are overweight or suffer from obesity. The US Census Bureau reports the US adult 2020 population was 258.3

*Research for this report includes studies from the US Environmental Protection Agency, National Oceanic and Atmospheric Administration, US Center for Disease Control, and US Census Bureau.*

million people — meaning that today, 172 million adult Americans have body sizes more susceptible than their ancestors to heat stroke.

## CONSUMER DEMAND DRIVES DROP IN DURABILITY

Certainly the electronics industry has driven consumer expectations to demand ever lower prices on air conditioners. However, unlike consumer electronics where smaller and smaller transistors have lowered the manufacturing cost to deliver better products, manufacturers at the low end of the air conditioner market have had to rely on lowering

product quality to lower the price point. Consumers are content to purchase a window unit at Costco, Sam's Club, or Home Depot that lasts a single season. Or if the unit fails, consumers benefit from liberal return policies. For example, a rugged and super-efficient 8,000 BTU window unit made in the US that justifiably sells for \$1,000 at a high-end appliance dealer — and could last for decades — competes with a low-cost “fast-fashion” unit from a big-box store.

## PLANNED OBSOLESCENCE INCREASES WASTE

Indeed, product failures for off-brand units may be a planned obsolescence marketing

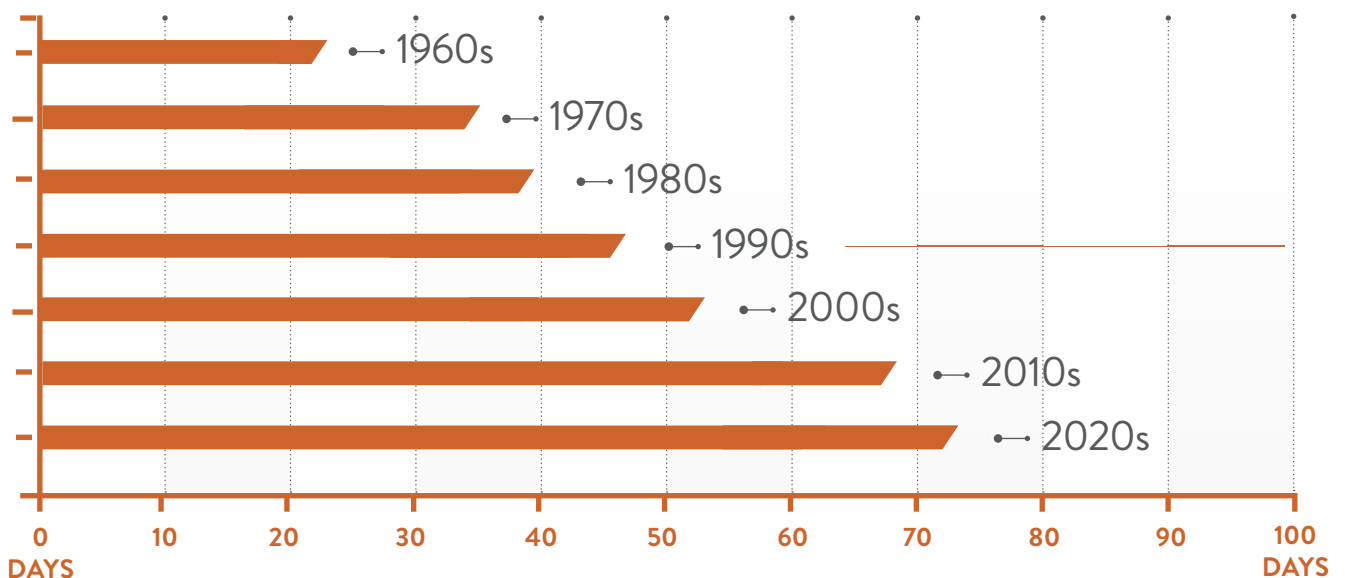
strategy — limiting the unit's useful lifespan prematurely by deliberately reducing durability. This necessitates frequent replacements, undermining the efficiency gains of heat pumps by increasing waste and resource consumption.

Before online sales were commonplace, window units were traditionally sold through regional or local appliance stores employing experienced salespeople, such as family-owned PC Richard in the Northeast. Online sales have exacerbated the problem with low-quality generic brands selling via direct-to-customer shipments. Some Chinese manufacturers have developed bargain-basement

# ANNUAL HEAT WAVES

AVERAGE LENGTH OF US ANNUAL HEAT WAVE SEASON

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DATA COLLECTED BY NOAA, UPDATE JULY 2022



# THE HIGHEST PERCENTAGE OF HEAT-RELATED DEATHS WAS AMONG PERSONS AGED 55–64 YEARS.

*The obesity prevalence is 44.3% among adults aged 40 to 59 years and 41.5% among adults aged 60 and older. (CDC data)*

products specifically for this market. Eneref found rave online reviews from influencers for low-end products boasting the cheap price tag. And for some customers with small apartments or home offices, “cheap and cheerful” gets the job done. Until it doesn’t.

High-quality heat pump brands no longer manufacture residential window units or commercial through-the-wall heat pumps in the US. This shift opened the door to off-brand competitors. Only Friedrich — an American company founded 1883 — continues to manufacture in the US. The company offered America’s first residential window heat pump technology in 1992, and continues to manufacture in the US today.

## ONLINE ADVERTISING MISLEADS SHOPPERS

Well made heat pumps are significantly more efficient than traditional air conditioners and resistive heaters in that

they provide both heating and cooling using a single system. In heating mode, heat pumps extract heat from the outside air and transfer it into a home or building. In cooling mode, they work in reverse. A reversing valve toggles the refrigerant flow direction, enabling switching between heating and cooling modes.

However, a simple Google search found that many low-cost products advertised online as “heat pumps” were not true heat pumps at all. Instead, in heating mode they employ only resistive electric heating elements, which use three to five times more energy than a true reversing-valve heat pump.

## INFERIOR COMPONENTS LIMIT DURABILITY OF BARGAIN-BASEMENT HEAT PUMPS

Eneref Institute broke down and examined a number of budget room-sized window air conditioners and heat pumps

and benchmarked where value engineering — trade-off decisions made by the manufacturer between cost, features, and quality — could result in component failures. In developing a more robust system, manufacturing decisions are restrained by the space available to fit within the enclosure, or sleeve; aesthetics and consumer appeal; and of course cost.

**Coil:** Evaporator coil freezing is a common complaint in subpar systems, especially for low-priced units that underperform in atypical outdoor temperatures. The function of the evaporator coil is to absorb heat from the indoor air. When the evaporator coil freezes, ice forms on the outside of the coil, hindering its ability to absorb heat.

**Leaks:** Eneref observed weak bonds in low-cost models. Brazed joints are used to connect pieces of copper tubing. During brazing, a filler alloy is melted to bond the copper tubes. Properly executed, the filler material forms a strong, leak-proof seal. Refrigerant leaks can stem from inadequately brazed joints within the copper tubing.

**Walls:** Eneref found that a major differentiator in the some substantially built systems was the use of steel instead of plastic for the exterior shell. Heat pumps have moving parts that test the

durability of the shell; steel is unlikely to crack under stress. Moreover, much of the unit is exposed to sunlight, and metal is unaffected by ultraviolet (UV) light, whereas some plastics can grow brittle over time.

**Insulation:** However, due to metal's superior heat conductivity compared to plastic, steel units require more robust insulation — a feature Enerf observed in steel-shelled units. Where the lowest-priced units used pieces of Styrofoam (extruded polystyrene) that loosely snapped together like Legos, the steel-walled system used well-fitting expanded polystyrene, which offers a better thermal resistance, or R-value.

**Blower:** Enerf discovered that the most economical models were equipped with smaller blower fans, which may compromise airflow and efficiency. The blower circulates air throughout the system. A smaller blower necessarily operates at a higher speed (cfm), resulting in increased noise. Because a larger blower can spin slower to achieve the same results, the life of the fan and the motor that drives it will increase.

**Controls:** Low-quality electric circuits carry the risk of complete system failure and can make repairs prohibitively expensive. Today, modern heat pumps employ efficient brushless

DC motors with electronic circuit boards rather than older mechanically driven induction AC motors. The induction motor industry is highly mature, with a century-long history of refinements. Brushless DC motors have only recently become common in smaller heating and cooling applications, as recent price reductions have made them affordable for these smaller units. Additionally, the new variable speed inverter compressors are electronically controlled. Both technologies offer significant energy-saving benefits, but value-priced units likely employ substandard circuit boards. Although Enerf did not evaluate the circuit performance in low-cost units, the analysis did reveal the absence of hardening techniques on some circuit boards, such as enclosures, coatings, and dampening.

**Design:** Some components of heat pumps are sourced from external suppliers and are therefore beyond the control of the heat pump manufacturer. For instance, today, small compressors used in most HVAC units are produced by just a few manufacturers based in China. Therefore, the overall design is as crucial as any individual component; best-in-class heat pump manufacturers design these components to work together for the highest efficiency and durability. This design-engineering process

is costly and time consuming. Manufacturers of bargain-basement heat pumps likely cut corners and sacrifice reliability.

## PAYING MORE UPFRONT FOR HEAT PUMP RELIABILITY

Enerf Institute's analysis highlights the contrast between durable brand-name heat pumps, designed to weather extreme conditions and protect vulnerable populations, and their low-cost, short-lived counterparts that are ill-equipped to handle the increasing demands of a warming climate. As consumers navigate an oversaturated market, with myriad options available from local retailers to online giants, the sobering reality remains: opting to invest in a reliable, high-quality heat pump is not merely a choice for comfort — it is a critical decision for health, safety, and environmental stewardship in an increasingly precarious world.



# LEAD BY EXAMPLE.

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***ENEREF CAMPAIGNS ARE DESIGNED TO CREATE A COMMON UNDERSTANDING OF SOLUTIONS TO GLOBAL WARMING AND ENCOURAGE PEOPLE TO TAKE ACTION.***

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**AS A SOCIETY,** we're more likely to act on environmental solutions when knowledge is shared. That is, when every member knows the same information—and knows that every other member shares that knowledge, too. A viral argument becomes common knowledge, and common knowledge becomes

action. Eneref Campaigns bring about that positive tipping point by creating the dynamic of common knowledge and the perceived social pressure to act responsibly. We'll ignite a movement so that you can lead others.

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*Every organization  
must harness their capacity to  
improve our planet and society.*

Right now, we need to make unprecedented changes to ensure a sustainable and equitable society. Limiting global warming requires rapid and far-reaching transitions in land, energy, industry, buildings, transport and cities. Every extra bit of warming matters to reduce irreversible harm to our ecosystems.

We encourage organizations to grow sustainably and act responsibly by raising awareness for clear, specific solutions that offer an efficient use of natural resources, demonstrate social responsibility and foster a peaceful, earth-friendly economy.

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