

US EPA ARCHIVE DOCUMENT

# Tabor Commons Green Jobs Training Program

The U.S. Environmental Protection Agency selected the Tabor Commons site and the Oregon Tradeswomen as one of the brownfields sustainability pilot projects. Working under contract with SRA International, ICMA coordinated the development of a green jobs training curriculum. The training curriculum is designed to inform entry level tradeswomen about the green job opportunities in areas such as deconstruction, weatherization, eco or solar roofing, stormwater systems and more. This curriculum is the result of the work conducted largely by Flying Hammer Productions—a green building and green jobs consulting organization, with support from the Oregon Tradeswomen. For more information on this effort, contact Tad McGalliard, Director of Sustainability, ICMA (202/962-3563 or [tmcgalliard@icma.org](mailto:tmcgalliard@icma.org)).

The logo for ICMA, consisting of the letters "ICMA" in a bold, blue, sans-serif font.

*Leaders at the Core of Better Communities*

Flying Hammer Productions

<http://www.theflyinghammer.com>

Oregon Tradeswomen, Inc.

<http://www.tradeswomen.net>

# Green Jobs

Introduction to Green Building  
and green jobs



# What is Green Building?

- **Green Building** is an approach to construction that focuses on energy efficiency, resource conservation for the life cycle of a building and has positive benefits both ecologically and socially.

# Energy Efficiency

- Energy efficiency is using less energy to provide the same level of energy service. Efficient energy use is achieved primarily by means of a more efficient technology or process rather than by changes in individual behavior. Energy efficiency can also be achieved via the design of a project.

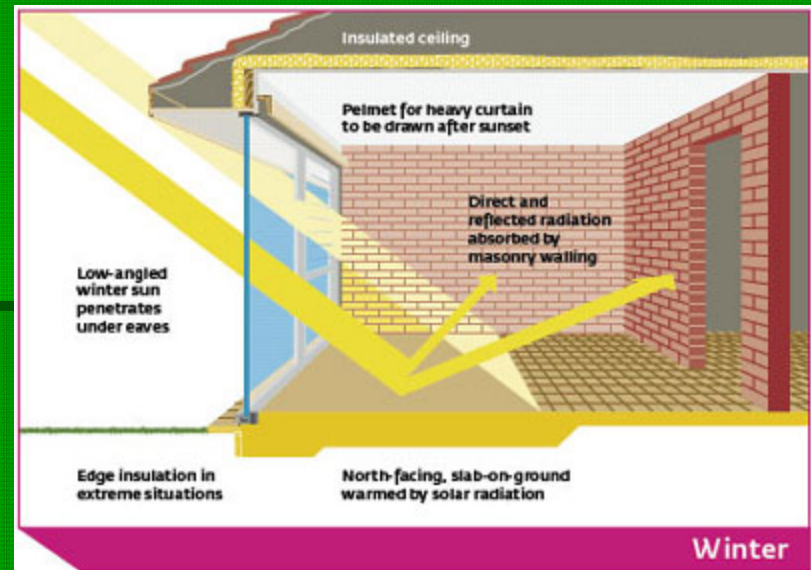
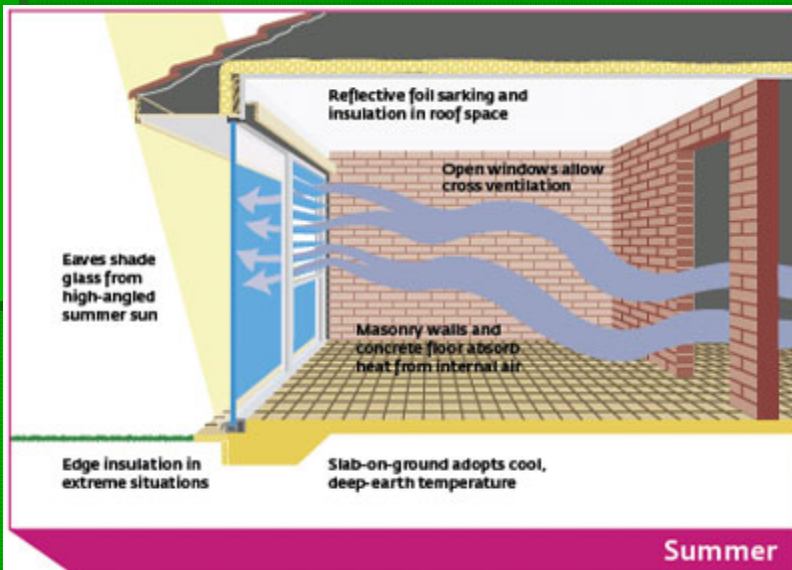
# Examples of energy efficiency

- Insulating a home so that less heating and cooling energy is required to achieve the same temperature
- Installing fluorescent lights or use of natural lighting fixtures (such as skylights, solar tubes, etc.) in place of incandescent lights to attain the same level of illumination.



# Passive solar

- Building design and orientation can greatly effect its efficiency



# Natural Resource Conservation

- The management of natural resources (land, water, soil, plants and animals) with a particular focus on how the management or uses of those resources affects the quality of life for both present and future generations.
- Using lumber that has been certified by the Forest Stewardship Council is one example of resource conservation. By not using lumber from unsustainable harvesting practices. Using materials that have a high recycled content, are re-useable or biodegradable are all ways to practice resource conservation.

# Natural Resource Conservation

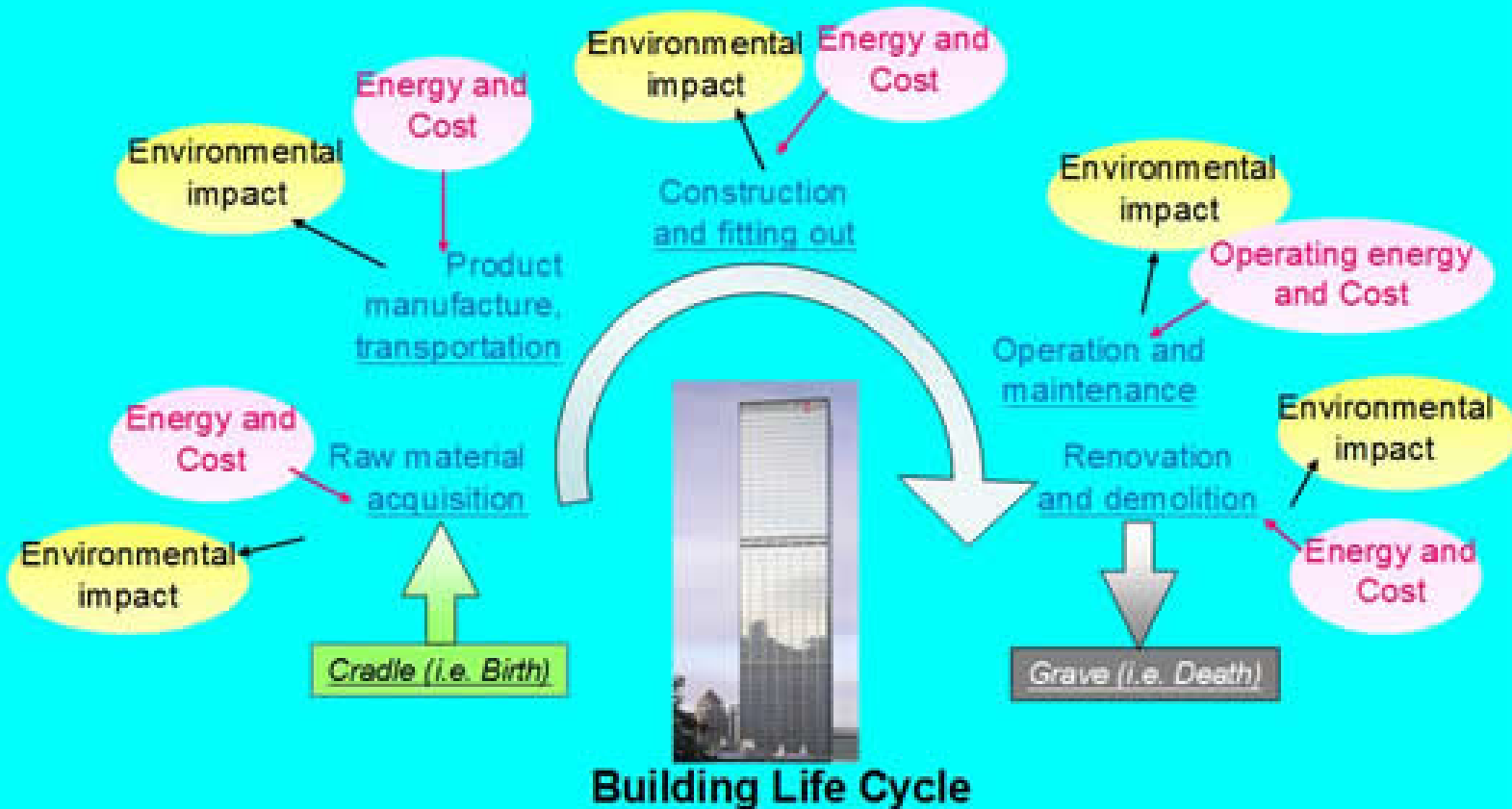


# Building Life Cycle

- Refers to the environmental impacts of the building from the production of the products that go into its construction, its performance and maintenance while in use and what happens to the building and its parts once it is no longer in use.

# Building Life Cycle

Impacts incurred by a building throughout its life cycle



# Positive Social and Human Impact

- This refers to the positive systemic impacts of green building on the people who process and work with the materials to the people who work or live in green buildings to the greater social implications of a healthier society. This includes building with indoor air quality in mind, using materials that are non or less toxic throughout their whole life cycle, improving water quality via conservation, grey water reuse, storm water management etc.
- Building green encourages a broad spectrum approach to construction. In stead of just looking at construction via the 'bottom line' (how much a project costs or profit to be made) it looks at it through a much broader lens referred to as the 'triple bottom line' (people, planet, profit) which expresses an expanded spectrum of criteria for measuring success: environmental/ecological and social and economic.

# Positive Social and Human Impact



# Why Build Green?



# Why is Green Building Important?

- Less embodied energy
- Healthier workers
- Healthier spaces
- Creates more jobs (example: deconstruction, recycling, and reuse) + niche markets and alternative economies
- More sustainable future
- Less reliance on fossil fuels and more energy independent structures
- Less reliant on virgin materials and finite resources
- Creates a sense of connection and pride in work
- Less greenhouse gasses
- Helps support more stable local economies
- Provides materials for future generations
- Longer term employment via jobs where resources are better managed
- Same sustainable building philosophies applied to work environment as are applied to resource management: healthy happy long term employment

# Green Building Umbrella

Green Building

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graph TD; GB[Green Building] --- HTM[High tech materials]; GB --- RM[Reclaimed materials]; GB --- NM[Natural materials];
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High tech materials

Reclaimed materials

Natural materials

# Green Building Umbrella



High tech materials



Reclaimed materials



Natural materials

# U.S.G.B.C.

## United States Green Building Council

- The **U.S. Green Building Council** is a 501(c)(3) non-profit community of leaders working to make green buildings available to everyone within a generation.
- In the United States alone, buildings account for:
  - 72% of electricity consumption,
  - 39% of energy use,
  - 38% of all carbon dioxide (CO<sub>2</sub>) emissions,
  - 40% of raw materials use,
  - 30% of waste output (136 million tons annually), and
  - 14% of potable water consumption.

# LEED

## Leadership in Energy and Environmental Design

- Construction activity pollution prevention
- Site selection
- Development density
- Brownfield redevelopment
- Alternative transportation
- Restoring habitat
- Stormwater design
- Heat island effect
- Light pollution reduction
- Water efficient landscaping
- Innovative waste water technologies
- Water use reduction
- Minimum energy performance
- Refrigerant management
- Onsite renewable energy
- Green power
- Recycled content
- Certified wood
- Material reuse
- Regional materials
- Ventilation
- Low-Emitting Materials
- Indoor chemical pollutant control
- Thermal comfort
- Daylight and views

# Earth Advantage

- At minimum, an Earth Advantage® home is designed to improve energy efficiency by 15 percent over a conventionally built home. The incorporation of products such as energy-efficient windows, appliances, mechanical systems and light fixtures can add up to lower energy usage and greater comfort year round.



# Energy Star



- ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy helping consumers save money and protect the environment through energy efficient products and practices.

# Net-Zero Energy Home

- A net-zero energy house is designed to produce as much energy as it consumes on an annual basis.



# Living Building Challenge

- generate all of its own energy with renewable resources
- capture and treats all of its water on site
- use resources efficiently and for maximum beauty



# Types of Green Building Techniques

- Smart Framing
- ICFs
- Formaldehyde free materials
- No VOC materials (Volatile Organic Compounds)
- Recycled materials (Trex, gluelams, blue jean insulation)
- High efficiency windows
- Tight thermal envelope
- Recyclable materials
- Energy efficient heating and cooling systems
- Reclaimed materials

# What assumptions does Green Building make?

Humans play an important role in the health of the planet.

Finite resources are worth using wisely.

Sustainability is an achievable goal.

Environmental health is an important part of economic health.

# Green Collar Jobs

- What are Green Collar Jobs?
- Pays decent wages and benefits that can support a family
- Inclusive and diverse workforce
- Provides upward mobility
- Reduces waste and pollution
- Benefits the environment
- Meets the triple “bottom line” of People, Planet and Profit

# GREEN JOBS:

## Green Building

- An approach to construction that focuses on energy efficiency, resource conservation for the life cycle of a building, and ideally has positive benefits both ecologically and socially

# Green Remediation

Using earth friendly technologies to repair and reduces damages to an area or building from toxic practices

*Examples:*

*Lead Abatement*

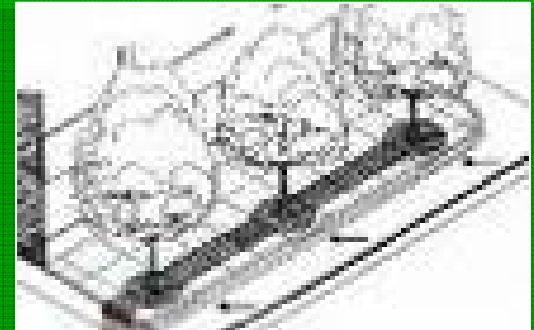
*Brownfields Remediation and Revitalization*

# Deconstruction

- Deconstruction is an alternative to the commonly practiced demolition of buildings by carefully removing reusable materials from a no longer needed building and making them available for reuse.
- The Rebuilding Center, Portland, OR
- Lovette Deconstruction, Portland, OR
- Urban Ore, Oakland, CA

# Stormwater Management

- The management of stormwater runoff, often using water retention facilities, to provide controlled release into receiving streams



# Eco-Roofs

- A green roof, or eco-roof, is a living, breathing vegetated roof system that provides a sustainable alternative to conventional roofing. An eco-roof is a lightweight system of soil and vegetation designed to be as self-sustaining as possible. A successful eco-roof is synergetic. It not only manages stormwater by slowing the run off via slow draining soil, it calms what is known as 'heat island effect' provides habitat and beauty, lasts a long time and aids in insulating a building.



# Solar Roofing

- Solar roofing refers to using the sun's energy that strikes the roof of a structure for generation of electricity, heating water or passively heating or cooling a building via a variety of technologies: photovoltaic, solar thermal and passive solar design.



# Weatherization

- Weatherization is the modifying of a building to reduce energy consumption and optimize energy efficiency.
- Examples: Insulating, replacing windows, fixing air leaks, upgrading heating and cooling systems

# Case Study: Tabor Commons

- Brownfields remediation
- Deconstruction
- Green building
- Passive solar

# Deconstruction and Materials Reuse



# What is deconstruction?



- Deconstruction is the dismantling of a structure into components that can be reused or recycled. Deconstruction is a viable alternative to demolition.

# What is demolition?

- Demolition is the removal of a structure by crushing it and hauling away the debris for burial at a landfill.



# Reduce, Reuse and Recycle

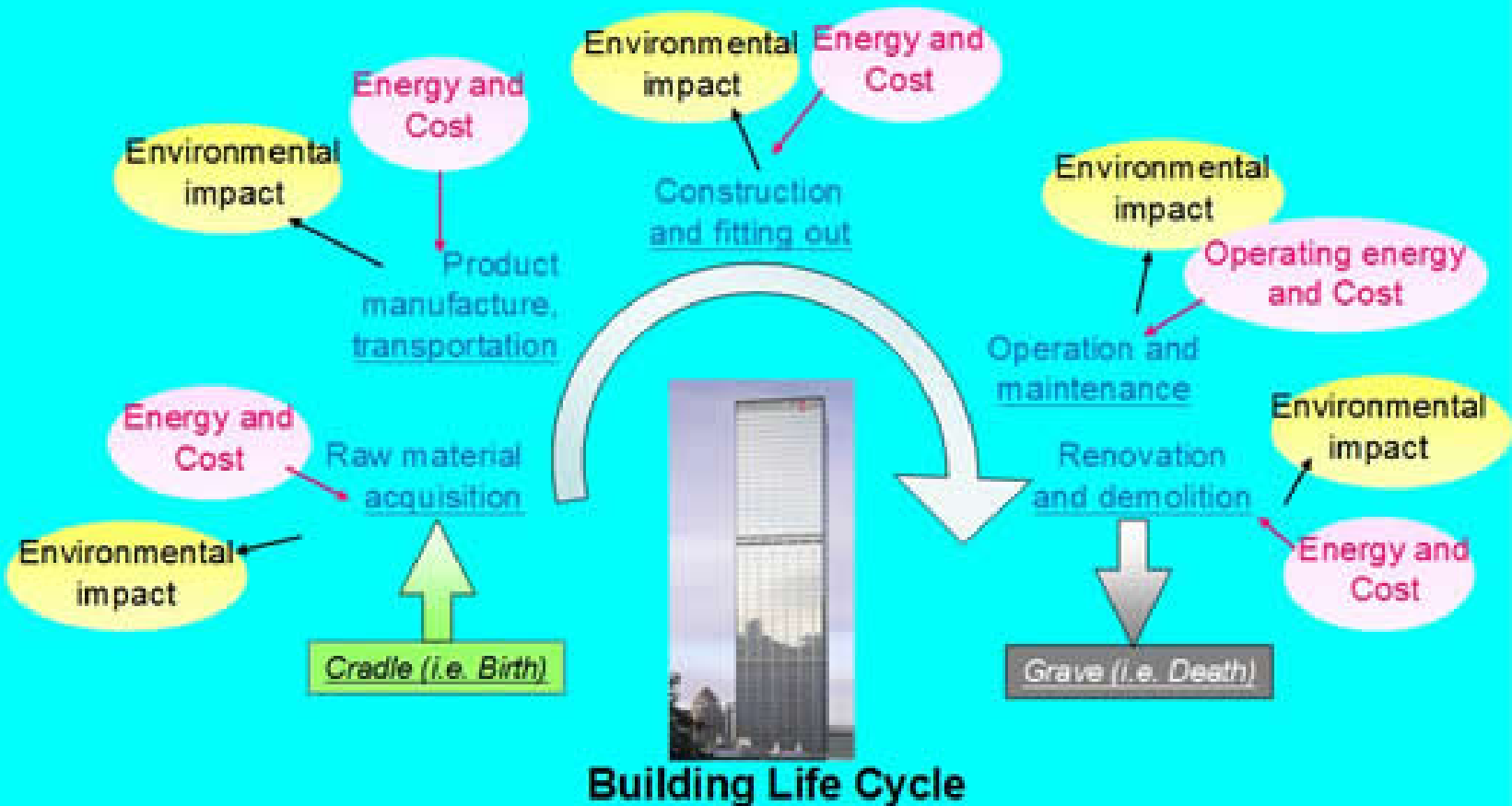


1. **REDUCE:** reduce waste or the need to recycle by not generating waste in the first place
2. **REUSE:** reuse materials before recycling or discarding
3. **RECYCLE:** transform material into another usable material

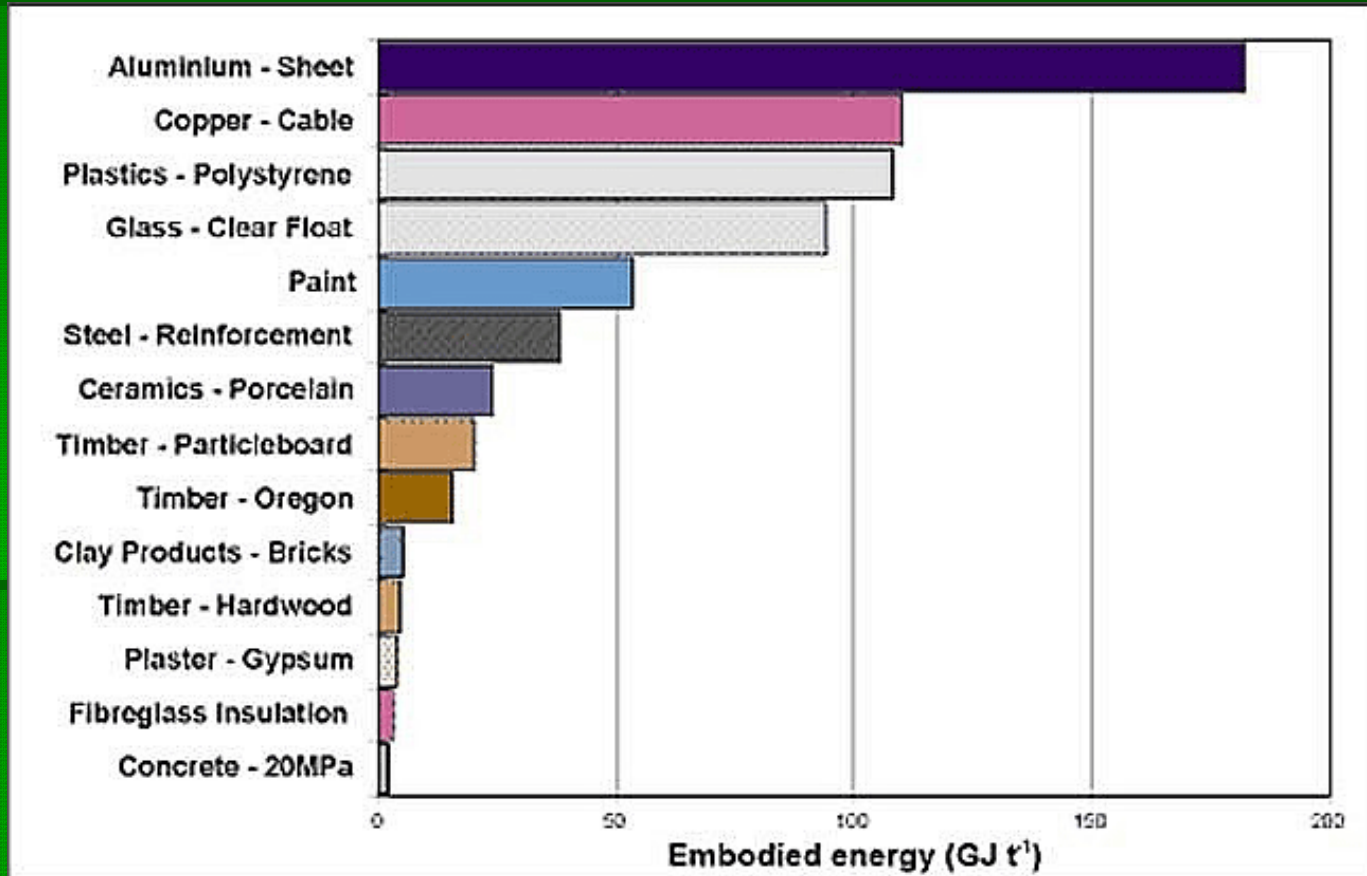
# What is embodied energy?

- Embodied energy is a way of describing all the energy required to create a material throughout the whole life cycle of its production.

# Impacts incurred by a building throughout its life cycle

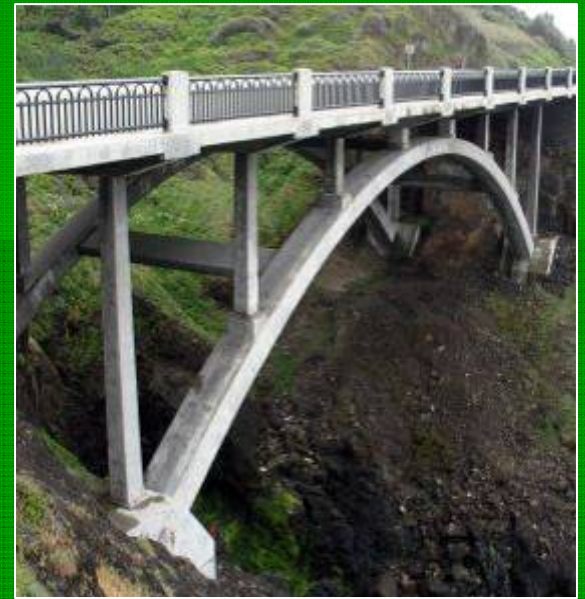


# Embodied Energy in construction materials

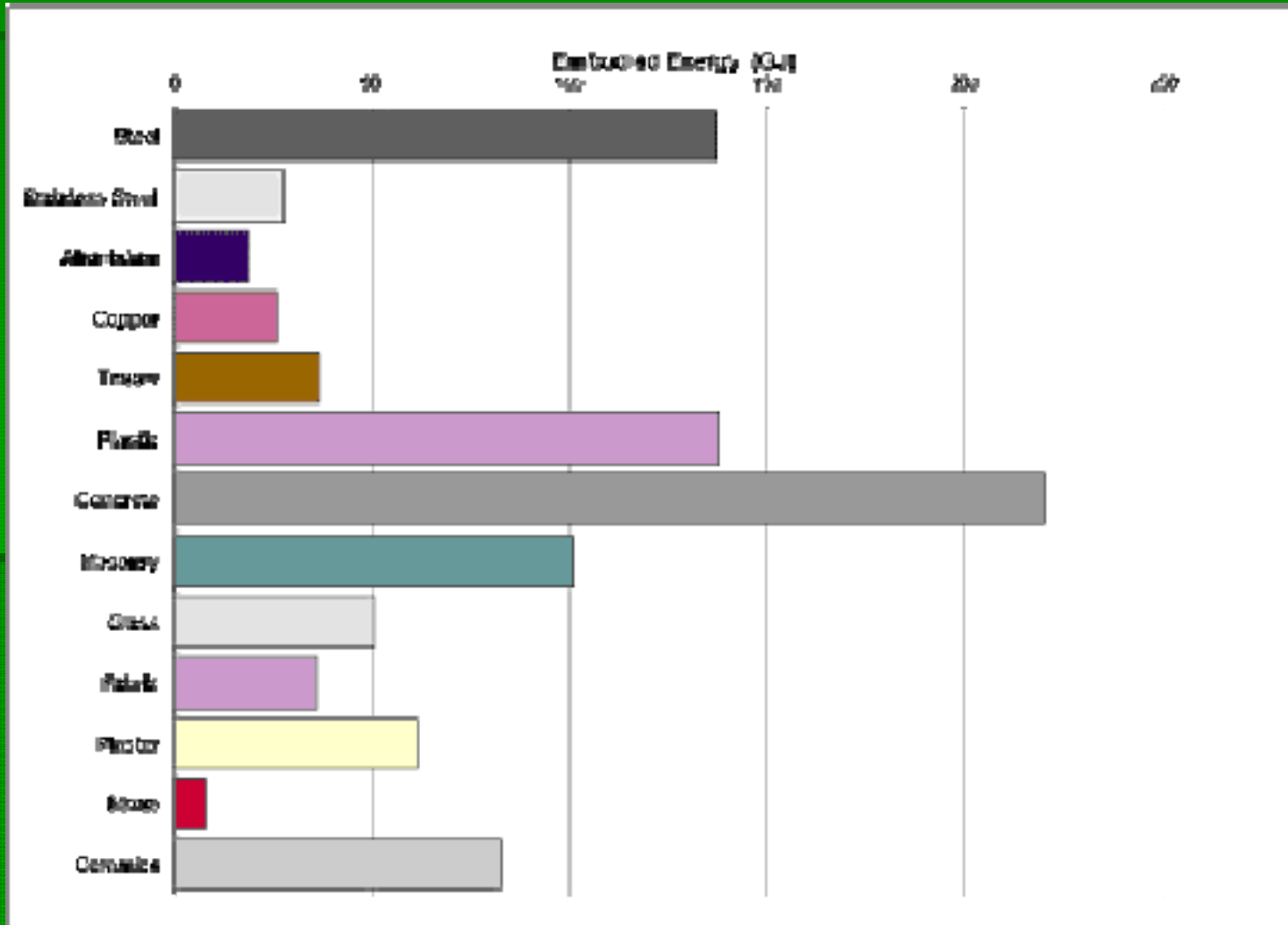


Graphic from TecEco Pty.Ltd

- Concrete is the most widely used material on earth with over two tons per person on the planet being used. Associated high usage in construction results in higher total emissions than any other material.



# Embodied energy based on usage and quantity



# **Deconstruction is positive for the environment, for the planet and for job creation**

- Reduces reliance on raw materials
- Keeps useable materials out of landfills
- Creates jobs
- Reduces energy consumption

# Reducing the use of raw materials ensures less negative impacts on the environment



# Deconstruction keeps usable materials out of landfills



Reclaimed doors



Crushed concrete as aggregate in new concrete



Reclaimed timber that can be milled into wood products

# What is materials Reuse?

- Materials can be reused for their original function or used in an innovative way. This is referred to as 'reclaiming materials' or 'repurposing'. Because there is minimal reprocessing, as in recycling, these materials have a lower embodied energy. Whenever possible, reuse should take priority over recycling which may mean taking more time to remove items carefully to ensure a undamaged product.

# What materials can typically be reused?

- Wood- one of the largest waste product from deconstruction. With only 5% of old growth forests left in the United States recovering old growth wood from deconstruction sites slows the cutting of forests and reclaims higher quality wood.



# Doors

- Doors are very easily reused.



# Windows



# Pipes

- Pipes can be reused or repurposed



# Cabinets and shelving

- Cabinet grade wood can be remade in to cabinets as well as the reuse of cabinets themselves.



# Insulation

- Fiberglass insulation can be removed and reinstalled



# Fixtures

- There is no limit to how materials, particularly fixtures, can be reused

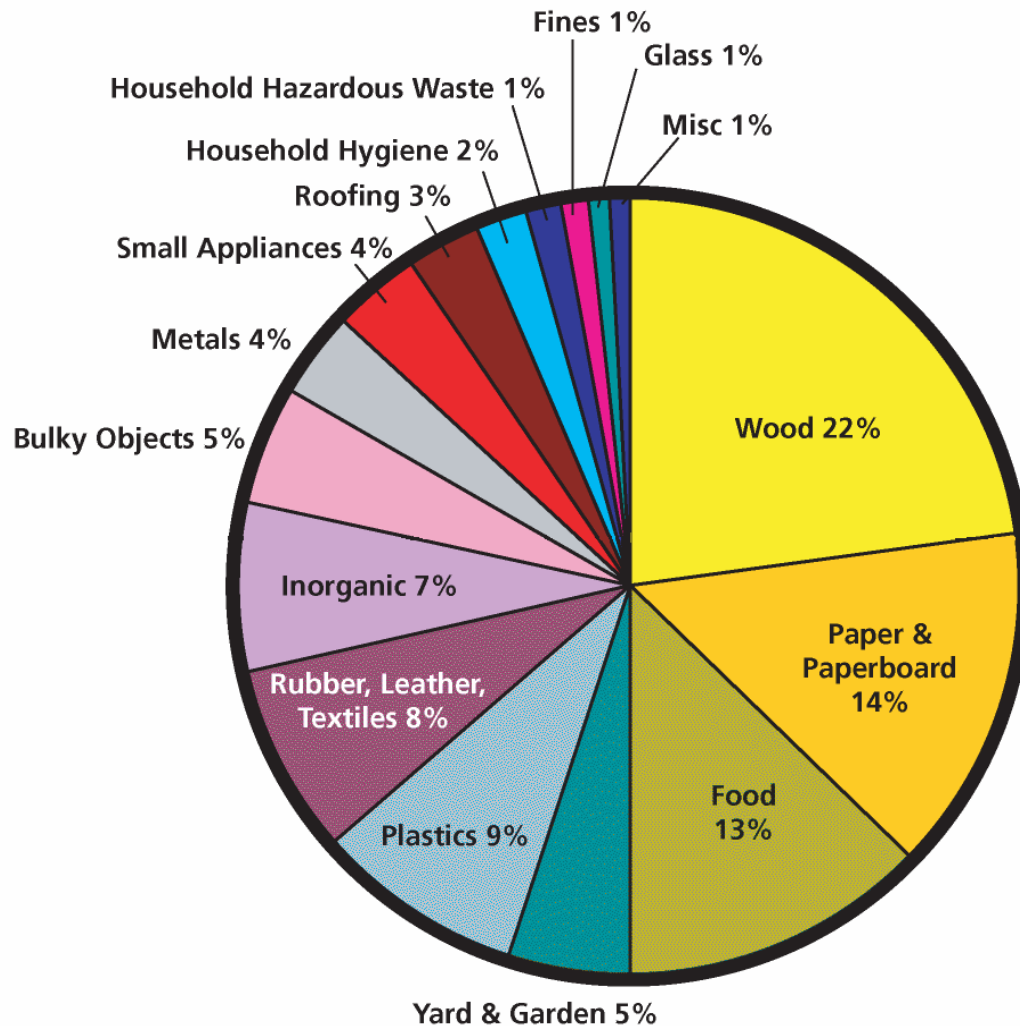


# Bricks

- Bricks can be reused for pavers or patios



# What materials are considered solid waste?



# What kinds of materials can be recycled?

- Metals
- Paint
- Concrete
- Asphalt
- Drywall
- Glass
- Plastic
- Carpet

# Tabor Commons Deconstruction

- Much effort was put into deconstructing part of the existing building for reuse and saving on waste



Students from Oregon  
Tradeswomen dismantle an  
awning and remove siding.

# The Future of Deconstruction

- This is a growing field and as the demand for 'green' products that are reclaimed or recycled there will be more and more desire for deconstruction services.
- Buildings that are designed for future deconstruction.

# Weatherization



# What is Weatherization?

- Modification of a building to reduce energy consumption and optimize energy efficiency
- Protection of a building from the elements of nature that can damage the life expectancy of the building.

# How to Conserve? Energy Efficiency!

Create and implement systems that use *less energy* to achieve the *same level of energy service* that is currently in use.

- Use more efficient technology
- Install this efficient technology through the lens of nature
- Educate Occupants on their energy-use choices and behavior in their home

These are all jobs of a Weatherization Technician

# How to Protect?

## Moisture Control!

- In certain climate zones, moisture can deteriorate a building very quickly through rot and mold.
- Protection is also important from extreme wind, sun, snow



Black Mold Damage



Dry Rot

# Weatherization Job Demand High and still Growing

Housing Market Bubble Burst



New Home Construction Crashed



Many Construction Workers Lost Jobs



Federal Stimulus Bill Created to:



Reduce Energy Use



Reduce Energy Bills, Tax Credits, and Offer Rebates



***And Create Jobs for Weatherization Workers***

# Federal Stimulus Stats

- \$5 billion to weatherize houses of low-income families
- \$2.25 billion to retrofit Section 8 housing with energy-efficient products
- The Existing Homes Tax Credit increases from 10% to 30% for the cost of energy-efficient windows, HVAC equipment, and insulation, up to \$1,500 per qualifying household through 2010.

# City of Portland Clean Energy Fund

- City of Portland will fund energy improvements for 500 homes through federal stimulus funds
- Payments of energy improvements will be integrated into monthly utility bills that will be offset by the costs of energy saved after the improvements
- More to Come? Program model was created as a test run and could be used for the Climate Action Plan, which calls for the energy retrofits of 10,000 homes per year

# Weatherization Practices

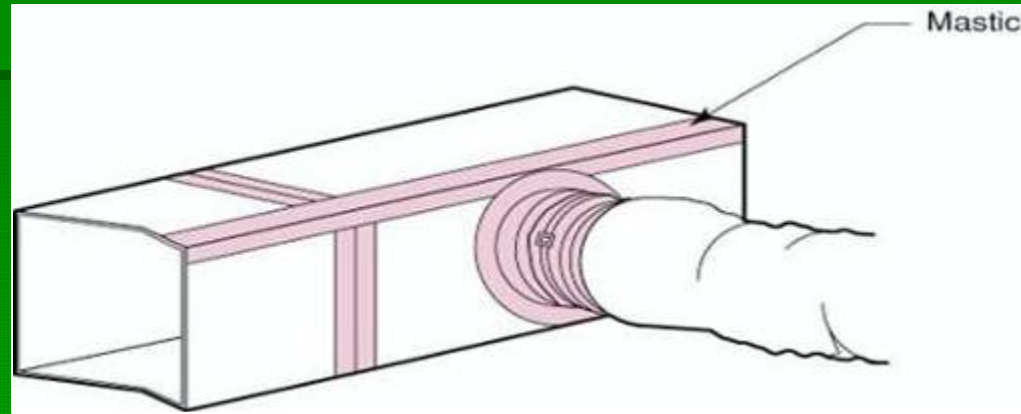
Insulation Installation:

Attic, Floors, Foundations, and Walls



# Duct Sealing: Prevents Heat Loss Ductwork

Ductwork: Pink indicates where to seal



Critical Duct Sealing directly above furnace where majority of heat escapes from ducts

# After Duct Sealing: The Results



- Throughout the U.S, duct leakage typically wastes 10% - 30% of the heating or cooling energy purchased by a homeowner

Residential Energy: by Krigger and Dorsi, in Duct Leakage Section

# Air Sealing



- Seal cracks, gaps, holes in the building shell to remove drafts and prevent heat loss from building
- Red Arrows indicate where heated typically escape, and Blue indicates where air typically leaks in

# Air Sealing Recessed Lights



# Air Sealing Wire, Plumbing, Venting Penetrations



# Other Air Sealing Measures

- Weather-stripping and caulking doors and windows
- Sealing chimney bypasses with flashing and and heat resistant caulking
- Replacing chimney dampers
- Sealing Rim Joists along Foundation walls
- Blocking and Sealing Knee walls
- And many, more, innumerable spots...

# Moisture Control

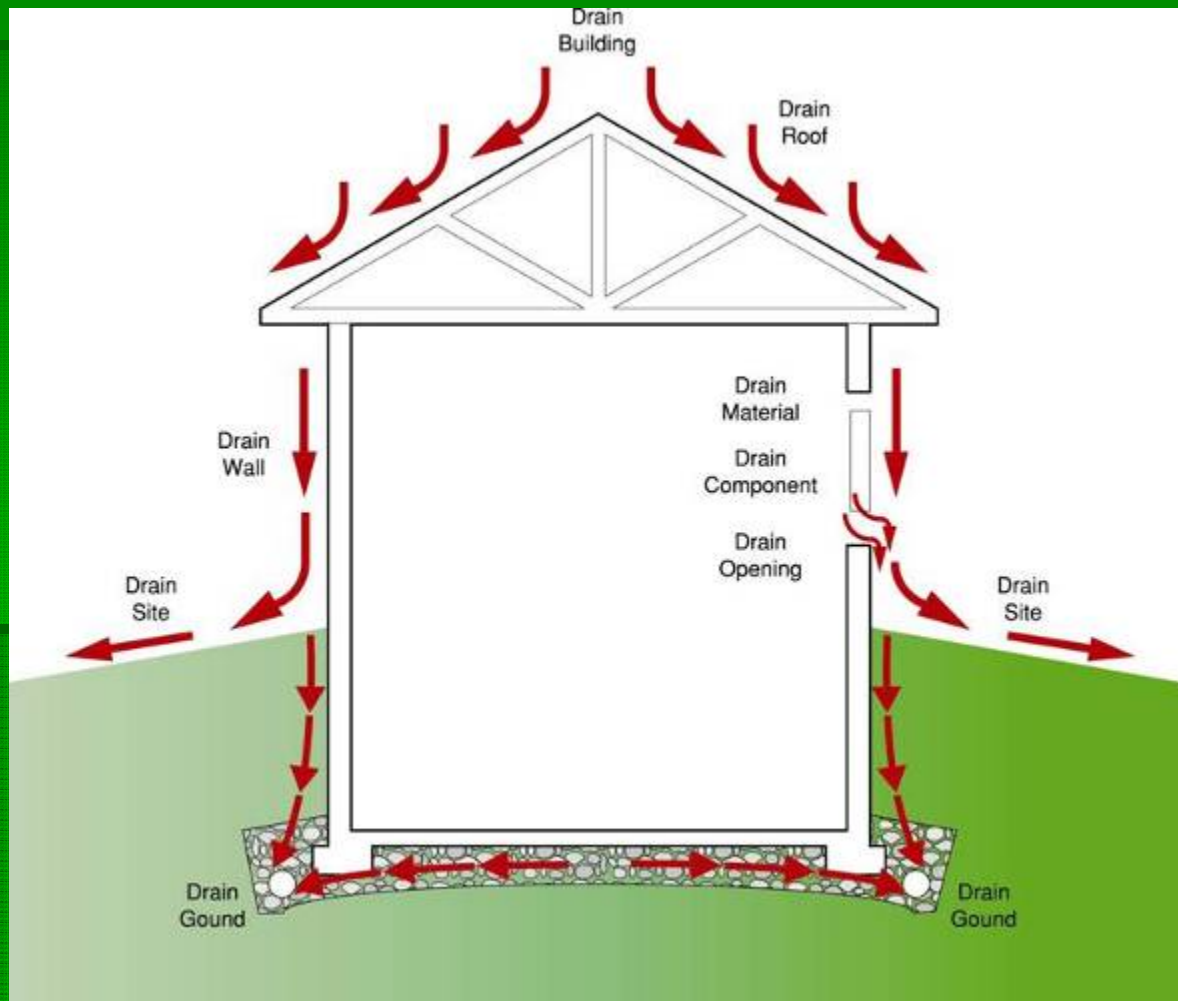


# Ventilating Out Moisture From Inside the Home



- Per Person Per Day, Showering, housecleaning and cooking can exude up to 3 pints per day + the average person evaporates 4 pints (Residential Energy, Krigger and Dorsi)
- Installing dryer vents and bath fans are basic examples which help remove moisture within the home.

# Moisture Control: Directing Water On the Outside



# Moisture Control in Roofing Construction

- Placement and design of flashing, tar paper, shingles, and ALL other roofing membrane materials are essential to create a lasting healthy building.



# Crawlspace Moisture Control

- Laying down Plastic Groundcover will prevent gallons of water everyday from rising up from the soil and through the floor.



# Other Weatherization Procedures

- Insulating Ductwork
- Clean and Install Furnace Filters
- Insulating Water Pipe
- Installing storm doors / Windows
- Replacing Windows with efficient, low emissivity, Double-glazed windows
- Installing Footing Drains, or other techniques to protect the building from surface water runoff or groundwater
- Ventilating Crawl Spaces and Attics

# Testing Weatherization Work

- Weatherization Installers who are certified in testing can test air leakage rate of homes
- Test are administered before and after work is completed to see how installation improved the home
- Blower Doors like the one shown below are used to measure air leakage



# Testing Continued:

- Duct Leakage can be tested with a Duct Blaster shown on the left. The Manometer on the right digitally shows you the air leakage rate



# Job Skills Needed:

- Ability to work in dark confined spaces; Crawl Spaces and attics are common
- Agility is needed to crawl under floors and in attics over water pipes, ducts, wiring, etc
- Comfortable with Heights: If roof insulation or vents are needed
- Carry and lifting heavy materials
- Operating power tools typical in carpentry
- Building Science background is helpful
- Basic Electrical and Carpentry is helpful

# List of Businesses that offer Weatherization Employment and Services:

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- County Governments – Low Income Weatherization Programs: State/County Referral List
- Energy Trust: Contractors Trained in Energy Efficiency are called Trade Allies. The referral list: <http://www.energytrust.org> Click For Homes>Existing Homes>Choose a Trade Ally

# Green and Solar Roofing Systems



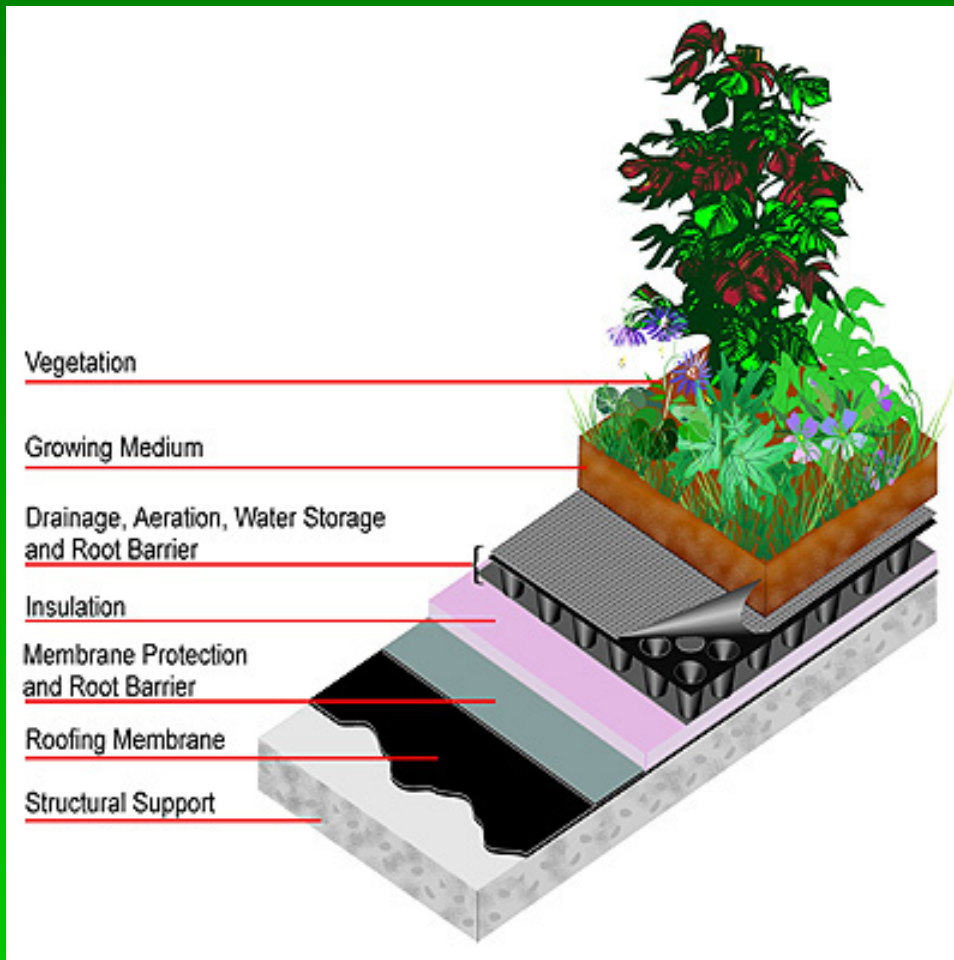
Photo from Oregon State University



Photo from Coca-cola

# What is a Green Roof?

- A green roof, (also known as an eco-roof, living roof or sod roof) is a living, breathing, vegetated roof system that provides a sustainable alternative to conventional roofing.



(Source: American Wick Drain Corp.)

An eco-roof is a lightweight system of soil and vegetation designed to be as self-sustaining as possible.

- A successful eco-roof is synergetic. The soil anchors the plant roots and supports plant growth. The plants protect the soil from erosion and heat gain. Water and sun feed the soil and plants. Plants photosynthesize and produce food for other species, which produce waste matter that helps improve the soil.

# What is a Solar Roof?

- A solar roof is a roofing system that has photovoltaic panels built into the roofing membrane, shingles or tiles.



# Solar Integrated Roofing

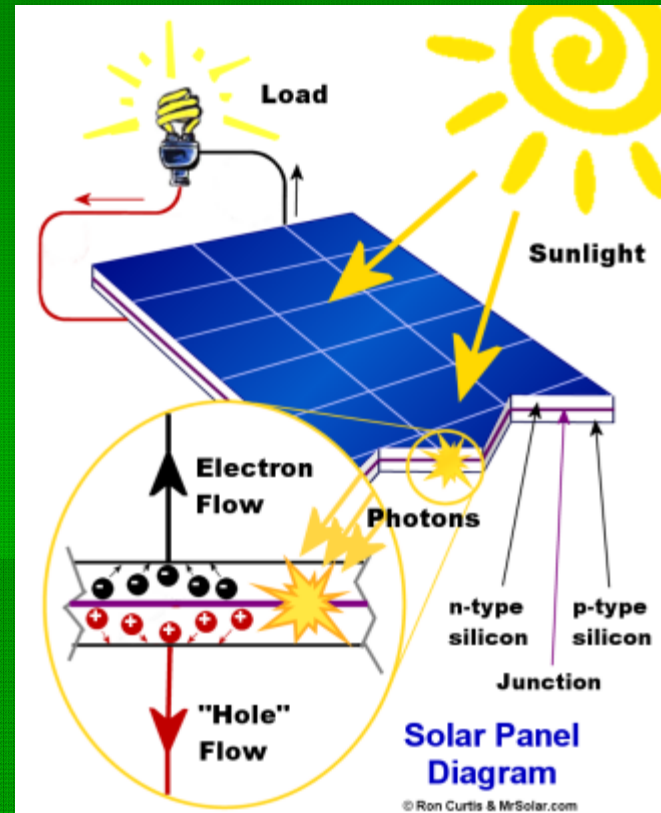
- Traditionally photovoltaic panels have either been mounted onto roofs via metal racks, or to a pole adjacent to the building. Solar Roofing allows for two systems to be installed at once.



Photo from General Motors

# What are Photovoltaic Panels?

- Photovoltaic (or PV) panels, otherwise known as 'solar panels,' are panels that convert solar energy (photons) in to electricity (volts). Photo+volts = photovoltaic.

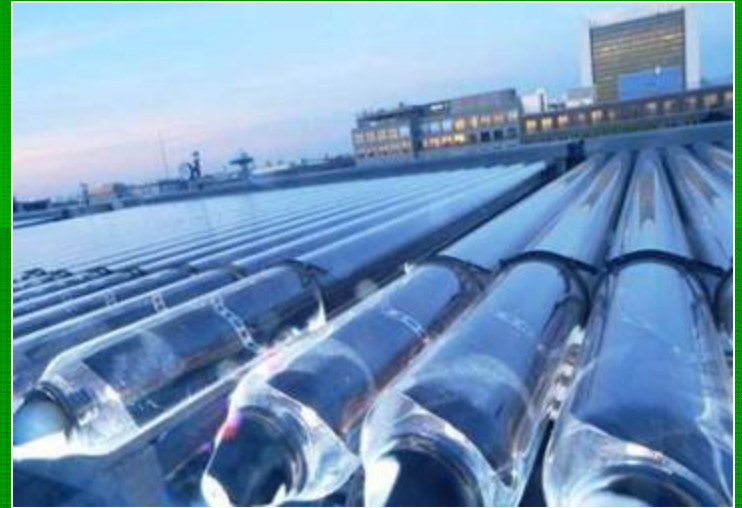


# What is Solar Thermal?

- A solar thermal panel is a panel that harnesses the sun's energy to store heat.



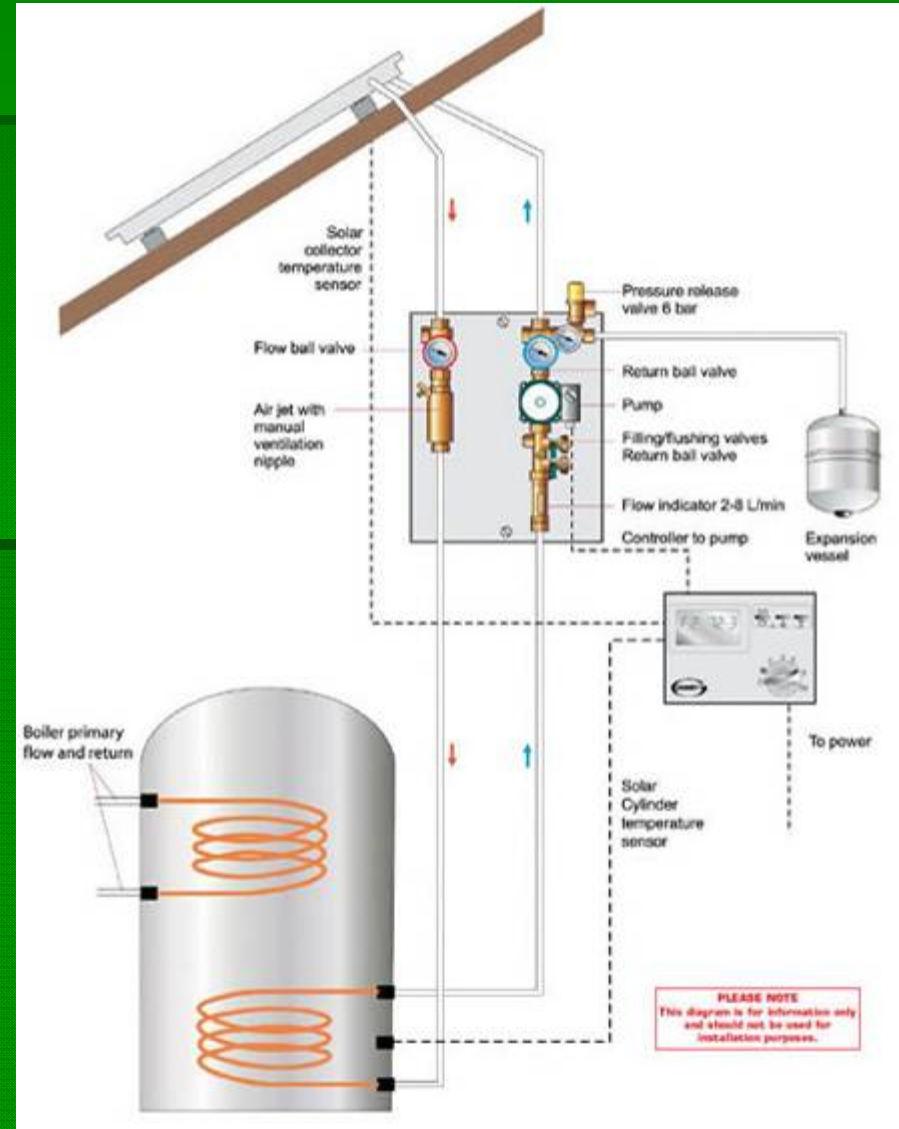
From EcoFirst.net



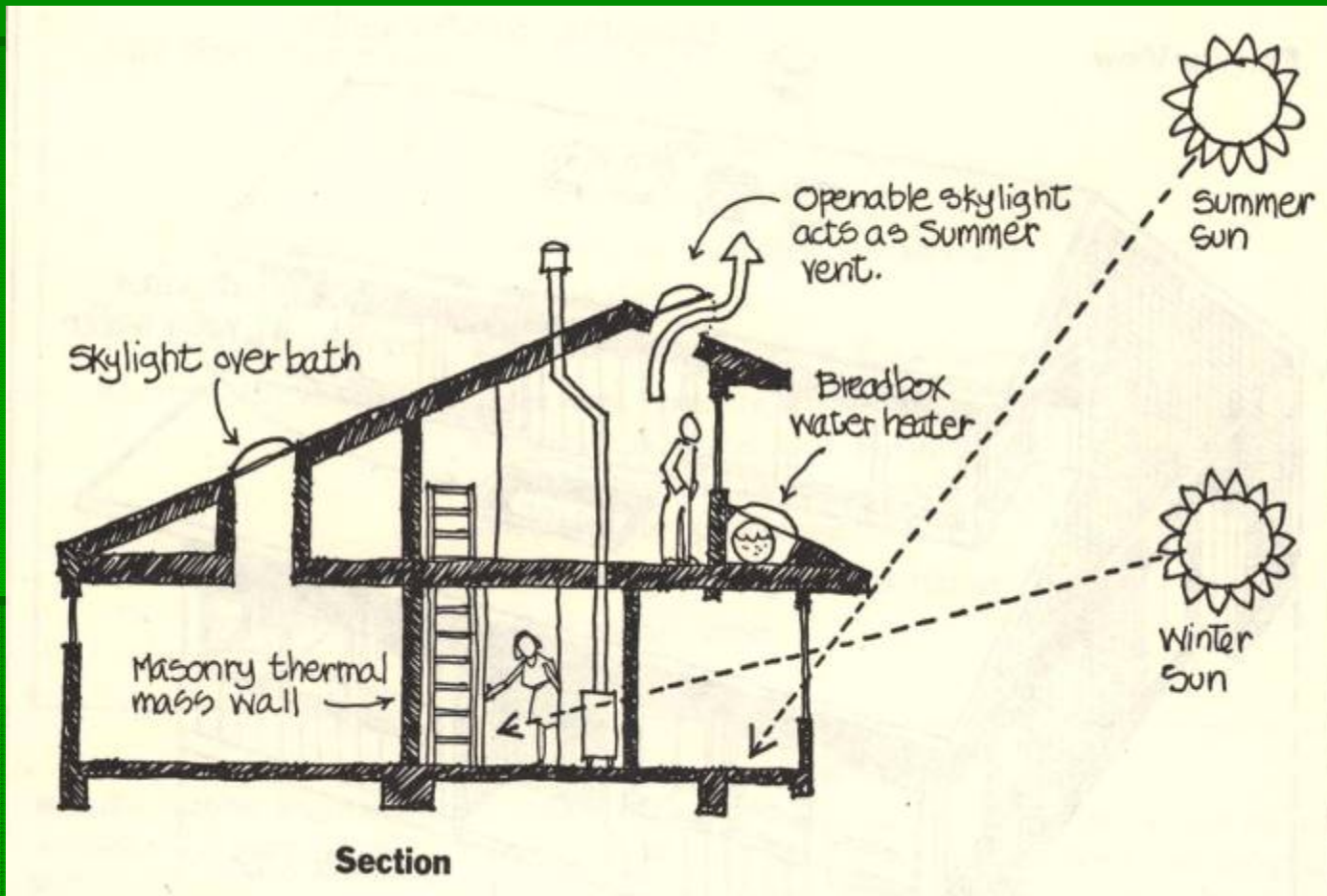
Greenpeace/Langrock/Zenit

# Solar Thermal Panels

-are shallow flat panels containing tubing that is filled with a fluid (water or glycol) that collects heat and transfers the heat to a tank of water for domestic or commercial use.



# What is Passive Solar?



# Tabor Commons Passive Solar Design

- South facing glass
- Minimal glazing on West
- Concrete floor to retain heat



# Designing for Passive Solar

- Location
- Orientation
- Native or planted vegetation
- Seasonal use of building
- Glazing
- Roof overhangs or trellises
- Thermal Mass

# Considerations for planning and designing an eco-roof

- Location and orientation
- Type of vegetation
- Live and dead loads
- Climate
- Anticipated levels of operations and maintenance
- Aesthetics
- Access
- Drainage



Photo from [www.waterproofing.co.nz](http://www.waterproofing.co.nz)



Photo provided by:  
Emilio Ancyaya  
Living Roots, Inc.



From [www.ecogeek.org](http://www.ecogeek.org)



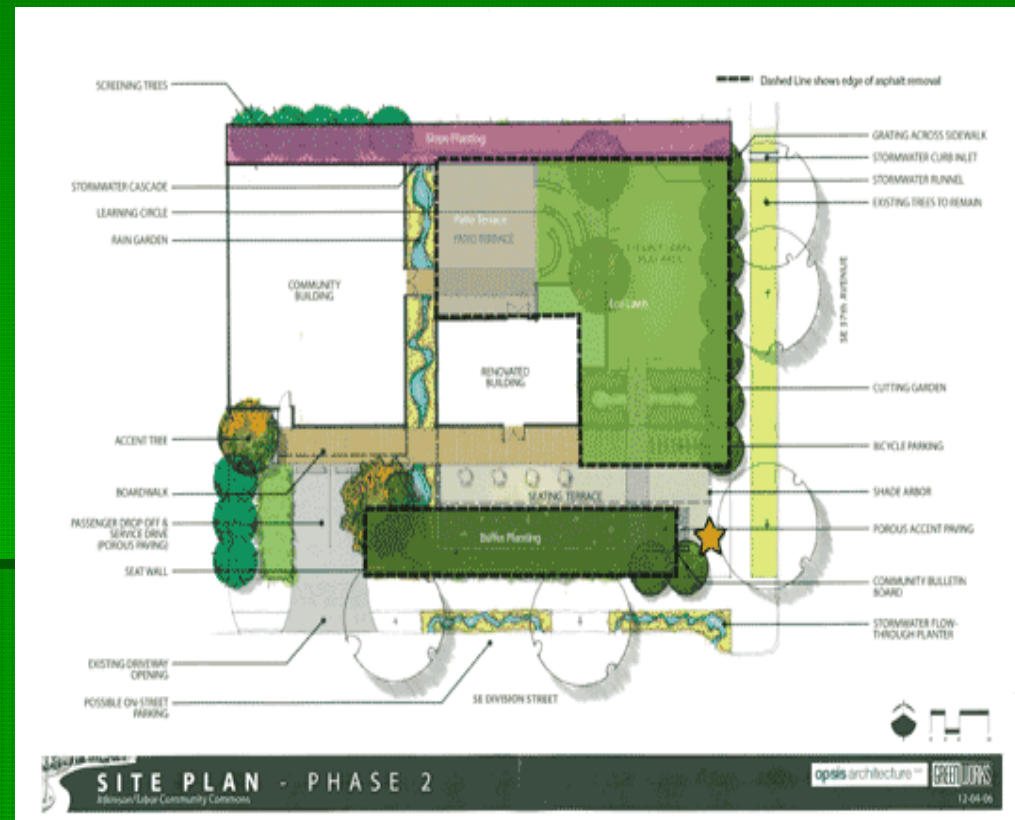
From [sfblogg.com](http://sfblogg.com)

# Considerations for planning and designing a solar roof

- Location and orientation
- Climate
- Local flora
- Amount of energy consumed by occupants
- Type of roofing

# Case Study: Tabor Commons

- “We just found out that we needed a new roof on the building. The metal roof is 50 years old; the project is going to be challenging. We wanted to do an eco-roof; this is our opportunity.”
- “Eco-roofs are heavy. We need to reinforce the building to be strong enough to carry the additional weight. We’re working with our volunteer engineers and advisory people to figure out what that would cost, and how we would do that.”
- -Paul Liestner

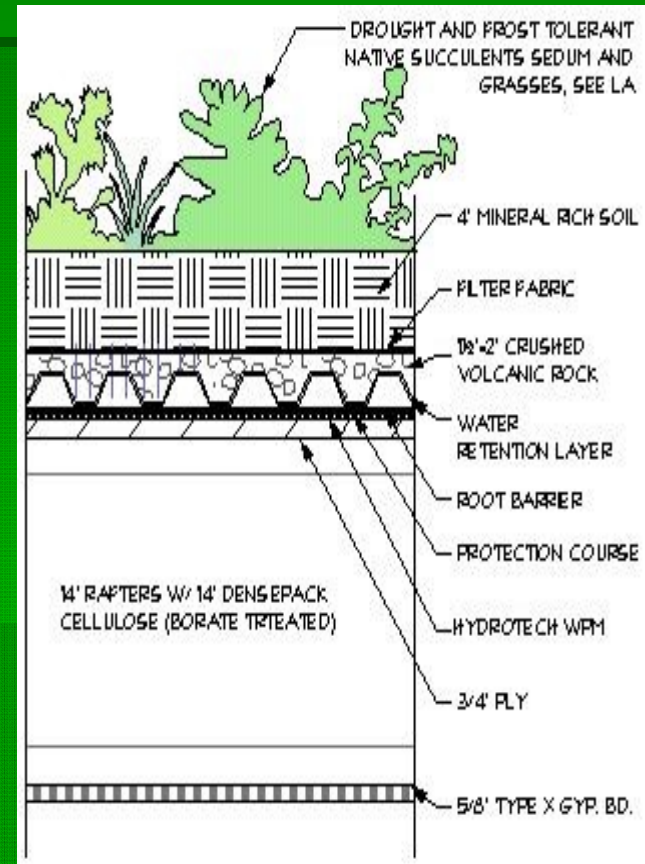


Text from The Bee April 30<sup>th</sup>, 2008

# Construction and installation of green roofing systems



Photo from Greenforall.org



From [www.presentationcenter.org](http://www.presentationcenter.org)

# Construction and installation of solar roofing systems

- *Traditional installation of rack and panel systems attaching the racking and mounting the panels*



Photo from Solar Richmond

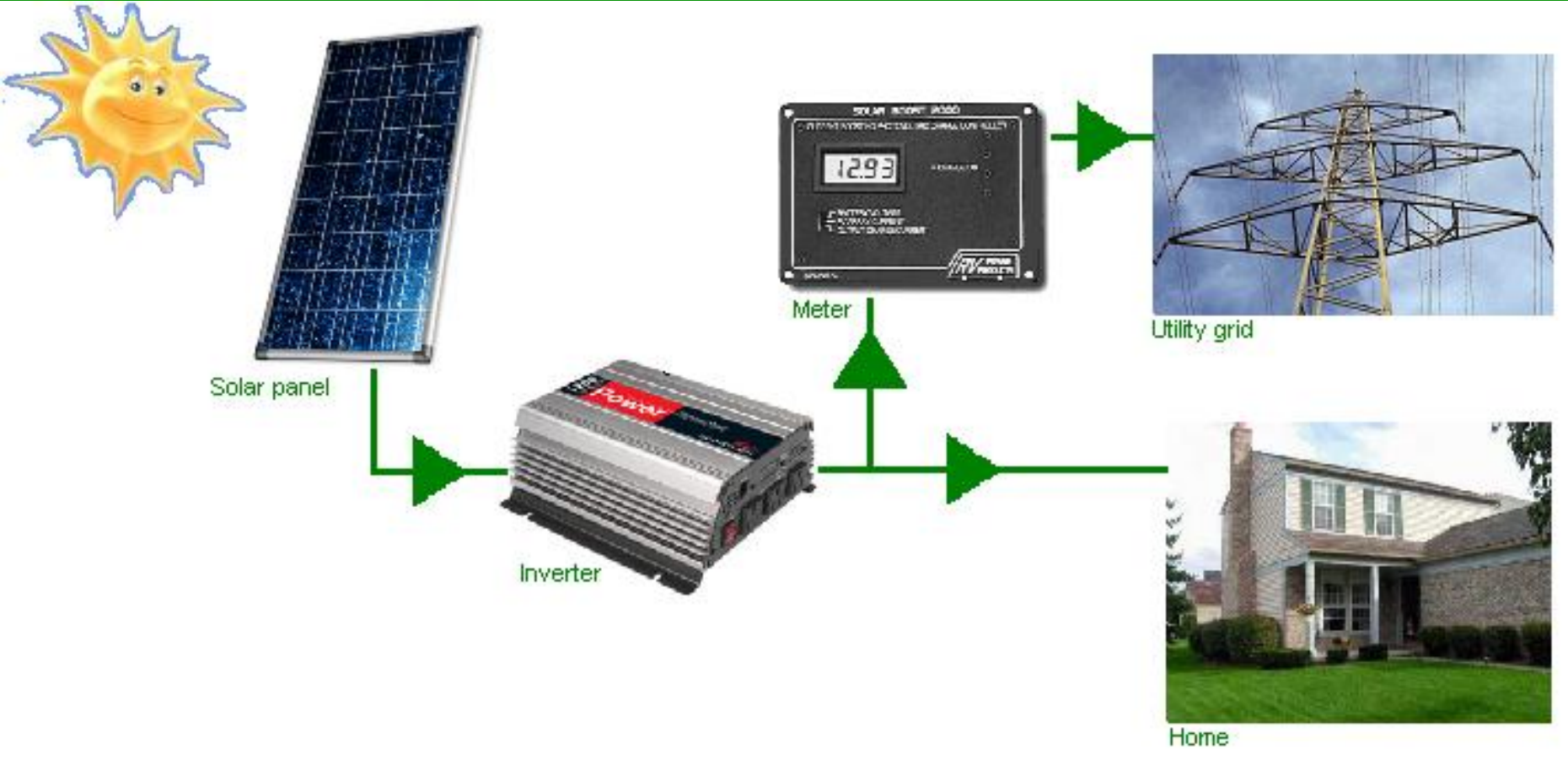
# Solar Panel Installation

- Mounting racks to roof surface
- Locating panels on roof
- Mounting
- Wiring
- Control panels

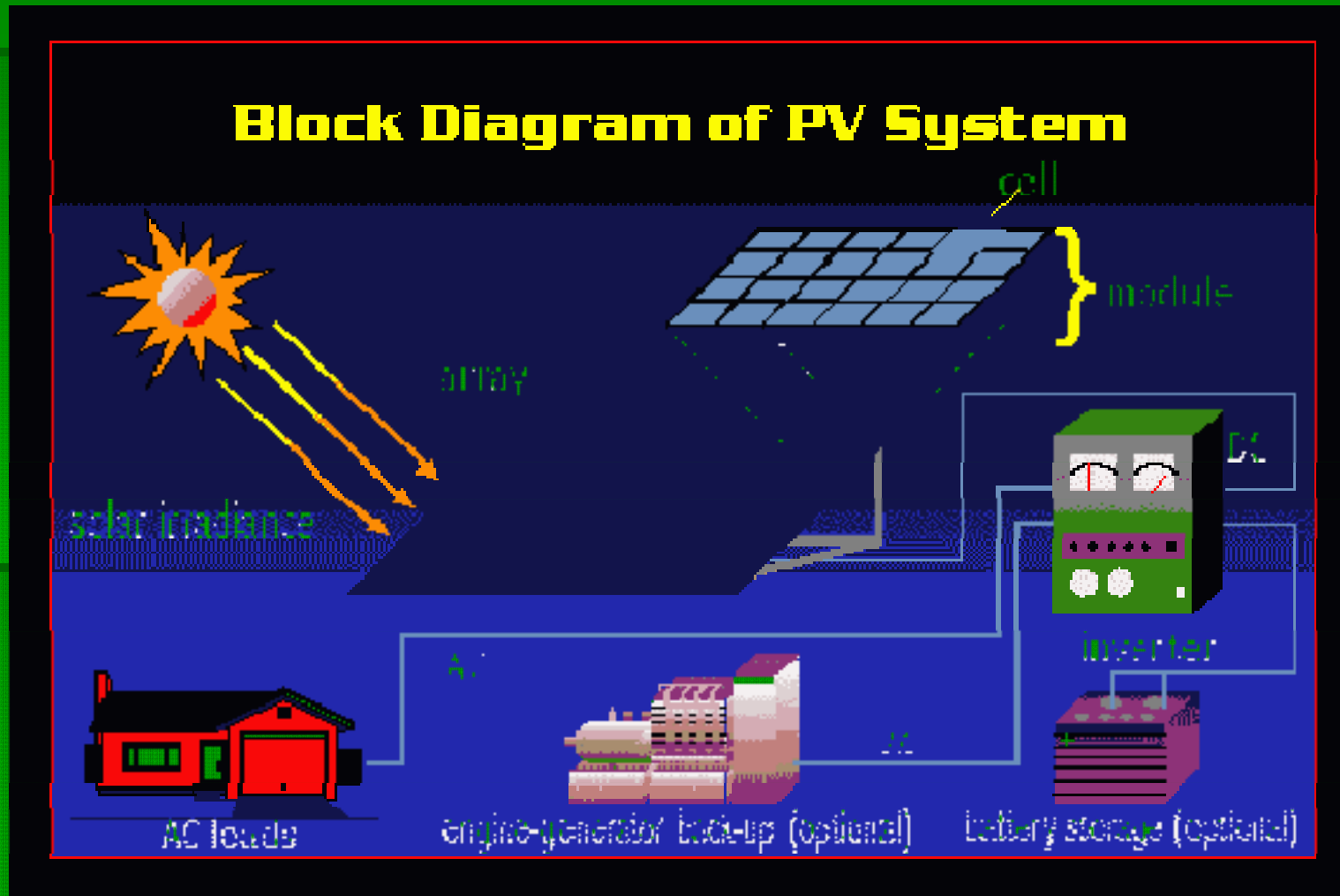


Photo from [silverbacksolar.com](http://silverbacksolar.com)

# Grid-Tied Solar System



# Stand Alone Solar System



# Pole mount systems

- Systems for locations where roof orientation is oriented poorly, shaded or inaccessible



Photo from KEETSA

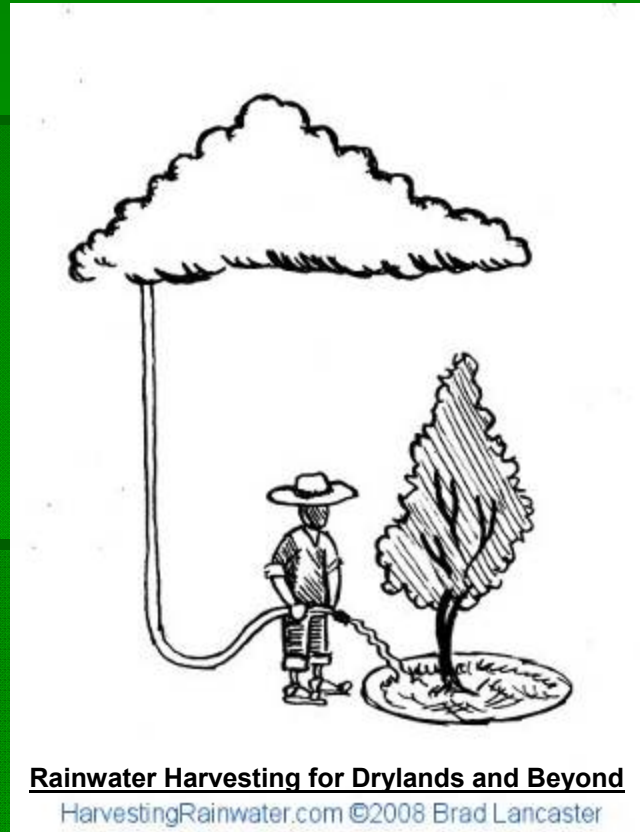
# Solar integrated roofing installation

- There are many different styles of integrated solar roofing
- Each system is unique and must be designed to fit in with planned roofing (new construction and roofing remodels)
- Designed to simplify wiring



Photo from [sweetsolarhome.com](http://sweetsolarhome.com)

# Stormwater Management



Introduction to Green Jobs in  
Stormwater Management

# What is Stormwater?

- Rainwater that flows across an impervious surface on its way to a natural body of water

# What is Stormwater Management?

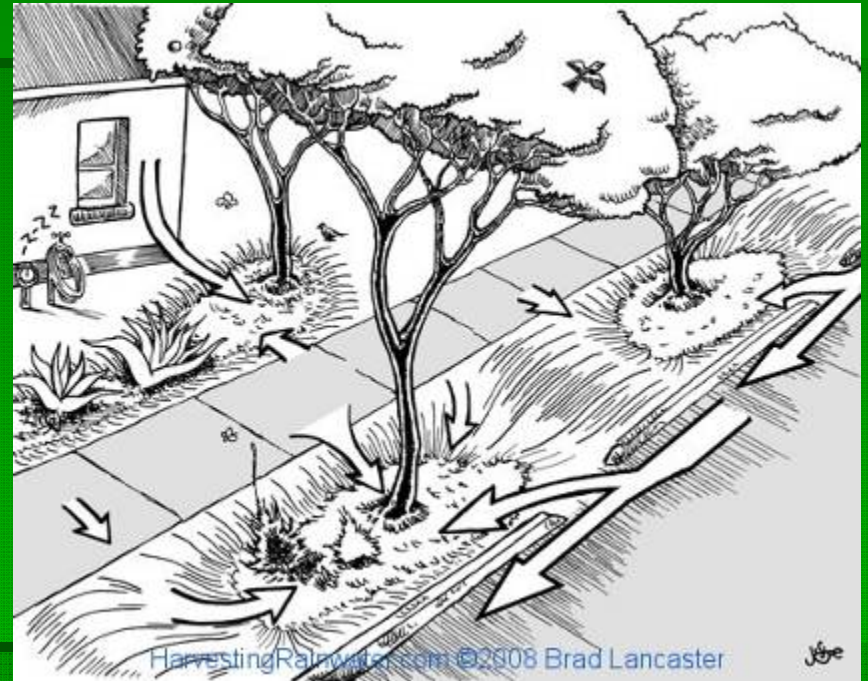
- The management of stormwater runoff that provides water retention facilities that control the release for stormwater to flow into receiving streams.

*Defined in [www.water-technology.net](http://www.water-technology.net) in glossary*

# Why manage stormwater?



Rainwater Harvesting for Drylands and Beyond



Rainwater Harvesting for Drylands and Beyond

When buildings, roads, parking areas and lawns dominate the landscape, rainfall becomes stormwater runoff.

# Why Stormwater Management continued...

- Much less water is able to be infiltrated by plants and soil,
- Less water evaporates back to the atmosphere
- Instead, more water (about 20-30 percent in a suburban neighborhood) becomes surface runoff or stormwater runoff.

*(Puget Sound Partnership <http://www.psp.wa.gov/stormwater.php>)*

# Why Stormwater Management continued...

The excess volume of water and increased flow rate can cause the following problems:

- Flooding hazard potential
- Stream erosion, which destroys certain fish habitat
- Combined Sewer Overflows

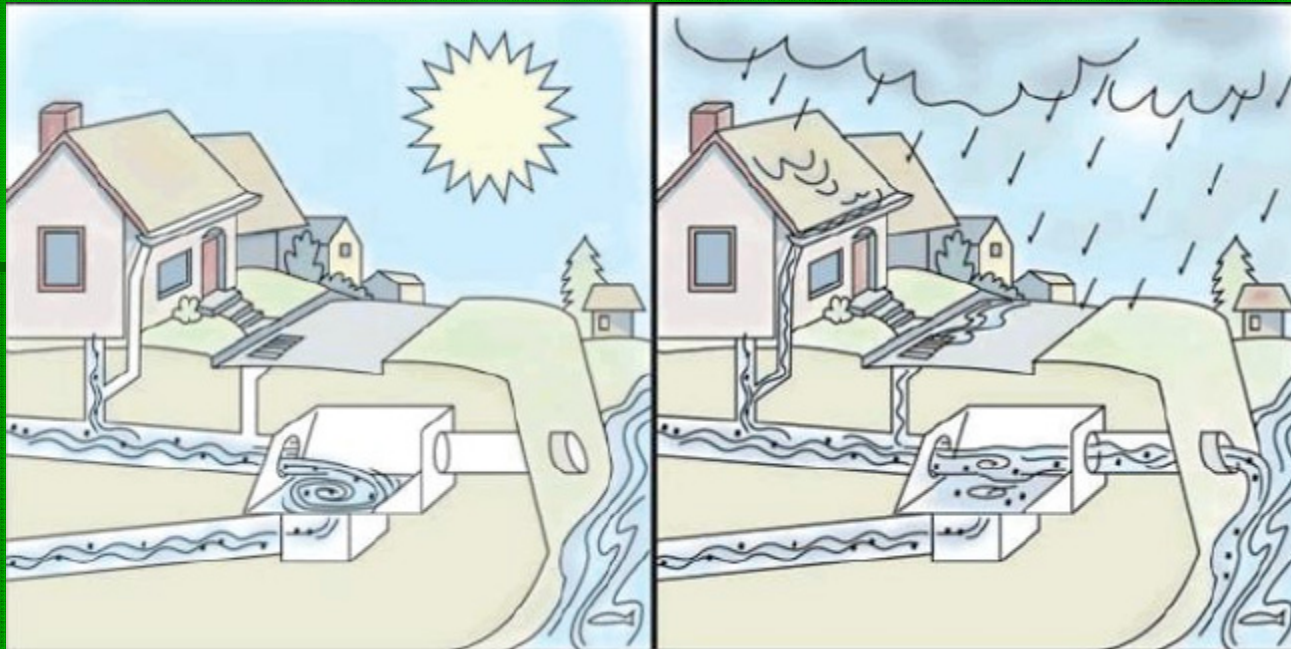


Illustration by City of Portland

# Combined Sewer Overflows in Portland, OR

- Stormwater from downspouts and from storm drains combine with sewage in underground pipes, which normally flow to a wastewater treatment facility.
- During most rain events in Portland, the pipes to the treatment facility exceed capacity, and trigger a built in automatic overflow recovery system that transfers the excess polluted mixture of stormwater and sewage directly into the Willamette River
- About half of Portland neighborhoods are connected to the Combined Sewer Overflows system. The city has been working to reduce these overflows since 1991

# Stormwater Carries Other Pollutants:

- Heavy Metals
- Animal waste
- Petroleum Products
- Sediments from construction sites, roads, highways, parking lots, lawns and other developed lands



Colorado Department of Transportation

*(Puget Sound Partnership <http://www.psp.wa.gov/stormwater.php>)*

# Effects of Stormwater Pollution:

- Water quality degradation requiring filtration and restoration.
- Loss of habitat in riparian areas
- Economic losses from damage to marine species such as fish and shellfish

*Puget Sound Partnership <http://www.psp.wa.gov/stormwater.php>*

All of these reasons outline why **sustainable stormwater management** is gaining more recognition and opening up more green job opportunities.

# Standard Practices

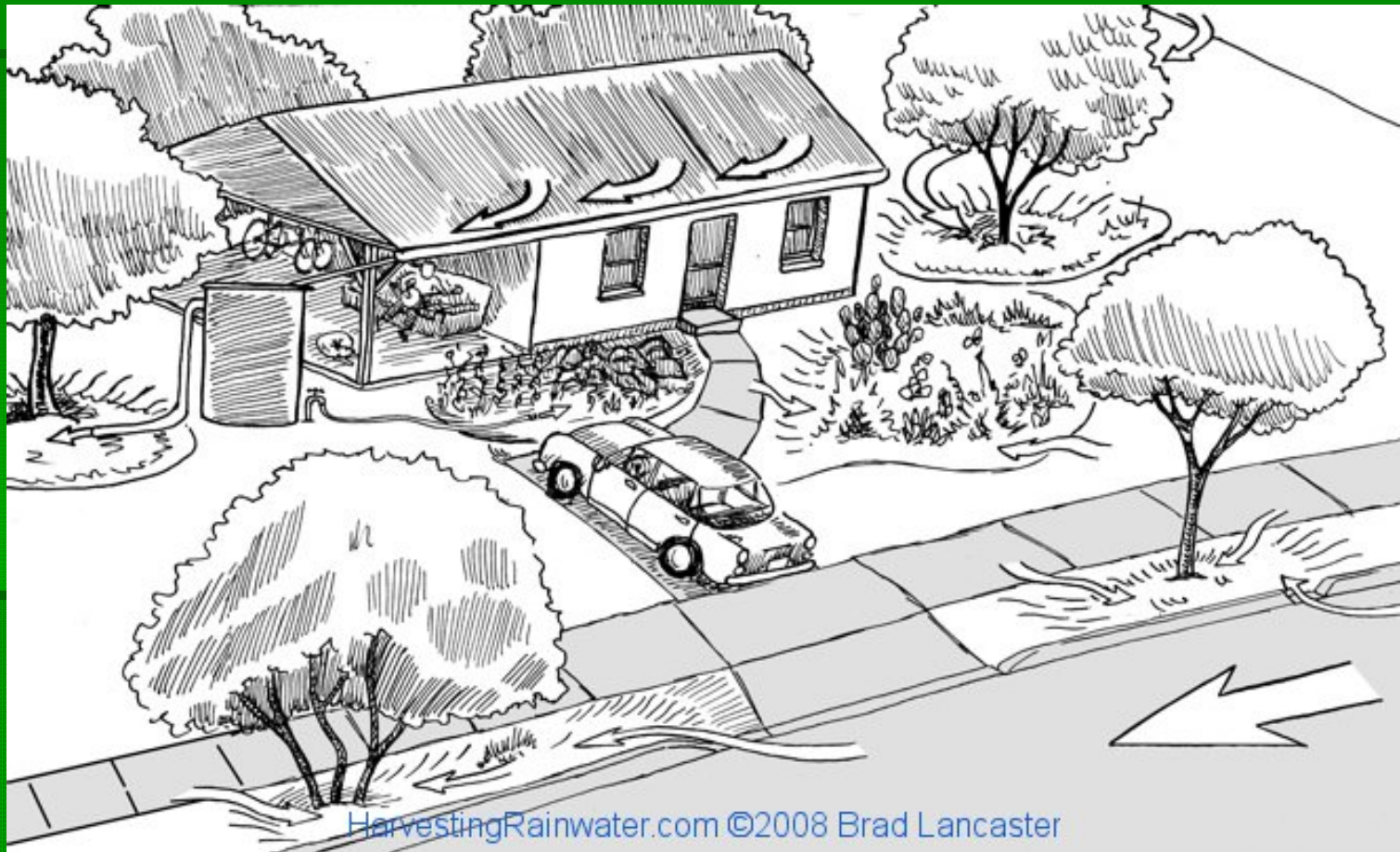


What has been the common stormwater management practice BEFORE sustainable stormwater became an accepted practice in stormwater construction?

# **The Standard Solution to Stormwater was Get rid of it QUICKLY, and OUT OF SITE.**

- Street, parking lot, or sidewalk grading that direct stormwater into piping systems underground that flow directly into our waterways
- Rooftop materials such as asphalt shingles and increased Roof pitch that direct stormwater into downspouts and away from buildings
- Gutters and downspouts that guide water into concrete inlets that lead directly to the stormwater pipe drainage systems mentioned above.
- Combined Sewer and Stormwater drains that mix and pipe into the river after large rain events

# Innovative Practices



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[Rainwater Harvesting for Drylands and Beyond](#)

# Downspout Disconnection

- Redirecting roof runoff from the sewer system by directing water from downspouts onto the surrounding landscape.
- Related Job type: Sheet metal worker, Pipefitter, Landscaper, City of Portland Downspout Disconnection Program



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# Rain Barrels

- Using rain barrels to collect roof runoff for re-use in Seattle.
- Related Job Type: Plumber, Pipe fitter, Landscaper



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# Cisterns

- Larger storage for stormwater runoff for reuse.
- Related Job Type: Plumber, Pipe fitter, Landscaper
- This image shows a innovative example of a dual-purpose rock-walled cistern and patio structure

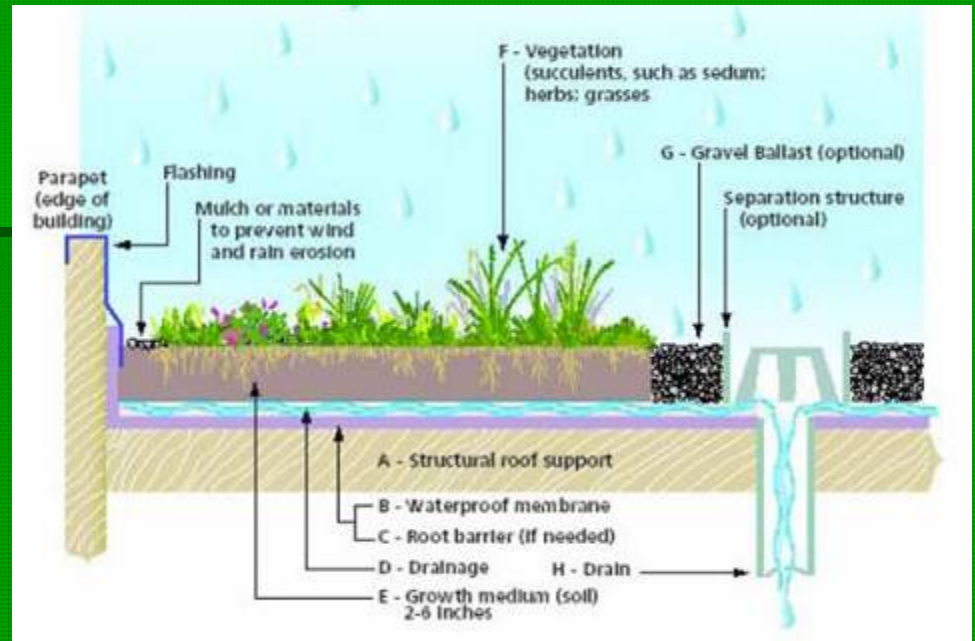


# EcoRoofs

- Managing stormwater with lightweight vegetated roof systems.
- Related Job Type: Carpenter, Landscaper, Framing Construction, Roofing Contractor



Photos from the University of Oregon and luxury property blog



# Roof Gardens

- Heavyweight roof systems that manage stormwater.
- Related Job Type: Carpenter, Landscaper, Framing Construction, Roofing Contractor



# Trees

- Increase vegetation and places to slow runoff through soil infiltration.
- Related Job Type: Landscaper



HarvestingRainwater.com ©2008 Brad Lancaster

# Contained Planters

- Increase vegetation and places to slow runoff through soil infiltration.
- Related Job Type: Landscaper, Concrete Worker



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# Vegetated Swales

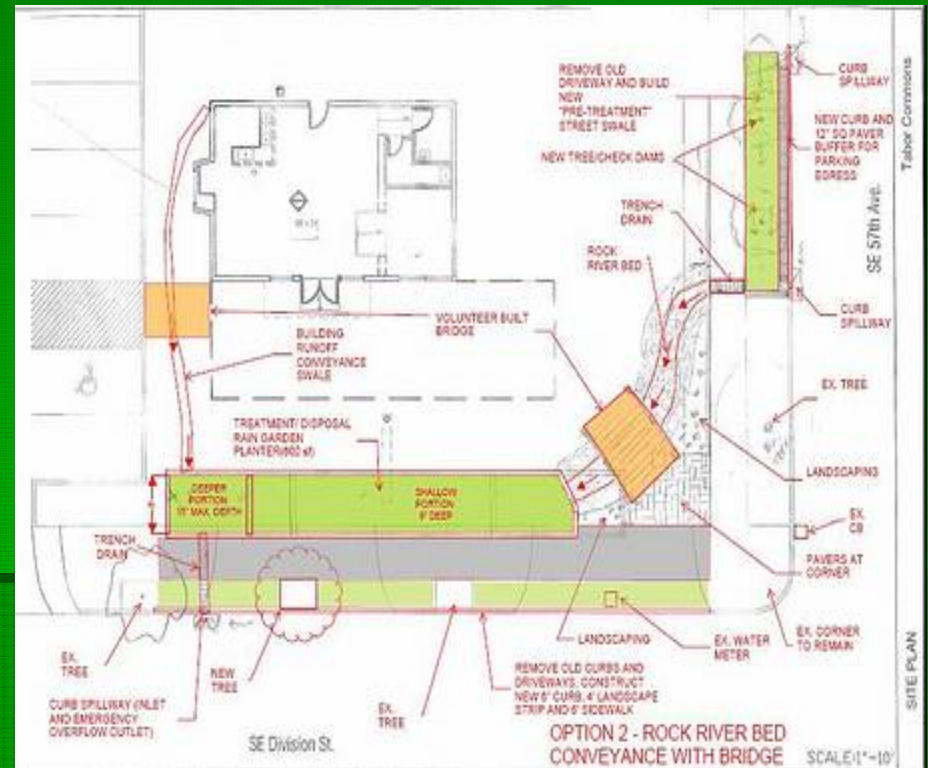
- Gently sloping, vegetated depressions that collect and treat stormwater runoff.
- Related Job Type: Landscaper, Surveyor



[Rainwater Harvesting for Drylands and Beyond.](#)

# Tabor Commons innovative stormwater management

- This is the layout design of the water garden that will be funded by Portland Bureau of Environmental Services. It will take runoff water from 57th street and redirect it to an onsite water garden retention facility. New curbs and bump outs will be constructed as part of the project.



# Curb Extensions

- Manage stormwater runoff from streets, slow traffic, improve pedestrian safety, and bring a natural element to the hardcape.
- Related Job Type: Landscaper, Surveyor, Laborer, Road Construction



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# Pervious Pavers



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- Pervious pavers allow stormwater to soak into the ground and reduce runoff.
- Related Job Type: Landscaper, Concrete worker, Road Construction, Surveyor

# Soakage Trenches

- Shallow lined trenches treat stormwater runoff from hard surfaces.
- Related Job Type: Landscaper, Road Construction



HarvestingRainwater.com ©2008 Brad Lancaster

# Other Innovative Stormwater Practices:

- Infiltration Planters Small planting containers work well in space limited sites with good drainage.  
Related Job Type: Landscaper
- Pervious Pavement resembles conventional paving material but allows stormwater to infiltrate.  
Related Job Type: Landscaper, Concrete worker, Road Construction, Surveyor
- Turf Block allows rain to infiltrate parking areas, driveways and walkways.  
Related Job Type: Landscaper, Concrete worker, Road Construction, Surveyor
- Drywells Underground perforated pipes collect stormwater and allow it to soak into the ground.  
Related Job Type: Concrete worker, Road Construction, Surveyor

# Constructing Stormwater Projects

- Example is the ROW Project in Tucson, Arizona
- Converting a sidewalk median into a stormwater catchment garden
- Neighborhood-Driven Project
- Photos Provided by Brad Lancaster

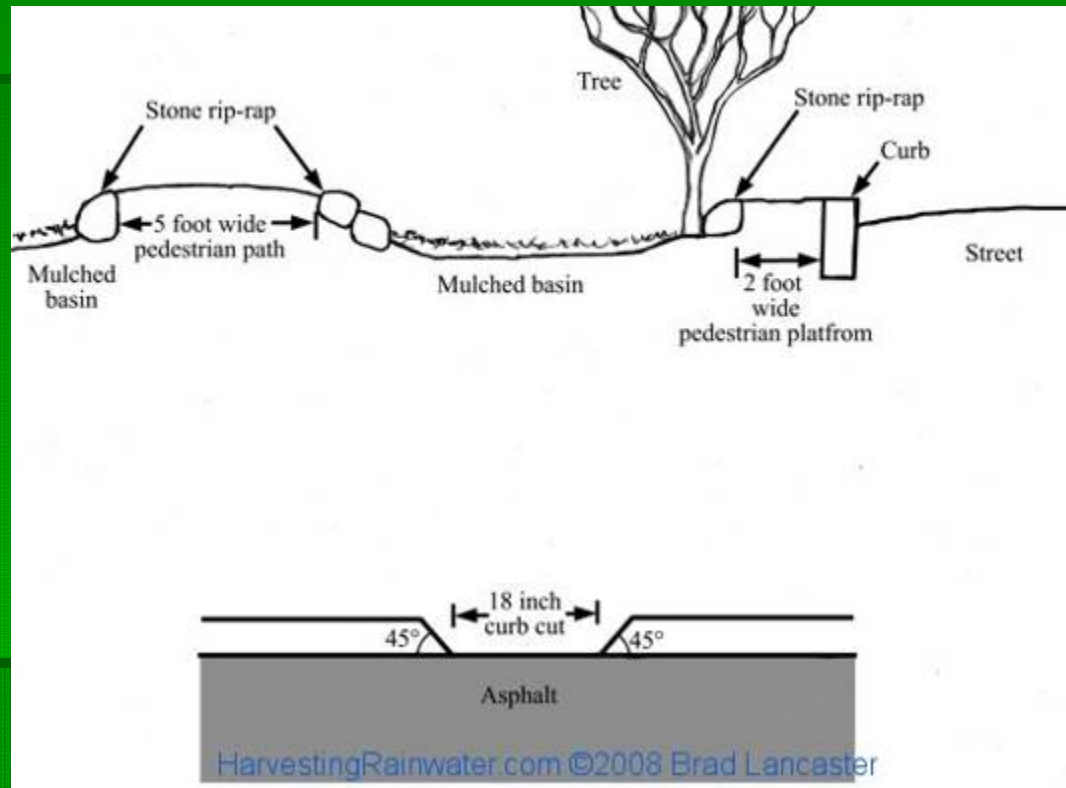
# The ROW Project – The Site



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- The median between sidewalk and roadway

# The Plan



Rainwater Harvesting for Drylands and Beyond.

- Create basins for rainwater collection and a curb cut to direct road stormwater runoff into the basins from the street surface

# Construction:



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# Curb Cutting:



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# The End Result



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- Curbs Cut and Basins mulched

# Businesses in Stormwater Construction

- City of Portland Stormwater Professionals In Stormwater List
- City of Portland EcoRoof Contact List
- Women On Water: Career Networking Group In Portland. Monthly gathering and Job Listserv:  
[womenonwater@lists.onenw.org](mailto:womenonwater@lists.onenw.org)