

{ green home remodel } 
healthy homes for a healthy environment

roofing





green

What is a Green Remodel?

It's an approach to home improvement with the goal of not only making your home *look* better, but *work* better—for both you and the environment. Want a healthier home? Lower utility bills? Reduced maintenance? A cleaner planet? A green remodel helps you realize a range of far-reaching benefits from a single smart design. With careful planning, you can create a home that combines beauty, efficiency, comfort and convenience with health and conservation.

why

Why Consider a Green Remodel?

SAVE MONEY

Home components chosen for their durability and timeless appeal will last longer and cost less to maintain in the long run. A quality roof plays a key role in protecting the rest of your home from the elements. Consider too, that roofing materials vary in their heat absorption and retention. This can affect home energy use.

MAKE A HEALTHIER HOME

Quality materials and proper installation will enhance the protective nature of your roof, reducing the risk of leaks and accompanying moisture problems.

REDUCE ECOLOGICAL IMPACT

By choosing a long-lasting quality roof, you'll delay its replacement. If you select recyclable materials, your roofing can escape the landfill altogether. When you avoid materials that are toxic to fish and other wildlife, you protect water quality. If you opt for products manufactured and installed with minimal ecological impact, we all benefit.

roofs

Seattle receives nearly *three feet* of rain per year, and your roof's ability to effectively shed this water dramatically affects your home's longevity. Northwest roofs really take a beating; months of constant moisture mean plenty of opportunity for moss and fungus to take hold.

Undetected or untended leaks can lead to major moisture damage, moisture-related indoor air quality issues, and even structural problems.

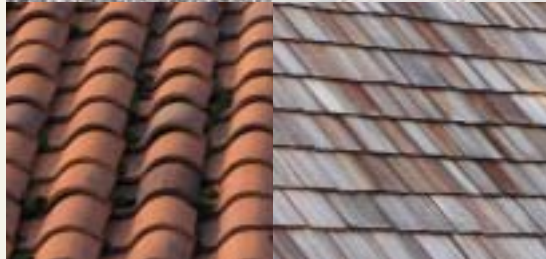
By making strategic decisions during roof replacement, you will maximize your roof's protective qualities—and your investment—while minimizing its environmental impact.

Cover photo: JAS Design Build
(photo © John Granen).
Photo top right: Miller/Hull Architects



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rethink remodel

Green remodeling requires a new approach to the remodeling process, with more up-front planning and coordination to capture opportunities that are often missed in a conventional remodel. This includes expanding your list of objectives as well as the way you compare the price of products and services, by taking wide-angle and long-term views of decisions. It also means being willing to invest time and energy to find solutions that best fit your needs. And finally, it means approaching your remodeling project with health and safety at the forefront. This advance planning pays large dividends in terms of long-term satisfaction with your project and cost containment.

Decide What You Want

Compare different products and designs by evaluating roofing choices with an established set of criteria. Beyond basic affordability and physical requirements (factors such as slope and roof load capacity), consider these additional elements:

Health & Safety	Are materials non-toxic? Will they require toxic products for maintenance? Does the design and material choice reduce the potential for slips and other injuries during roof maintenance?
Reduced Maintenance	Will the material and design result in less work over time? Are products easy to clean without chemicals? Does the design discourage debris accumulation and leaks from wind-driven rain?
Durability	Do the products stand up to use over time? Are warranties long and comprehensive, covering materials <i>and</i> installation? Do the design and materials mesh with the era of your home?
Ecological Benefit	Do products protect water quality? Consider current and potential uses for roof rainwater such as landscape watering. Will the materials you're considering allow for this natural recycling? Do products reduce or avoid environmental harm during their production, use and disposal? Are they made from recycled, responsibly mined or harvested, renewable and/or local materials? Are the products themselves reusable or recyclable?

Let this guide serve as a starting point for your research. Remember, every decision you make regarding your roofing project can help improve your home's performance—for both you and the entire Puget Sound environment.



Expand Your Definition of *Cost*

Focus on long-term savings, ease of maintenance and conservation. Initial price gives just a peephole view of the true cost of a product or design. A higher purchase price may mean a better deal in the long run. For example, you can actually reduce the cost of living in your home by choosing resource-efficient materials and designs that lower monthly utility bills. Long-lasting products require less frequent replacement. A low purchase price may be simply a good deal, or it may signify a lack of quality or durability. Or it may mean that some environmental, health or social costs are not reflected on the price tag.

Lenders are beginning to recognize the value of ongoing savings to the homeowner. Mortgage Options for Resource Efficiency (MORE™) is a new program that lets you add up to \$4,000 to your mortgage for home improvements that save energy or water, such as increasing your attic's insulation. The savings from a more efficient home can cover and even exceed the incremental addition to your mortgage payment, meaning the improvements pay for themselves, and then some. See www.seattle.gov/light/conserve for information (*click on Loan Options*).

The price of roofing materials is only a portion of the total cost of a roof replacement. Factor in labor and the disposal of the old roofing, as well. By choosing a roofing product with a long life span (warranties of 40+ years), you can delay the next replacement—as well as disposal, material and labor costs. Divide the *installed price* of the material by the warranty length (in years) to better assess the lifetime cost of prospective roofing options. This will help you compare the cost of, say, a 50-year metal roof with “inexpensive” 15-year asphalt shingles. Also keep in mind that some roofing materials require more maintenance, so consider these costs when making your decision.

Professionals warn that—with roof replacement in particular—you get what you pay for when hiring a contractor. The lowest bid seldom proves the best deal, since the performance of a roof relies as heavily on quality installation as it does on quality materials. As with any service, research prospective roofers and compare installation warranties carefully. Start with friends and family who have had similar work done. Once you've identified potential contractors, ask for and follow up on references. Referral services also exist for roofing contractors. See the Washington State Attorney General's tips on hiring contractors: www.at.wa.gov/consumer/contractors.shtml.

Do Your Homework

Research helps you ask the right questions of retailers, your designer and/or contractor—or avoid costly mistakes if you are doing the work yourself. Finding green products can be a challenge. Start early to look for manufacturers that offer products you like. Keep a file of contact names and businesses, as well as magazine and newspaper clippings. Identify everything you'll need—down to roofing brands and style, underlayment, flashing options and gutter materials. This will help you determine cost and availability, while reducing the need for expensive, last-minute decisions. Find out how long special-order items take and factor this into your schedule. The Internet is a great place to start searching for products, but be aware of biased information sources. The line between sales pitch and fact can be quite blurry online.

Work that violates building codes may also breach the terms of your insurance policy, leaving you vulnerable to loss. So familiarize yourself with and follow local building codes, and save yourself the hassle and expense of having to tear something out later—which wastes precious resources, as well. Even if you don't have to remove a non-compliant element, the reason it doesn't comply is likely due to safety, health, or energy efficiency issues—all goals of a green remodel. If you have questions about permits in Seattle or whether a particular material or design complies with code, contact the Department of Planning and Development's Applicant Services Center at (206) 684-8850 and ask for a Permit Specialist.





a new roof?

*The Northwest EcoBuilding
Guild (www.ecobuilding.org)
is a resource for finding
professionals experienced in
designing and installing
alternative, environmentally
responsible roofing options.*



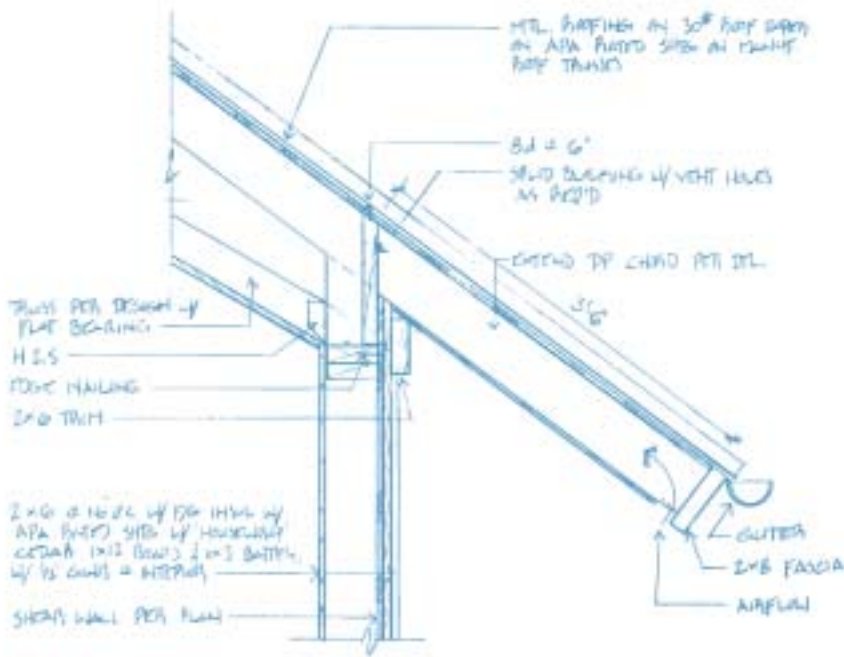
Make sure your roof needs replacing, rather than less costly repair or maintenance. Your roof should be inspected annually for signs of deterioration or damage. Inspections can be coordinated with regular roof and gutter cleaning. Keep in mind that roof surfaces damage easily (especially asphalt shingle in hot or cold weather), so minimize foot traffic. And always exercise extreme caution when on the roof or a ladder. Often roof inspections can be performed safely from the ground with a set of binoculars.

Consider both the visual inspection and age of your roof when determining whether it's time to replace or repair. Look in the attic for signs of moisture damage, and try to determine the source of leaks. Often, the culprit is failed or improperly installed flashing in especially vulnerable areas. These include:

- chimneys (especially wide chimneys and those with a lot of roof surface above),
- penetrations in the roof, such as skylights and roof vents,
- roof valleys, and areas where the roof changes slope,
- previously repaired areas,
- roof areas that concentrate drainage onto lower roofs, and
- areas where roofing meets another material.

Rule out these spot repairs before resorting to a complete tear-off. Visit the Housing and Urban Development web site at www.huduser.org/publications/destech/inspection.html to view the *Residential Rehabilitation Inspection Guide*; Chapter 2 includes a section on inspecting roofs of various slopes and materials.

Signs of a roof in need of replacement include curling shingles, broken tiles, asphalt shingles losing their granular layer, and excessive moss (which may indicate a degraded roof, or just a roof in need of cleaning). If you do need a new roof, prepare yourself by comparing the many options in advance.



roof anatomy

If you have a moderately or steeply sloped roof (at least four inches of rise for every foot of run), it probably consists of several layers of structural and protective materials. These layers work together as a system to shelter your home from the elements. Each plays a critical role in the ultimate performance of your roof, so carefully consider every component:

- sheathing,
- underlayment,
- flashing,
- roofing material, and
- gutters and downspouts.

Roofs with pitches of less than three inches of rise (height) for every foot of run (length) are generally considered low slope. Low slope roofs (often called *flat roofs*) are relatively uncommon on Seattle homes, but they're out there. The elements that make up this type of roof are distinct from moderate to steep sloped roofs. See page 9 of this guide for considerations related to low slope roofs.

Proper Installation: Key to a Lasting Roof

Whatever materials and design you choose, proper installation will ensure that your new roof lasts. Locate an installer that has gone through manufacturer training with the product you've selected, or at least can refer you to several past jobs using the same roofing. Ask for references and check them. Finding experienced installers can be challenging with some of the more unique roofing options, such as *green roofs* (see page 10). Look for applied experience, backed by both installer's and manufacturer's warranties. Most roofing manufacturers provide literature outlining step-by-step installation instructions. Ask your installer to show it to you and explain how he or she follows the directions. Manufacturer web sites often offer free downloads of installation literature.

Proper ventilation is crucial to the performance of a roofing system, and required by code, but is outside the scope of this guide. For best practices regarding roof ventilation, see Chapter 3 of the Washington State Energy Code Builder's Field Guide, available at www.energy.wsu.edu/code/







sheathing

Attached to the roof's framing, sheathing (also called the *roof deck*) creates a surface to stabilize framing members and secure roofing. In homes built prior to 1950, sheathing often consists of tongue-and-groove boards. Plywood or *oriented strand board* (OSB) is common in newer homes. Wood shakes are sometimes laid on top of regularly spaced boards called *skip sheathing*.

If your current sheathing is in good condition, consider leaving it in place. Roofing contractors often add a layer of plywood or OSB on top of a tongue-and-groove sheathed roof to create a uniform surface for applying roofing materials. Discuss the benefits of this additional layer with your contractor to make sure it's truly necessary. While it may make the installation easier for the contractor, it could add cost to your project and almost certainly wastes resources. If you do need to replace your sheathing, follow engineering requirements for sheathing thickness given the roofing material and rafter spacing of your roof.

sheathing choices

MATERIAL	DESCRIPTION/TIPS
Plywood 	<ul style="list-style-type: none">■ consists of multiple layers of wood veneer, stacked with the grain in alternating directions, then glued together■ use only exterior-grade panels labeled with EXTERIOR 1 or HUD APPROVED markings; phenolic resins make these impervious to moisture■ production requires medium-to-large diameter trees that often come from forests not responsibly managed; choose regionally-produced plywood with the FSC label to promote and increase market demand for sustainable forestry in the Pacific Northwest; for more on FSC certified wood products and how to find them, see sidebar on page 6.
Oriented Strand Board 	<ul style="list-style-type: none">■ also called OSB; made from wood wafers pressed and glued into panels; for increased strength and stability, wood fibers are oriented in various directions■ by using wafers instead of full sheets of veneer, OSB utilizes smaller diameter trees, as well as tree parts not useful for dimensional lumber or plywood applications—a more effective use of resources■ should not be confused with particleboard or MDF (medium density fiberboard); neither of which is appropriate for sheathing
Tongue-and-Groove 	<ul style="list-style-type: none">■ largely relegated to use for specific architectural styles like exposed-beam construction where boards serve as ceiling finish material; insulation is installed above the tongue-and-groove layer■ look for wood certified by the FSC as sustainable harvest—see sidebar on page 6 for information on FSC.
Paper Fiber 	<ul style="list-style-type: none">■ roof decking made from up to 100% waste paper■ primarily used in commercial applications, but also available for residential building■ check with a Permit Specialist at Seattle's Department of Planning and Development to ensure that the roofing you're considering meets building code requirements with these and other innovative sheathing options

underlayment and flashing

Acting as a second line of defense against moisture damage, roofing *underlayment* prevents any water that gets past the roofing and flashing from compromising the sheathing and causing leaks. For additional protection, *membranes* are often used beneath the underlayment in areas prone to leaks, such as valleys, and help seal holes created by roofing nails. The underlayment choice depends on your roof's pitch and other factors, but the standard is roofing felt (often called *tar paper* or *builder's paper*). Historically made from paper fibers saturated with asphalt, roofing felt today utilizes fiberglass to resist tears. The felt's thickness is measured in pounds per *square* (one square equals 100 square feet of roofing material); 15- and 30-pound felt are most common. Thirty-pound paper lasts longer and provides better leak protection. There are few alternatives to builder's paper for roofing underlayment. Look for recycled content. During installation, make sure your roof's sheathing is dry—the waterproof underlayment can trap moisture and damage sheathing.

Breather membranes are uncoated spun-bonded polypropylene multiple ply barriers that perform especially well for metal, tile and wood shake roofs. Allowing potentially troublesome moisture to escape, they resist tears and are even strong enough to be used as temporary roofing.

Flashing and Drip Edges

Another important barrier to leaky roofs is flashing. Placed in valleys and wherever chimneys, ventilation or skylights penetrate the roof, these bent metal pieces form a watertight barrier spanning unlike materials or other vulnerable areas. You can sometimes reuse existing flashing if it's in good condition; old galvanized flashing can be recycled. New flashing is usually made from galvanized steel, and less often from copper or lead—all of which are harmful to water quality and human health. Additionally, lead and copper production processes cause significant pollution. For durable flashing that does not compromise environmental or human safety, consider *powder-coated* aluminum or steel, or stainless steel flashing. Although more difficult to install than galvanized, stainless steel flashing lasts much longer, and is both reusable and recyclable.

Drip edges are installed along the roof's perimeter to keep water from tracking under the eaves where it can damage the roof and siding. All roofing systems should include some sort of drip edge component. The material choices are similar to flashing, with aluminum being the most readily available and ecologically-friendly option. One fairly new innovation involves products that combine a drip edge with roof ventilation. Available in plastic and rolled aluminum, they pair with a ridge vent to provide necessary airflow, while guiding water into gutters.

Our forests make Washington the Evergreen State. We can help ensure this remains the case by purchasing wood products that are responsibly grown and harvested. The Forest Stewardship Council (FSC) is an independent organization that develops standards for responsible forestry practices. Wood products stamped with the FSC logo meet rigorous standards for environmental and social performance. Purchasing FSC certified products sends a message that you care about the sustainability of our forests.

Find out more: www.cwpa.info.





roofing choices

MATERIAL

INSTALLED COST/DESCRIPTION/TIPS

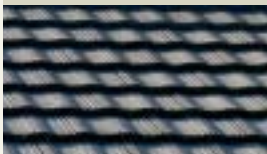
Asphalt Shingle



\$40-\$150 per square Standard three-tab asphalt shingles are 12" x 36" units, cut to look like three individual shingles when installed. They're made from asphalt-soaked fiber topped with a layer of mineral granules. Available in a wide variety of colors, styles and grades, they are appropriate for moderate- to steep- sloped roofs. Fiberglass mats have replaced wood fiber felts.

Tips: Look for longer (at least 30-year) warranties on asphalt shingle roofing. Avoid products containing built-in moss inhibitors as many contain zinc, copper and other toxins that harm aquatic life, and may render water unusable for landscape or other rainwater harvest applications. Opt for manufacturers that offer up to 25% recycled content. Select light-colored mineral top layers; dark asphalt roofs create additional unwanted heat gain during summer months, and shingles subjected to wide temperature swings don't last as long.

Concrete Tile



\$150-\$250 per square Made from Portland cement and sand/aggregate, these tiles resemble clay tile. Although they require a large amount of energy to produce, concrete tiles offer a long life expectancy and require minimal maintenance-both key environmental benefits. A heavy roofing choice (800-1,200 lbs. per square), concrete tile may require structural reinforcement.

Tips: Look for product warranties of 50+ years. If the weight of standard concrete tiles is a limiting factor, lighter-weight versions are also available. Professional installation is especially important with concrete tile; choose roofers with demonstrated experience.

Fiber Cement



\$250-\$300 per square Made to look like slate or shingle, fiber cement consists of Portland cement and a cellulose fiber product added for reinforcement and to reduce weight. These products tend to weigh between 300-600 lbs. per square.

Tips: Research carefully. Various complaints have been raised about these products' performance over time, especially in regions with extreme temperature variations. Inquire about any warranty limitations. Look for recycled content fiber.

Wood Shake



\$200-\$300 per square Most shakes are made from naturally rot-resistant species of wood, such as cedar. From a water-quality perspective, wood shakes not treated with preservatives and moss inhibitors perform well; most include these additives, however. If properly installed and maintained, wood shakes can last 30+ years. One of the few locally produced roofing choices, wood shake roofs fit with the style of many Seattle houses. They're also a renewable resource.

Tips: Look for wood shakes from environmentally responsible harvest, including FSC-certified products (see sidebar, page 6), made from storm-damaged trees, and trunks left over from previous eras of timber harvest. Such wood naturally resists rot better than more commonly available second-growth material. Wood shakes can be a challenge to maintain in our area. Use stainless steel nails for wood shake installation.

Recycled Content



\$300-\$600 per square Description: Recycled-content (up to 100%) wood shake and slate alternatives are available, made from various materials such as recycled plastic and cellulose fibers, tires, and industrial rubber.

Tips: Inquire about these products' suitability for rainwater harvest; not all have been tested for water-quality impact. Different products vary in recycled content; find out specifics from the manufacturer or retailer. Given the incredible durability of these products, use high-quality stainless steel fasteners for roof attachment. Look for long warranties up to 75 years.

roofing materials

The top layer in the assembly, your roofing material not only determines the appearance of your roof, but its longevity and maintenance requirements. The roofing product you select also affects water quality, as well as your home's heating and cooling abilities. The load capacity and pitch of your roof will partially determine what type of material you can use. Roofing material weights vary widely. Consult a structural engineer if you have any questions regarding the load capacity of your roof. As for fire safety, roofing materials must meet a *Class C* fire rating or better in Seattle. Unless otherwise noted, the following roofing choices apply to medium- to steep-sloped roofs (4 or more inches of rise for every foot of run), which make up the vast majority of Seattle rooflines. Low-sloped roofs (less than 3 inches of rise for every foot of run) are good candidates for *green roofs* (page 10). Avoid copper and zinc-coated roofing materials. Copper production is energy-intensive and extremely polluting. Additionally, copper leaches from roofs, eventually finding its way into creeks, lakes and the Puget Sound—where it is toxic to aquatic life. It also renders rainwater unsuitable for landscape uses. Galvanized steel's protective zinc layer helps prevent rusting by continuously releasing zinc from its surface, where it is carried away by rain. Like copper, zinc is toxic to aquatic life.

MATERIAL

INSTALLED COST/DESCRIPTION/TIPS

Steel



\$80-\$350+ per square Steel roofing is coated to avoid rust. Coatings include paints and powder-coat finishes. *Aluminized steel* is also used, the result of a process similar to galvanizing in which aluminum is applied to steel sheet to form a protective layer. Care must be taken to maintain the aluminum finish; scratches that reach the steel surface will rust.

Tips: Look for finishes with warranties against fading, chipping and chalking. Powder coat finishes emit virtually no air pollution compared to wet-applied metal finishes. Also, order factory-cut and finished roofing as field-cut products tend to rust where unfinished ends are exposed to the elements; it performs better from a water-quality perspective, too. Opt for steel products with over 50% recycled content. Look for roofing with *hidden* or *clip* fasteners designed to avoid direct exposure to the elements.

Aluminum



\$250-\$300 per square A lightweight option, aluminum roofing usually comes pressed into shake, shingle, tile or slate-like forms, then coated or painted in various colors. Aluminum production consumes large amounts of power, but this roofing material's durability reduces some of the environmental burden.

Tips: Choose products with high recycled content. Aluminum shingles are available with nearly 100% recycled content (80% post-consumer), with high-quality baked-on resin finishes meeting National Sanitation Foundation (NSF) standards for rainwater harvest. One product was tested by the Florida Solar Energy Center and shown to reduce attic heat gain by up to 34% compared to composition roofing materials. Look for products with an anodized finish (oxidized aluminum forms a protective layer that is integrally bonded to the metal); this is environmentally preferable to other coating options.

Clay Tile (Terra Cotta)



\$400-\$500+ per square Because they tend to outlast the buildings they're protecting, clay tiles may be reused, depending on how they were installed. Manufacturing involves extruding wet clay in various shapes, then kiln firing. Considered the best roofing from a water quality perspective, clay tile is heavy and often requires structural reinforcement.

Tips: Look for salvaged clay tiles — searching online using "salvaged tile roof" and similar terms will result in multiple companies that specialize in reselling vintage roof tiles. If buying new, look for long warranties up to 75 or even 100 years. At 600-900 lbs. per square, your roof may need structural changes to support this roofing choice.

Slate



\$900-\$1,200+ per square One of the most water-quality-friendly roof choices, slate is also very expensive but lasts a long time; 100-year limited warranties are not uncommon. Popular in Seattle for educational institutions and high-end residential projects, slate can be used for residential applications, as well (see the Commander's house at the Ballard Locks). Slate goes from quarry to roof with minimal processing—an environmental strength. However, consider transport costs because most slate comes from the northeast United States or from abroad. A heavy roofing option (700-900 pounds per square), slate roofs may require structural reinforcement.

Tips: Several companies across the country sell salvaged and antique slate tiles. Search on line for services using terms such as salvage, slate, tile, and antique.

low slope roofs

Roofs less than 4 inches of rise for every foot of run are generally categorized as *low slope* roofs. These roofs are notoriously leaky, and replacing them usually generates a tremendous amount of waste. They're also costly to repair.

Metal

Metal is likely the most environmentally benign low slope roofing choice due to its recycled content, recyclable nature, and long service life (warranties of up to 50 years are available on some products). Metal roofing can be installed on roofs at slopes as low as $\frac{1}{2}$ inch per foot, although some experts claim a more appropriate minimum slope is 2 inches per foot. Steel is the only low-slope roofing option that is fully recyclable.

Tips: Look for *powder coated* steel products. This painting process is efficient and does not result in air pollution during production. It is also friendly to water quality. Avoid roofing products that have exposed galvanized elements: the zinc in these products can harm aquatic life. Have metal roofing cut to size at the fabrication plant rather than on site: this will reduce waste.

Built Up

Overlapping layers of roofing felt (tarpaper) are coated with asphalt (a byproduct of petroleum processing) or coal tar (a byproduct of coal refining). A service life of 20 years is common. Asphalt and coal tar are both non-renewable products.

Tips: Coal tar roofing pitch has self-healing properties due to its quality of being semi-liquid at temperatures above 60 degrees Fahrenheit. This also limits it to application on very flat roofs (less than $\frac{1}{4}$ inch rise per foot of run). Asphalt roofing has different formulations that allow it to be installed on roofs with up to a 3-in-12 slope.

Membrane

Bituminous membranes combine bitumen (coal tar pitch or asphalt) for adhesive and waterproofing qualities with plastic and synthetic rubber sheet. Polymeric membranes include PVC (polyvinyl chloride), TPO (thermoplastic polyolefin) and EPDM (ethylene propylene diene monomer). Roofing membrane products often contain chlorine (usually in the form of PVC which is 50% chlorine by weight) or a fire retardant such as bromine. In a fire, chlorine-containing products can produce dangerous toxins like hydrochloric acid and dioxin. Bromine and other *halogenated fire retardants* destroy the earth's protective ozone layer.

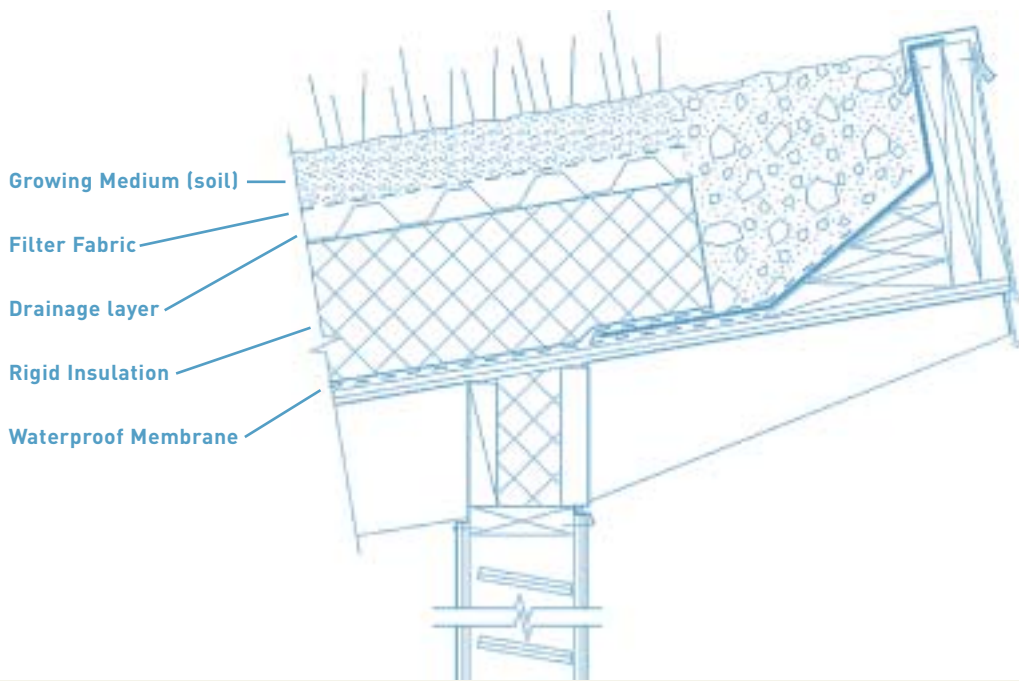
Tips: TPO is considered the most environmentally benign roofing membrane. TPO membranes are relatively new to the marketplace and concerns have been raised as to their durability. Be sure to research options carefully and evaluate warranties. Since membrane roofs consist of a single layer of material, damage to the membrane is very likely to result in leaks. Look for non-halogenated fire-retardant products that meet fire code requirements. Consider a *green roof* (see page 10) on top of a membrane roof for increased durability and environmental benefits.

Roll

Roll roofing is asphalt saturated roofing felt with a surface layer of granules. Roll roofing is applied in overlapping layers.

Tips: Pay particular attention to seams during installation: this is the most common point of failure with this roofing product. Recycle old roll roofing at asphalt shingle recycling facilities: find roofing recyclers in the Recycling Database (look under Construction, Demolition, and Landclearing), at www.resourceventure.org.





green roofs

Conventional roofs may do a good job of keeping your house dry, but their environmental consequences prove less beneficial. Hard surfaces increase the amount of rainwater entering our storm water system, which damages local creek habitat and adds pollutants to Lake Washington and Puget Sound. In some Seattle areas, downspouts connect directly to the sewer system, resulting in the periodic release of untreated sewage into our local waters during storms. On hot sunny days, roofing materials collect heat, increasing temperatures both inside your home and outside.

Green roofs (also known as *eco-roofs* or *living roofs*) help reduce the negative side effects of conventional roofing, while adding green space to your property. They consist of various roofing layers topped with a soil-like growing medium and plants chosen for their ability to withstand a roof's extreme conditions. Seattle's downtown Justice Center and City Hall feature green roofs. Residential-scale versions usually have a much thinner layer of growing medium than their commercial cousins, with low-growing plants from the succulent family and other rock-garden-friendly varieties.

Green roofs offer a range of benefits for both your home and the environment, including:

- acting as an additional insulating layer to reduce unwanted summer heat gain and winter heat loss
- capturing, filtering and slowing roof runoff
- extending the life of the roof itself by protecting the waterproof membrane at its foundation from sunlight or puncture damage

Low-pitched roofs (at least one inch of rise for every foot of run, to facilitate drainage) are best suited to green roof applications, but the Northwest EcoBuilding Guild's Green Roof Project has experimented with various roof pitches. The Green Roof Project estimates the cost of a green roof at approximately twice per square foot of a quality metal roof, but this can vary with roof design and the owner's willingness to contribute labor. Although more expensive up-front than conventional roofing, the extended life span of a green roof makes it cost-competitive over the long term. To learn more, see the Northwest EcoBuilding Guild's web site at www.ecobuilding.org/proj/ecorooft.

Drawing: Robert Harrison Architects

*Photo top right, middle right, bottom: Jon Alexander.
Photo middle left: Geoff Belau and Lauren Woodward.*





gutters and downspouts

Effective green gutters must be durable, watertight and water-quality-friendly. Unfortunately, two popular products release toxins into storm water. Unpainted galvanized gutters leach zinc into rainwater; they also rust over time. (Recycle old galvanized gutters, downspouts and flashing at Seattle's North and South Recycling and Disposal Stations.) Another common gutter and downspout choice, PVC (polyvinyl chloride) contains additives to increase its flexibility that can also leach into rainwater and harm fish. Over 50% chlorine by weight, PVC forms dioxins—very potent and persistent toxins—when it is burned improperly.

Aluminum. Longer-lasting than galvanized products, painted aluminum gutters make a better choice for maintaining water quality. Look for seamless aluminum products from services that fabricate gutters on-site to the dimensions of your home, reducing the likelihood of leaks. Factory-applied, baked-on (often called *powder-coated*) finishes prove more durable than sprayed finishes, and create less pollution during manufacturing.

Gutters should be installed at a slight slope toward downspouts to allow for complete drainage after rain. Standing water can shorten the life of your gutter system, and can also breed mosquitoes. Look for designs that minimize clogging by leaves and debris, or consider installing leaf guard systems in existing gutters. Check your gutters regularly and clear them of debris. Blocked gutters can also breed mosquitoes, and even damage roofing or siding.

If your existing gutters are in good condition, consider reusing them. Roofing contractors don't usually include gutter replacement in their bids, but make sure they clean your gutters of any debris generated during the roofing process.





roof decks

If your home boasts a low slope roof with sufficient structural support or a dormer that can accommodate it, consider a roof deck or balcony as a way to gain territorial views and additional outdoor living space. Roof decks can have open railings extending four feet above the maximum building height. Adding a roof deck in Seattle requires a building permit; discuss structural and permitting requirements with a Permit Specialist at Seattle's Department of Planning and Development by calling (206) 684-8850.

Roof decks offer opportunities to introduce green elements beyond simply the plants themselves, including decking from sources certified as responsibly grown and harvested by the Forest Stewardship Council (see sidebar, page 6 for more on FSC certified wood) or products made with recycled plastic. The durability of recycled plastic decking products is an added bonus on roofs, where extreme weather can considerably shorten the life span of other products.

Those extreme weather conditions also require careful plant selection for roof gardens. Only certain plants are up to the task of roof living. For plant selection tips for rooftop gardens, see Chapter 5 of *Big Ideas for Northwest Small Gardens* by Marty Wingate (Sasquatch Books, 2003).



reuse & recycling

Tearing off a roof generates a lot of waste. But this material doesn't have to be destined for the landfill. Depending on the materials, they can be recycled, and sometimes even reused. Have your contractor contact the Resource Venture at Seattle's Chamber of Commerce for free information, advice, and referrals related to roofing material recycling. The Resource Venture is on the web at www.resourceventure.org and staffs an information hotline at (206) 389-7304.

ASPHALT SHINGLES

Experts estimate that asphalt composition shingles claim nearly 90% of the roofing market. According to the Environmental Protection Agency, between 7 and 10 million tons of asphalt roofing end up in U.S. landfills each year. In Seattle, we're lucky to have a more environmentally friendly alternative: grinding and mixing asphalt roofing products into asphalt paving. When replacing an old asphalt roof, select a contractor that regularly brings old shingles to a recycling facility rather than disposing of them as waste.

Although recycling asphalt shingles into road materials is better than burdening our landfills, it's still *downcycling*, or reusing materials to make a less valuable product.

METAL

If old metal roofing is still in good condition, building materials salvage companies can sell it for reuse—even small amounts come in handy for garden sheds and outbuilding projects. Find building salvage companies in the phone book under *Building Materials - Used*.

Metal flashing can also be recycled, and reused if in good condition. The key to successful reuse is careful dismantling and removal. If used materials retailers aren't interested in your materials, try listing them on King County's Reusable Building Materials Exchange at www.2good2toss.com. It's free to list and browse for all sorts of building materials.

TILES AND SLATE

Other high-end roofing products like terra cotta, Spanish tile and slate are candidates for reuse, as well. In fact, there's an active national market for buying and selling vintage tile and slate roofs. Search the Internet by using terms such as *salvage, slate, tile, and roofing*.

WOOD SHEATHING

As mentioned earlier, if your roof's sheathing is in good condition, consider reusing it. Preventing waste in the first place is better, and cheaper, than recycling. If your old tongue-and-groove sheathing is going to be removed, investigate whether it could be sold or donated to local building materials salvage companies. Often this material is from old-growth Northwest timber, and can be re-milled into beautiful interior trim or even flooring. Find building salvage companies in the phone book under *Building Materials - Used*.



solar

Solar power in Seattle? Our cloudy days may make this sound like an unlikely option, but there are plenty of reasons to consider solar power for your roof. Seattle gets most of its power from hydroelectric sources, which are plentiful in the fall, winter and spring. But our region's electric demand can outstrip hydro supplies in the summer months, requiring Seattle to supplement its electricity supply with non-renewable and polluting sources such as natural gas and coal. By installing a solar electric, also known as *photovoltaic* (PV) array on your home, you can reduce demand for city-supplied power. With a PV system, you can also take advantage of *net metering*, a law that requires your electricity provider to purchase back any surplus power your system creates at full retail value. For information on Seattle City Light's Net Metering Program, see www.seattle.gov/light/solar.

Cost is usually the main deterrent to installing a PV system. With current electricity prices, payback is long—usually 20+ years. Rolling the cost of a system into your mortgage with a home improvement loan is one popular option. By selecting a system that doubles as roofing material, you may also reduce the overall system cost, if timed with a roof replacement. Current products include solar electric shingles similar in appearance to three-tab asphalt shingles, as well as thin, flexible rectangular panels designed to fit in the pan section of standing-seam metal roofing.

Solar hot water systems provide another eco-friendly option for your home, and can be installed together with PV. Designs vary, but the principle remains the same: systems use the sun to heat water for home use. Designs have advanced in recent years; they now resemble solar electric panels and can be unobtrusively placed on various roof styles. Solar hot water systems provide a much quicker payback than PV—often less than 10 years—helping to heat water for home use even on cloudy days.

You can also save on the cost of a system by purchasing it through Western SUN. This regional network of utilities, public utility districts and electric cooperatives provides solar electric and solar hot water systems wholesale to the consumer, without sales tax. For more information, see www.westernsun.org.

If you're not willing or able to commit to solar with your upcoming roof replacement, you can still support the development of solar in Seattle by signing up for City Light's Seattle *Green Power* program. See www.seattle.gov/light.green for more information (click on *Green Power*).

Additional Seattle solar resources include:

- For information, including technical assistance, on solar technology, contact the Northwest Solar Center, a program of WSU Energy, at (206) 396-8446.
- *Solar electric systems for homes in single family zones* (CAM #420) a customer assistance memo by the Seattle Department of Planning and Development provides information about permitting and installing solar electric systems in Seattle. Available online at www.seattle.gov/dpd/camlist/camlist.asp





rainwater harvest

We spend so much time getting water away from our homes that we often fail to see rain as a valuable asset—delivered right to us for free. Excessive amounts of rainwater diverted into storm or sewer systems can damage local creeks, cause flooding, and impair water quality. But what if you could to use that water to benefit your home or garden? You can—in a multitude of ways.

Roof rainwater can be stored for later use outdoors in the yard. Rain barrels are popular, but their small size makes them more educational than instrumental in minimizing your city-supplied water use. This is especially true in July through September, when weeks without rain mean your rain barrel doesn't refill. See the Seattle Public Utilities web page at www.seattle.gov/util/rainbarrel/ for a list of retailers and use instructions, plus links to other rain barrel sources.

Cisterns store from several hundred to thousands of gallons of water, enough to significantly reduce or even eliminate the need to use municipal water for landscape purposes, especially when combined with the use of water-wise plants. Cisterns can offer the added benefit of helping regulate storm water runoff during the winter months, when landscape water isn't needed. By incorporating a valve in the base of the tank, rainwater captured during the winter can slowly and safely drain from the tank over time. To store water for summer use, simply close the valve. *The Texas Guide to Rainwater Harvest* provides an excellent overview of all aspects of rainwater harvest and storage: www.twdb.state.tx.us/publications/reports/RainHarv.pdf.

You can also put that roof water directly to use in your yard with a rain garden. These landscape elements feature plants that thrive in wet conditions coupled with soils that allow safe ground percolation. Rain gardens must be carefully designed and located to avoid flooding and causing damage to your home or neighboring properties. For an overview, see <http://clean-water.uwex.edu/pubs/raingarden/>. Classes on rain gardens are occasionally offered through Seattle Parks & Recreation; for information, call (206) 684-0877.

Homeowners in Portland, Oregon created their own mini water treatment plant, using captured rainwater for drinking and other indoor uses. Although this application is not currently allowable by code in King County, you may want to design your roof to accommodate this use in the future. *The National Sanitation Foundation* (NSF) maintains a list of roofing materials approved for drinking purposes at www.nsfconsumer.org/environment/rainwater.asp.



resources

Print

- *The Green Building Handbook vol. 2: A Companion Guide to Building Products and their Impact on the Environment* edited by Tom Wooley (E & FN Spon, 2000). Includes a chapter on roofing materials.
- *Roofing: The Best of Fine Homebuilding* (Taunton Press). Articles on roofing, from slate to sod.

Online

The Internet is a great place to research green remodeling topics. Try search terms such as: *residential green building, green building materials, healthy building, energy conservation, water conservation* and *sustainable building*.

Home Energy magazine's article "Seeking Green Building on the Internet" is a great overview of the resources available on the Web for green building information.

Seattle Public Utilities maintains a website to complement the Green Home Remodeling series. The site includes an extensive list of links to additional information on green remodeling in general in the following topics:

- Appliances and Fixtures
- Certified Wood
- Energy and Water Efficiency
- Indoor Air Quality
- Materials Selection and Use
- Paints and Finishes
- Recycling and Reuse
- Remodeling Hazards (Asbestos, Lead, and Formaldehyde)
- Toxics Reduction, and
- Universal Design

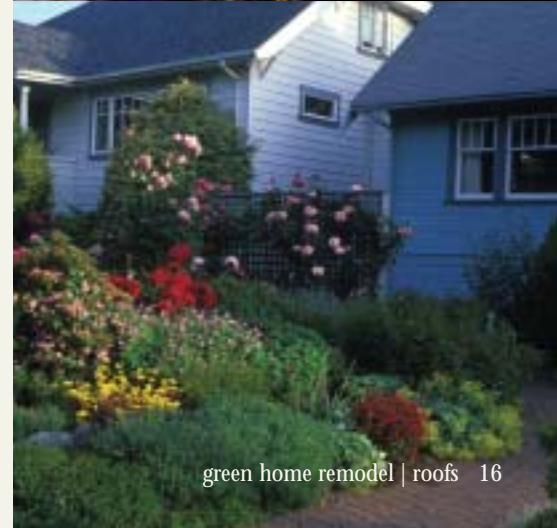
Find these resources and other guides in the Green Home Remodel series at www.seattle.gov/sustainablebuilding (click on *Green Home Remodel*). Or call Seattle Public Utilities' Sustainable Building Program at (206) 615-0731 to receive a print version of the resource list or other brochures in this series.



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For TTY assistance, please call (206) 233-7241. This information can be made available on request to accommodate people with disabilities and those who need language assistance.

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