

Countertops

Many people consider the kitchen to be the heart of a home, the place where nourishing food is prepared and guests tend to gather; and perhaps countertops are then the heart of a kitchen. Between preparing food and drinks, cutting bread, and using the surface as a trivet, dish dryer or eating place – topped off by aggressive scrubbing – countertops take a lot of abuse and require high durability in the average kitchen. With myriad options and so many performance demands, how does one choose the greenest surface?



Actually, no material obviously stands out as the best, and greenest, countertop choice. The ideal surface for your kitchen ultimately depends on your budget, aesthetic preferences, cooking style, and maintenance requirements while considering green attributes.

1. The first step is to set a budget, as costs run the gamut from \$10 to \$150/SF and can climb even higher. Keep in mind that cost is dependent not only on the material choice; complex layouts, special edge detailing and backsplashes, undermount sinks, integral drain boards or sinks, and additional cutouts will add to the base cost. Also, structural support requirements for heavy materials like stone or concrete might complicate your project. Tile and butcher block are the easiest DIY projects if you choose to supply your own materials and labor.
2. Once your budget is set, ask yourself what you expect from your countertop:
 - a. Low maintenance?
 - b. Stain resistant?
 - c. Scratch resistant?
 - d. Heat resistant?
3. Finally, weigh your narrowed list against environmental impacts.
 - a. Manufacturing phase: Was the product locally sourced or manufactured? Does it have low embodied energy (use relatively low energy to produce)? Was it made with sustainable materials such as salvaged, recycled content (preferably post-consumer), rapidly renewable, or FSC Certified?
 - b. Lifecycle phase: How long will this material last? Is the product recyclable, or will it end up in a landfill at the end of its life? Will it readily biodegrade?



Facts at a Glance

Material	Maintenance Requirements	Stain Resistance	Scratch Resistance	Heat Resistance	Manufacturing & Resources *	Lifecycle	Cost
Laminate	4	3	2	3	3	2	\$
Tile	2	3	3	4	3	3	\$
Butcher Block	1	2	1	2	4	4	\$-\$\$
Fiber Cement	2	2	2	4	2	3	\$\$
Solid Surface	4	3	2	3	1	1	\$\$
Paper Composite	3	3	3	3	2	1	\$\$
Engineered Stone	4	4	4	4	2	1	\$\$\$
Natural Stone	2	3	1-4	4	2	3	\$\$\$
Concrete	2	3	2	3	2	3	\$\$\$
Metal	3	2-4	2	2-4	2	4	\$\$\$

* Based on greenest available options

Key: 4= Excellent/ 3= Good/ 2= Fair/ 1= Poor

Cost (installed, per SF): \$= \$10-40/ \$\$= \$40-80/ \$\$\$= \$80-150

Performance and cost ratings are based on a variety of references, testing reports, and anecdotal evidence and should be viewed subjectively. For example, a manufacturer might recommend regular sealing of a product to maintain stain resistance, but if you think stains add character, perhaps you don't need to be as concerned with certain maintenance requirements. If you don't mind using a trivet, you can be less concerned with heat resistance properties. And other considerations might affect your household; for example, if some family members are clumsy with dishes, a more forgiving surface to reduce breakage might make sense.

You might fall in love with a certain material and decide that you're willing to live with a negative attribute you had initially thought was a must-have. Also, remember that you don't have to limit yourself to a single material for every surface; a combination might make better functional sense, or allow you to splurge on your dream material in a smaller area.

As with any product choice, remember that nothing can last forever or always look like new, so be realistic in your expectations for a product. Appropriate use and maintenance are the keys to ensuring longevity and satisfaction. And unfortunately, given current tendencies to remodel and replace elements that still have many good years of use left, a future owner might replace your countertop long before its time has come.



Laminate

Historically a less glamorous or desirable option for many homeowners, laminate countertops are in truth an excellent budget option and can provide an attractive, kitchen-worthy surface when its limitations are heeded. Laminates are made with sheets of resin-saturated paper pressed together under pressure. The topmost sheet is the decorative layer, which could be a solid color or printed pattern or picture. The thin plastic laminate (about 1/16") is then adhered to a flat substrate, such as particleboard, on site.

Not all laminates are created equal. Be sure to choose a high-pressure laminate, which is thicker and more durable than the less expensive low-pressure (sometimes called post-formed) laminates. If treated well, a laminate countertop can offer many good years. While minor burns or scratches can sometimes be buffed away with an abrasive cleanser, don't use an unprotected countertop as a trivet or cutting board since damage that extends through the thin laminate might be repairable but will be difficult to camouflage. Also specify an alternative substrate, as conventional particleboard and MDF (medium density fiberboard) can offgas high levels of formaldehyde due to their urea formaldehyde adhesives. Fortunately, particleboard and MDF products made with alternate adhesives are available.

The synthetic plastic resins used in laminate products are petrochemical based and have high embodied energy; however, this component is a small proportion of the completed installation. Theoretically, the particleboard substrate can be recycled if the laminate is removed, but in reality most laminate countertops end up in a landfill.

Green Tips:

- Choose a high-pressure laminate product
- Specify particleboard or MDF made with no added urea formaldehyde
- Use a low-VOC, solvent-free or water-based adhesive to adhere the laminate

Butcher Block

Wood or bamboo butcher block can add beautiful warmth to an otherwise "cold" kitchen and nicely complement other more carefree surfaces. Maple, walnut, oak, bamboo (a grass), and almost any other wood species can be fashioned into a smooth solid surface from end grain or edge grain pieces. However, since butcher block is generally high-maintenance and not well suited for wet areas, in most kitchens it is wise to limit its use to islands or eating bars. Ultimately, its appropriate use will depend on what you plan for the surface: will it be a cutting surface, or used only for less demanding tasks?

If you desire a cutting surface that will best stand up to sharp knives, look for a hard, dense wood such as Hard Maple, Red Oak, or White Ash that is constructed from the end grain. Cutting surfaces should be treated regularly with food-grade mineral oil or paraffin wax, both of which are unfortunately petrochemical based but will not turn rancid like vegetable oils. Non-cutting surfaces can be finished with any wood finish.

One advantage of butcher block is how readily it can be renewed. A good sanding can remove deep scratches and burn marks (though you should always use a trivet!) and, as a natural unprocessed product, can theoretically be recycled and kept out of the landfill. Finally, butcher block has by far the lowest embodied energy of typical countertop materials.



Green Tips:

- Use an [FSC Certified](#) wood , [salvaged](#) wood, or [bamboo](#) product
- Mechanically fasten the butcher block
- Salvage small leftover pieces for cutting boards
- Finish decorative (non-cutting) surfaces with natural plant-based products

Tile

For durability that can rival or exceed solid surface or stone but at a fraction the cost, consider tile. Tile can be made from just about any material including ceramic, porcelain, glass, stone, concrete, terrazzo, or even metal. Tile is generally installed with thinset mortar over cement backer board to ensure a moisture resistant, thermally stable bonding surface. To minimize grout joints and associated maintenance, choose larger format – ideally full counter depth – tiles. Flat tiles will provide a more even, easier to clean surface. Epoxy grout is more hazardous to health until it has cured but has superior strength, durability, mildew and stain resistance than conventional grout.

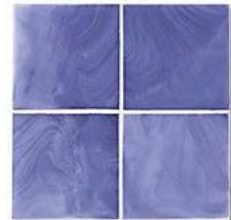
Performance characteristics depend on the tile material. Glazed ceramic or porcelain tile is water and stain resistant and should not require sealing, while other types should be periodically sealed. Epoxy or latex-modified grout generally does not require sealing, but be sure to seal other types of grout to ensure best performance.

To explore characteristics of other materials that could be used for tiling, review other sections of this fact sheet. Cost also varies with the material choice. Tile can be the most economical countertop option, especially as a DIY installation.

Damaged tiles can be replaced as needed, so it's wise to keep a few extra original tiles on hand to ensure an inconspicuous replacement.

Green Tips:

- Choose a [salvaged](#) product or [ceramic tile](#) with high post-consumer recycled content
- Use large tiles
- Use a low-VOC thinset product
- Seal unglazed tile, stone surfaces, and grout joints with a low-VOC, solvent-free or water-based product



Fiber Cement

If you like the old-fashioned and cool look of soapstone (see Natural Stone), fiber cement might be for you. As its name suggests, fiber cement is made primarily with Portland cement and fillers, including sand and cellulose fibers, and is formed into large sheets under very high pressure. Unlike its concrete cousin, however, fiber cement is much lighter and stronger and can be formed into sheets appropriate for substrate-free countertops as thin as .75 inches. It is also much less expensive than concrete or soapstone. Fiber cement is installed with minimal seams that are filled with an epoxy grout to provide a smooth, integral surface.



Cutting directly on fiber cement might scratch the surface and will dull knives. As a porous material, moderate maintenance about twice per year is recommended to increase water and stain resistance. However, fiber cement is expected to patina into a more “mottled” look with age. Like conventional concrete, fiber cement can take hot pans but not acidic liquids, which will stain the surface. Unlike concrete, colors are limited to a handful of muted options.

On a project basis, the embodied energy of fiber cement is much less than either imported or domestic stone. However, even at a resource-efficient thickness of .75 inches, its embodied energy is only slightly less than a typical 1.5 inch thick cast-in-place concrete countertop.

Green Tip:

- Specify a thin product

Solid Surface

Among the leaders in durability, synthetic solid surfaces are a breeze to clean, have excellent stain resistance, and do not require sealing. They are easy to fabricate and accommodate challenging layouts that might not be possible with other materials. Unfortunately, they falter in environmental performance. Most products are made from roughly equal amounts of virgin acrylic or polyester plastics mixed with mineral fillers, and like other composite plastic products, recycling options are practically nonexistent.

One green benefit of a solid surface is its ability to be repaired. Since the material is homogenous, scratches and light nicks can be buffed out. Deep gouges or chips can be filled with matching filler material to provide a practically invisible repair.

To increase environmental performance, choose the thinnest product possible. Creative edge detailing can give the appearance of a thicker product if desired. Also, at least one manufacturer offers a product line made with some pre-consumer waste from the manufacture of its other products.

Green Tips:

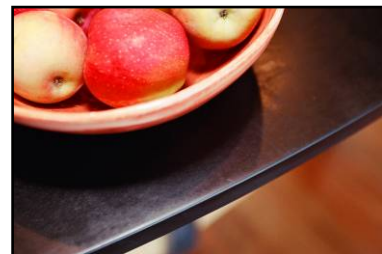
- Specify a thin product
- Source a product made with pre-consumer recycled plastic content

Paper Composite

Known in commercial kitchens for almost 50 years, paper and resin composites are new to the residential countertop market. These surfaces are formed by compressing multiple sheets of resin-saturated paper under heat. The end product is quite hard and has better scratch resistance than solid surfacing, although its slight porosity can allow some staining. The surface is hard enough to resist deep scratches, though not too hard on sharp knives.

Very hot pans can leave rings on these surfaces, though light sanding should remove marks and surface scratches.

Resins used to manufacture these products are generally petrochemical based and contribute no more than 30% to the finished material. However,





the newest kid on the block uses a non-petrochemical resin along with thicker paper, reducing the overall resin content and environmental burden. Unfortunately, like many other composite materials, viable recycling options are lacking.

Green Tips:

- Specify a thin product
- Source a product made with at least 50% post-consumer recycled paper

Natural Stone

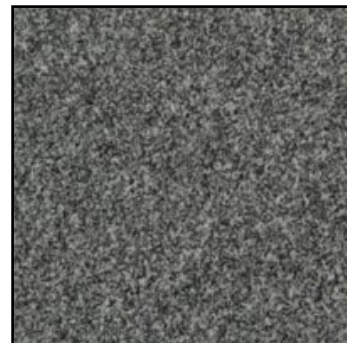
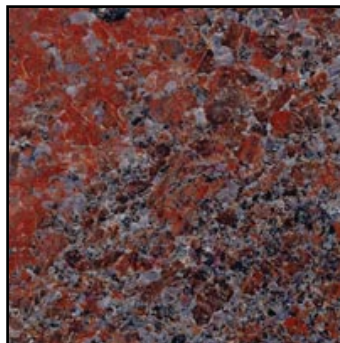
At home in both modern kitchens and ancient farmhouses, stone holds its own as an attractive and functional countertop and can stand up to decades of rough treatment. Its physical properties, such as porosity and hardness, can vary as much as a stone's colors and patterns. Granite has the lowest porosity of common options but still must be sealed occasionally. Stone countertops are generally fabricated from large slabs to limit seams.



The mining or quarrying of stone has significant environmental impacts including air and water pollution, habitat destruction, and energy use. Because stone is so heavy, transportation multiplies its embodied energy many times over. Sourcing a domestic product will dramatically reduce this impact and can actually drop its embodied energy below that of cast-in-place concrete. Fortunately, popular options including granite, marble, soapstone, slate, and limestone in a wide range of colors are available domestically.

Green Tips:

- Source a domestically quarried and fabricated product
- Use a low-VOC or water-based stone sealer



Engineered Stone

A workhorse in the kitchen, engineered stone is at the head of the pack in terms of low maintenance and high durability. Unlike natural stone, these countertops are non-porous, never require sealing, and are impervious to stains. Due to its manufactured nature, the material tends to look more homogenous and lack the character variations of natural stone, which might or might not be desirable depending on your taste.



Most engineered stone products are made from 93% quartz or marble chips, often waste from other processes, and 7% resin. As with other composite materials, recycling options are limited. Though heat resistance of engineered stone outscores granite, manufacturers recommend always using a trivet. And similar to natural granite, cutting on it will not damage the surface but will dull your knives.

Green Tip:

- Specify a thinner product

Concrete

Given its creative potential, unique character, and practicality, concrete isn't just for foundations and garage slabs anymore. Now, both cast-in-place (CIP) and precast countertops are making their way into industrial-style lofts and bungalow remodels alike. However, concrete is not the carefree and inexpensive surface many people believe it to be. Concrete is a custom product that is comparable to high-end granite in cost; it is in its nature to crack; and as a porous material, can stain.



To increase water and stain resistance, fabricators generally apply a penetrating sealer. Regular sealing is then required to provide adequate protection. While concrete can take warm pans without cracking, its sealer can be damaged from heat, so it's best to use a trivet. Cutting boards are also recommended.

Concrete is made with Portland cement, water, sand, and coarse aggregate. While most of these raw ingredients are abundant and widely available, the cement portion is what really degrades the "greenness" of concrete, requiring large amounts of energy to produce. Displacing up to 50 percent of the cement with industrial byproducts such as fly ash or slag will substantially reduce the embodied energy of the finished product. Also, recycled materials including glass, metal shavings, seashells, and plastic or wood chips can be incorporated into the mix to produce a special custom look.



Green Tips:

- Find a fabricator that uses [fly ash](#) or other reduced cement mixes
- Source a product that incorporates a high percentage of post-consumer recycled content materials

Metal



Copper, zinc, stainless steel, pewter, bronze, brass, or even hot rolled industrial steel can be fabricated into fashionable and hardy work surfaces. Metal is non-porous and generally has good stain resistance, although softer types are prone to getting scratched, dented, and sometimes distorted under high heat. Metal



countertops are usually professionally fabricated from sheets, wrapped over a smooth sturdy substrate such as plywood, and seams can be welded and finished to provide a seamless surface. Prices generally start at \$100/SF installed depending on type of metal, level of detailing, and addition of integral sinks or backsplashes. Metal tiles can offer a less expensive do-it-yourself option.

Stainless steel makes for the most durable countertop although the look is too modern or industrial for some people. For those who appreciate a weathered patina character, just about any other metal might be a better fit. Regular polishing or waxing is needed to retain the original look of a metal and increase stain resistance, although metal countertops do not require sealing and maintenance can be as simple as a little soap & water. Matte or distressed finishes will hide fingerprints and scratches better than a polished finish. Buffing generally erases surface scratches.

Metal is a finite resource, and while large amounts of energy go into the mining and refining of raw ores to make metal, practically all metals can be recycled. Also, most metal is comprised of at least 50 percent recycled content and is currently a valuable commodity, making recycling even more likely.

Green Tips:

- Before committing to a metal that will patina, try out a sample piece and see how it ages to ensure it fits with your taste and décor
- Specify particleboard or MDF made with no added urea formaldehyde, or exterior grade plywood, for the substrate
- Limit use of adhesives and mechanically fasten where possible to ease recycling

Green Building Guidelines References

Products discussed on this fact sheet may correspond to specific measures, points, or credits in various [Green Building Guidelines and Rating Systems](#):

New Home Construction Green Building Guidelines (Build It Green)

- L3 – Use Low-VOC Wood Finishes
- L4 – Use Low-VOC Construction Adhesives
- L6 – Use Environmentally Preferable Materials for Interior Finish
- L7 – Reduce Formaldehyde in Interior Finish

Home Remodeling Green Building Guidelines (Build It Green)

- M2 – Use Low-VOC Wood Finishes
- M3 – Use Low/No-VOC Adhesives
- M4 – Use Salvaged Building Materials for Interior Finish
- M5 – Use Engineered Sheet Goods with No added Formaldehyde
- M6 – Use Exterior Grade Plywood for Interior Uses
- M8 – Use FSC Certified Materials for Interior Finish

Multifamily Green Building Guidelines (Build It Green)

- E4 – Use Low/No-VOC Paints & Coatings
- E6 – Low-VOC Construction Adhesives
- E7 – Environmentally Preferable Materials for Interior Finish
- E8 – Reduce Formaldehyde in Interior Finish Materials



LEED-H Rating System (U.S. Green Building Council)

MR3 – Local Sources

MR5 – Environmentally Preferable Products

LEED-NC Rating System (U.S. Green Building Council)

MR Credit 3 – Resource Reuse

MR Credit 4 – Recycled Content

MR Credit 5 – Regional Materials

MR Credit 6 – Rapidly Renewable Materials

MR Credit 7 – Certified Wood

IEQ Credit 4 – Low-Emitting Materials

For learn more about these Green Building Guidelines & Rating Systems, visit:

www.builditgreen.org/guidelines

Resources

For current product, manufacturer, and supplier information on countertops, search the Green Product Directory: www.builditgreen.org/products.

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This program is funded by California utility ratepayers under the auspices of the California Public Utilities Commission.