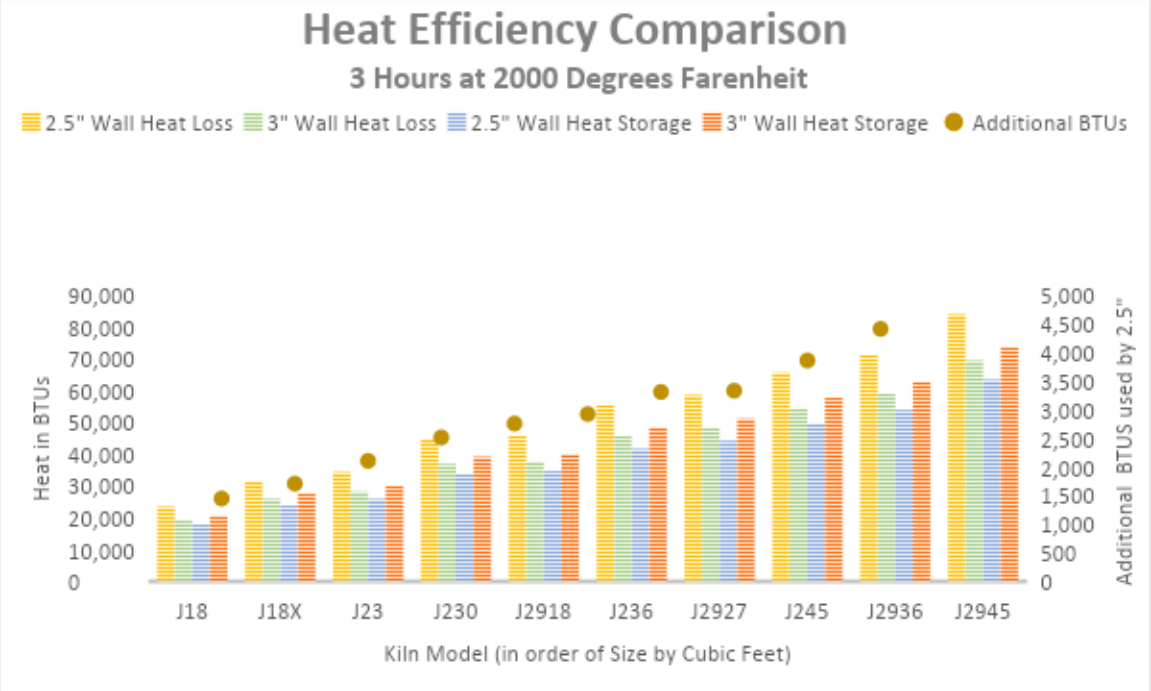
Kilns and Efficiency

As makers, we have much to consider in regards to our environmental impact.
So much so that it can be a little overwhelming.

I am a current graduate student, and I think a lot about how my practice impacts the planet. To alleviate some of the stress, I pulled together this paper that I would like to share with you. I concentrated my research on kiln efficiency as a place to start. My goal is that this will provide you with helpful, relevant information for setting up an environmentally friendly studio, and, hopefully, make it a little less stressful.

Does Wall Thickness Make a Difference?

Most electric kilns on the market have a wall thickness of either 2.5 or 3 inches. One of the advantages of a thicker wall is that the additional insulation keeps more heat inside the kiln, resulting in a more energy efficient firing. But, does a half an inch of insulation make that much of a difference? The short answer is yes.



A study by L&L Kiln Manufacturing Inc. of their Jupiter Kilns revealed that across all models, the three-inch walls reduced heat loss by an average of 17.5% over the two-and-a-half-inch walls. The three-inch walls also stored an average of 15.9% more heat than the smaller bricks. This means more heat stays in the kiln. In fact, the study showed that the thinner walls consistently lost more heat than they could store, as opposed to the thicker walls which stored more heat than they would lose. In addition to being more energy efficient, opting for the thicker bricks could also prolong the life of the kiln elements. Since more heat stays in the kiln, the elements don't have to work as hard to reach temperature.

It can also be beneficial to increase the thickness of the top and bottom of the kiln. If your kiln lid is cracking and needs replacement, try upgrading to a thicker brick for the lid and reusing the old bricks to make a double bottom by stacking them between the existing bottom and the stand. (Keep in mind that you may need to drill holes to accommodate the ventilation system.) For a new kiln, select a thicker brick for the lid and invest in a few additional soft bricks to double insulate the bottom. Potter Maggie Furtak noted that when she upgraded her lid and added a double bottom, her electricity usage went down an astonishing 14% and her glaze firings completed two hours faster.

The added bonus of making energy conscious choices when purchasing or building a kiln is that it saves you money over time. According to the kiln manufacturer Skutt's website, choosing the three-inch brick could save makers around 15% on their energy bills, depending on firing practices. Not only that, less wear on the elements could reduce the frequency with which they need to be replaced, saving additional money and valuable time.

How Does Wall Thickness Affect Kiln Space?

One concern many makers have about choosing a thicker brick is the loss of kiln space. It is true that the three-inch wall does slightly reduce the available real estate within the kiln as an inch is lost from the internal diameter. There is, however, an easy way to lessen the impact. Brick thickness affects how much space there is between the walls. Because of this, a kiln that is tall and narrow will be more affected by a change in diameter than a kiln that is short and wide. When selecting a size, opt for width over height. If your work requires the height, choose a kiln that is both wide and tall. (For more information, a chart has been provided below to illustrate how different kiln dimensions are affected by the three-inch brick.)

Model	Dimensions for 2.5" in Inches	Dimensions for 3" in Inches	Cubic Feet for 2.5"	Cubic Feet for 3"	Size Difference in Cubic Feet	Percentage of Space Lost
J18	17.5D x 18H	16.5D x 18H	2.6	2.5	.1	3.8%
J18X	17.5D x 27H	16.5D x 27H	4.0	3.7	.3	7.5%
J23	23.375D x 18H	22.375D x 18H	4.6	4.4	.2	4.3%
J230	23.375D x 27H	22.375D x 27H	7.0	6.7	.3	4.3%
J236	23.375D x 36H	22.375D x 36H	9.3	8.9	.4	4.3%
J245	23.375D x 45H	22.375D x 45H	11.6	11.1	.5	4.3%
J2918	29D x 18H	28D x 18H	7.0	6.8	.2	2.8%
J2927	29D x 27H	28D x 27H	10.5	10.2	.3	2.8%
J2936	29D x 36H	28D x 36H	14.0	13.6	.4	2.8%
J2945	29D x 45H	28D x 45H	17.6	17.0	.6	3.4%

Kiln Size

What about the size of the kiln? Is one size more efficient than another? In a way, yes. The most efficient size to purchase or construct will be the smallest size capable of meeting your needs. A full kiln is a happy kiln, so selecting a size that you can consistently fill will make the best use of both time and electricity. Also, if you can, choose a kiln that is rated for a higher temperature than you need. Kilns rated for higher cones are equipped to regularly handle intense firings, so they will reach lower temperatures with ease – this means faster firings that use less energy and put less stress on elements. Oftentimes, there is no price difference between a kiln that can reach cone ten as opposed to cone six. The tricky part here is that some kilns are rated for different temperatures based on voltage. When it comes time to buy, check to see if upgrading the outlet or the breaker is a worthwhile investment.

Hard Brick or Soft Brick?

When it comes to kilns, and gas kilns in particular, is hard brick or soft brick better? Hard brick is great for structural applications as it is strong and dense and can withstand extreme temperatures and atmospheres. It is also very durable and can stand up to the bustle of even the busiest studios (I'm looking at you, classrooms.) However, it makes a terrible insulator. Soft brick, on the other hand, is an excellent insulator and is therefore

recommended for the walls of kilns. Most of the time, soft brick can be used in place of hard brick, but if additional structural support or durability is necessary, hard brick can be used on the exterior of the kiln with an internal layer of soft brick as insulation.

Posts, Shelves, and Loading

It is important to consider the material of your kiln posts and shelves as well. When structurally possible, avoid using whole hard bricks as supports. Energy will be spent heating up the bricks rather than the work. Instead, look for posts with a hollow center. These posts will draw less energy and often save space in the kiln. Just make sure that whatever posts you choose can safely support the load.

Heat can also be lost to the shelves. Thinner shelves will pull less heat than thicker ones, and the fewer shelves you can (safely) use the better. Shelf placement can also make a difference. Offsetting and staggering the shelves can make for a more efficient firing by allowing the air to flow between levels, whereas having the shelves aligned one over the other can limit air flow and cause the firing to be uneven. For bisque firings, “tumble stacking” is the most energy efficient way to load as it requires no shelves at all, can utilize more space, and has unrestricted airflow.

Firing Practices: How Behavior Affects Efficiency

In addition to loading practices, the way we fire can have a significant impact on energy efficiency. Candling and preheats can be great ways to ensure that the work is completely dry before climbing to temperature. However, it is not uncommon for makers to candle or preheat unnecessarily out of tradition or habit. Since candling and preheats can use a lot of energy, assessing whether or not the step is necessary can be a great way to increase efficiency and reduce consumption. Additionally, oftentimes, makers will remove the spies during the early stages of the firing to allow any moisture to escape from the kiln. However, since many kilns run automatically, it is easy to forget to put the spies back in place once the moisture has “cooked off”. This can result in a fair amount of heat loss, so remembering to return the spies is a small step that can truly make a big difference.

Surprisingly, *when* we fire can also have an impact. Neighborhoods often have peak times of energy consumption. During these times, outlets can experience *voltage drops*. Essentially, because people are using a higher amount of electricity at the same time, less voltage reaches each individual appliance in use. This means that during peak times, your kiln will have to work harder to reach temperature. Try contacting your electrical provider to find out what the peak times are for your area. Scheduling around these times can help you fire more quickly and efficiently. Weather can also make a difference. On days of extreme heat or cold, neighborhoods experience greater voltage drops due to the use of air conditioners and space heaters. Extreme cold can also cause longer, more challenging firings for kilns placed outside. When possible, schedule firings to avoid these days.

A great way to manage your energy consumption is to keep a log of your firings. Take note of the date, start time, end time, and weather conditions. You will also want to jot down what cone you were firing to, how full the kiln was, how many shelves were used, and if the kiln over- or under-fired. This information, along with anything else that you choose to include, can help you track how different factors affect your kiln’s efficiency. For example, you might find that Super Bowl Sunday is not a good day for a firing or that a tumblestacked bisque runs faster than a bisque loaded with shelves and posts.

Kiln Maintenance

To ensure that your kiln fires at its best and most efficient, try to address maintenance issues as soon as you can. A burnt-out element can make it more difficult for the kiln to reach temperature, resulting in a longer firing and greater energy consumption. Kiln lids can also get tired overtime and will often gap around a quarter of inch. Learning how to adjust your kiln lid so that it sits flush will save energy by keeping valuable heat inside the kiln. In a pinch, you can close the gap by weighing down the edge of the lid with a brick. If a spy breaks, try to replace it as soon as you can or keep a few extra on hand just in case. Here, too, it can be helpful to keep a log to track any changes in your kiln's performance.

Blaauw Kilns: Are They Worth It?

Maybe…

Blaauw kilns are considered to be the most efficient on the market. Blaauw is a Netherlands based company that creates custom built kilns designed to be incredibly efficient while meeting the specific needs of each of their clients. Aside from complete customization, there are a couple of things that set Blaauw apart. For starters, the computers that run their kilns are highly sophisticated and offer complete freedom in terms of programming. Additionally, the computers monitor not only flow of the ramp, but the temperatures of up to four zones in the kiln, ensuring a truly even firing. The electric models also have a built-in drying function and controlled quick cooling function that enable work to be fired far faster than other models. This means a quicker turnaround and greater productivity. The electric kilns also have high grade insulation and optimally placed heating elements placed on ceramic tubing that is said to provide the most effective heat transfer.

The gas models are fully automatic which means consistent firing every time. They also have the added function of a computer-controlled atmosphere in the kiln – be it reduction, oxidation, or neutral. They also claim that their kilns will halve the cost of natural gas consumption per firing over other kilns on the market. And, both the gas and electric models boast a 25-to-40-year lifespan with daily use.

All of this is to say that the Blaauw kilns are among the most technologically advanced and energy efficient available today. So, what's the catch? Well, these babies are expensive. We're talking they don't list their prices on the website level of expensive. For reference, Wichita State University ordered four kilns from Blaauw to the tune of $150,000. (One of the kilns had a "gradient" capability where two temperatures could be fired at once in the same kiln.) In short, depending on usage, a Blaauw kiln might be a worthy investment, particularly in a high production setting, but for most studio potters and clay artists, the initial cost may well outweigh the benefits.

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