



**Brooks Solar, Inc.**

*Solar power for People*

solar, wind, micro-hydro renewable energy systems  
design, installation, and service

## Passive solar design principles

- Orient the long axis of the structure east/west. This allows maximum solar gain through south facing windows, and a large south facing roof surface for solar hot water and photovoltaic arrays.

- Size roof overhangs to shade south facing windows completely during summer months (May through Sept), while still allowing maximum solar gain in winter.

Roof overhangs ratio for this latitude (per NREL):

if window height = 1.0

then vertical distance from top of window to overhang = .326

and overhang = .754

- Limit window square footage to no more than 10% of floor square footage (skylights count double, but “solar tubes” do not count), and have minimum windows on east/west aspects, and none, if possible, on north aspects.

- Windows should be double pane, at least. Triple pane is advised on north facing windows in cold winter climates. Glazing on south facing windows should be plain glass, not low-e, since low-e limits heat gain in winter by up to 60%. Shade these windows with overhangs to prevent summer heat gain. East or west facing windows should have low-e film on the third surface (outside surface of inside pane) for best year round performance. North facing windows should be plain glass. Metal clad wooden framed windows are the most energy efficient and maintenance free.

- Super-insulate (at least double code requirements.) This can be done in a variety of ways - SIP (structural insulated panels), double walls, solid foam, high density fiberglass insulation, earth berming, etc. Insulate windows at night with thermal blinds, such as Window Quilts (tracked insulating shades) or Warm Windows (quilted roman shades.)

- Include thermal mass inside the insulated space to moderate temperature swings. Size thermal mass to store enough BTUs to meet heat losses of the structure for the usual period of cloudy days. Use backup heat for longer cloudy periods.

- Use deciduous plants or exterior shades to shade east and west surfaces in summer, but allow solar gain in winter. Exterior shades are more effective than interior shades because they stop solar gain before it enters the structure.

- Use openable windows to allow cross ventilation without undue heat gain or loss. Use a whole house fan or heat exchanger to insure good indoor air quality in winter.

- Use an air lock entry way to limit heat gain in summer and heat loss in winter.
- Make the house “solar ready” by pre-plumbing for a solar hot water collector, and placing conduit for potential future photovoltaic (PV, solar electric) arrays. These are usually on south facing roofs, but can be on southeast or southwest roofs, or on separate mounting racks or poles near the structure.