Masonry Heaters are Massively Comfy

BY ERIC MOSHIER AND LESLIE JACKSON

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You enter the house on a winter's evening, remove your wet boots and coat. In your living room, there are a few pieces of split, dry firewood, ready to burn. You open the door to the firebox, build a fire. You shut the door, and go about your evening.

The heater purrs away. That one fire lasts 45 minutes to an hour and a half. It's the only fire you'll build until tomorrow night—maybe tomorrow morning, if it's especially cold. That heater, with the small, hot fire in it, and the heat stored in the mass of bricks or stone, cost you a high up front cost. But the initial outlay of $15k or so has in about nine years paid for itself in fuel savings. Add one year for learning that you need to order your wood in May to start drying it (not in September, when you think about being cold). In a few years, you might spend $10 on a new grate, or $150–250 on a chimney cleaning. In 50 or 60 years, your descendants are considering some maintenance (a three-to-four-hour job: $600). And in 100 years, someone is still enjoying that heater, and paying around $600 per year (today's prices) for fuel.

Moshier built this masonry heater for a client in the Upper Peninsula of Michigan.

But the economics aren't your measure; your comfort is.

Few people, especially in the warmer climates in North America, know about the masonry heater, but it is a household word in the colder parts of Northern Europe, and Asia, and an old one. Stonemason Eric Moshier of Solid Rock Masonry built four heaters this winter and taught

four workshops on them. He stays busy; there aren't many professional masonry heater builders in the United States, "probably fewer than one per state," he says. Yet look in the Austrian phone book for a stove fitter, as they are called there, and you'll find 20 to 40 in a medium-sized city. Why so many for a country the size of Wisconsin? It's more than how cold it is, and it's certainly not for lack of technical innovations. It's how efficient these masonry heaters are as heaters, for an enormous payback of comfort, with very low emissions, burning very little fuel (in a country where firewood resources are limited). Could we enjoy these heaters as much in North America, even if we have plenty of firewood?

The heart of a masonry heater is a firebox constructed out of a refractory material such as firebrick. As the fire burns, the gases move through the heat-exchange channels inside the heater. The warmth is absorbed by the masonry and radiates throughout the home long after the fire has gone out—often for as long as 24 hours.

Lean on me.

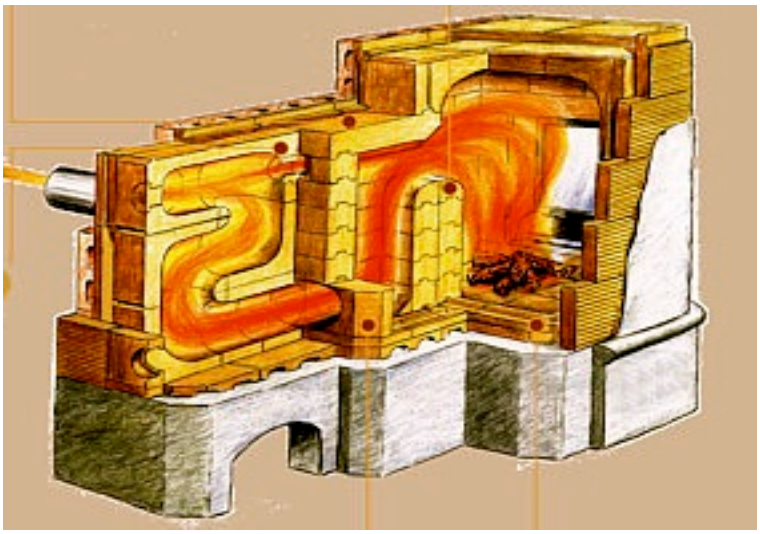
An Old Solution to an Old Problem

When the European versions of these heaters originated, (in the 15th to 18th centuries) scarcity, risk of fire, and the cost of wood were the mothers of invention. People devised ways to get the most out of the little fuel they had, to survive the extremely cold winters. And some of their best designs are still in use today. The key is to burn all the gases in the wood at high temperatures, and store the heat you produce in a thermal battery.

Take a standard Contraflow heater, traditional and still popular in Northern Europe. Weighing in at up to 3 tons and standing as high as 9 feet, this heater can be finished with clay plaster, tile,

stone, soapstone, or exposed brick. Efficiency for this heater hovers around 73–78%. Maximum efficiency is about 85%, since you will always lose 10-15% in moisture in the wood, and no heater is designed perfectly. This is because there needs to be a balance between the size of the firebox, the amount of channels, and the mass or area of the heater, and this balance can't ever be 100% perfect.

Austrian Kachelofen or Tile Stove showing the Engine or Core of the unit with some of the channeling.



Typical Kachelofen showing the gas path.

A peek into the complex workings of a Moshier-built *kachelofen*, or traditional Austrian/German heater, finished with kachln tile.

Measurable Coziness

After a heat-loss calculation, Moshier may determine that a given 1,000 ft2 house needs 7,000 Btu per hour to satisfy its heating needs. He'll size the firebox to provide that output. (Maximum heat output on a really large heater, in case you're wondering, is about 25,000 Btu per hour.)

Testing helps to establish how a masonry heater performs with respect to particulate emissions, combustion efficiency, and overall efficiency. In terms of masonry heaters, combustion efficiency describes how completely the heater is burning the cordwood fuel load. Overall efficiency describes how well the stove transfers energy released from combustion of the wood fuel source into usable heat energy radiated from the heater.

Moshier installed this heater in a timber frame home and finished the bricks with earthen plaster.

To measure temperatures in the oven and the external brick or stone, Moshier uses a laser thermometer that you can buy for $40 from your local auto parts store. They are not used to measure temperatures inside the firebox, which can reach 1,800–2,000°F.

This high temperature is a major player in the resulting efficiency, because most of the volatile organics in wood don't burn until they reach at least 1,100°F. The materials of the firebox, the correct size of the box, and oxygen introduced at just the right locations in the firebox give you a combustion efficiency of around 98%, with just fly ash left, and a particulate measure of clean combustion of 0.4 to 2 grams per hour.

learn more

Learn to build masonry heaters, find a contractor in your area, be inspired by beautiful pictures, or pore over test results at The Masonry Heaters Association website.

Learn more about Eric Moshier's Solid Rock Masonry.

Lyle, David. *The Book of Masonry Stoves: Rediscovering an Old Way of Warming.* Baltimore: Brick House Publishing, 1984.

Read more about test procedures and results for measuring PM.

Emissions are not measured with a $40 tool, but with a $3,000 tool called a Testo Fuel Gas Analyzer and a Condar Unit. Particulates, alternatively referred to as particulate matter (PM) or fine particles, are tiny particles of solid or liquid suspended in a gas. In the case of wood burning, PM refers to particulates in exhaust gases (smoke) that exit the chimney and enter the atmosphere. PM consists of ash, and other organic compounds. Testing for R&D research is done with fairly expensive moisture meters, thermocouples, very accurate scales for measuring soot. A Testo Combustion Analyzer and a Condar Unit for sucking in the PM to weigh a filter on a scale with accuracy of .001g.

It's notable that these craftsman-built, custom-fit heaters cost the same in Austria as they do here in the United States. It's not as if they were cheaper there just because everyone has one. For those of us who take pleasure in interacting with our sources of energy, and the systems in our homes, or who simply like to light fires, here is a guilt-free source of heat we can save up for.

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