NMSEA

Buying Solar Energy Systems

System Sizing, Cost, and Where to Find Information & Services

I. Photovoltaics (PV) - Solar Electricity from the Sun: These systems utilize a semiconductor based technology to produce dc electricity from sunlight, which is then converted to ac power using an "inverter". **System Sizing:** As the first rule of thumb below states, a carefully installed PV system with an array of "modules" (PV panels), with a total rated peak dc *power* output of 1000 watts, produces 4 to 5 kilowatt-hours (kWh) of usable electrical *energy* per day in New Mexico on average. (Note the distinction between power and energy: Energy equals power multiplied by time. For example, 1 kilowatt-hour is the *energy* obtained from a power of 1000 watts operating over 1 hour of time).

PV Sizing Rule of Thumb: 1000 watts of PV modules (dc peak rating) produces 4-5 kWh/day

So, to size the PV array for your system, you first need to know how many kWh per day you typically consume. (Note, by the way, that the power output of the dc-to-ac inverter is sized differently from the array: For off-grid systems, inverter power is based on your peak power demand, not array size. For grid-tied systems, the inverter's power needs to be a little above the peak output of the array). You can usually obtain your average kWh usage by examining your electric bill carefully, and many solar installers can also estimate this for you from a detailed list of your appliances. *Note that a grid-tied system does not necessarily need to provide the full amount, because you can rely on the grid for the remainder if you need to*. Using the rule of thumb above, the minimum number of kilowatts of PV needed is then equal to the number of kWh/day consumed divided by 4 or 5. Five is an easy number for quick estimates: Use the smaller number, 4, to be more conservative. Typical energy efficient homes use anywhere from 5 to 15 kilowatt-hours per day, depending on exactly what appliances are used and how much. Typical (less efficient) homes use 20 or more kilowatt-hours per day. Using the rule of thumb above, we find that efficient homes can often be fully PV powered with a 1 to 3 kilowatt system, whereas typical homes would require a 4 to 6 kilowatt system: Energy efficiency pays!
PV System Cost and "Payback" Issues: PV modules by themselves cost approximately $5 per watt (in terms of the peak rated dc output wattage of the modules). The entire installed cost for a home system costs about $10 per watt:

PV Cost Rule of Thumb: Total installed cost is about $10/watt of peak output from the array

We therefore calculate that the total cost of a PV system, for an efficient home using 5-15 kWh/day, ranges from $10,000 to $30,000 - about the price of a car. Compared to grid power, it works out that PV power costs about 3 times more, if a 20-year lifetime of the equipment is assumed (about 25 cents/kWh). This implies a very long "payback" time, over 60 years if there are no incentives. A Federal Tax Credit for PV will be available in 2006-2007, however, which will help lower the cost, and several NM state incentives are expected soon as well, which will help even more (see next page for a link to incentives info). The cost *is* decreasing gradually, and is expected to equal grid power around 2016. Don't get hung up on payback issues though: The payback question is actually misleading from an environmental standpoint: PV is clean, whereas grid power is not, and investing in PV now is precisely what will help bring its cost down, and make it widespread. **Note:** A number of qualified installation companies exist in New Mexico, but it may be difficult to find services far from the North-Central part of New Mexico. Make sure your installer has a good track record, and you may want to tour some of the installer's previous projects first.

II. Domestic Solar Hot Water Systems: These are systems that utilize a solar thermal panel (collector) to heat a mixture of water and glycol (in the most typical version), which is pumped through the collector by a small pump. The pump itself is usually powered with a very small PV module. The heat in the liquid is then transferred into a water tank using a "heat exchanger", which transfers the heat but not the circulating liquid itself into the water tank.

Solar Hot Water Sizing Rule of Thumb: 1 square foot of panel heats about 2 gallons per day

Therefore a single panel of 30-40 square feet will heat 80 gallons of water, the typical size of a water heater, quite adequately. **System Cost:** The components of a domestic hot water system cost anywhere from $1000 to $3000. A single collector is about $800. There are a range of solar hot water storage tanks available, ranging from the regular sort of hot water storage tanks to very nice stainless steel tanks: What you choose here effects the cost significantly, and also the quality and component lifetime. Total installed cost is usually $4000-$5000, with a significant amount of the cost in labor. Solar hot water systems *are* cost effective today, such that the investment is usually paid back in under ten years, especially with today's natural gas prices. Federal incentives for solar hot water systems will be available in 2006-2007 (see next page for a link to incentives info). **Note:** Finding qualified, experienced, willing, and available solar thermal installers is, unfortunately, somewhat difficult these days in New Mexico. Take your time and be patient. *This also means your contribution to helping get this industry going will be especially valuable.*

III. Active Solar Space Heating Systems: These are systems that utilize solar thermal collectors to heat air directly, or heat water instead which is then used to heat a radiant floor directly or baseboard radiators. If baseboard radiators are used, a solar thermal storage tank is usually incorporated, to allow on-demand dispatch of the solar heat. Solar hot water collectors integrate extremely well with radiant floor heating systems from an engineering standpoint, and the floor acts as thermal mass storage, which avoids the need for a storage tank.

Solar Heating Sizing Rule of Thumb: Total collector area should be about 10% of the floor area

System Cost: The cost of a large space heating system is about $3000 - $4000 per collector, or $15,000 to $20,000 for a typical home. Heat storage tanks can increase the cost significantly, which is one reason why a radiant floor approach is so ideal. **Note:** As with domestic solar hot water systems, finding the right installer may be somewhat difficult. Take your time and be patient.

IV. Passive Solar Design: This means taking advantage of the Sun's path in the sky to naturally heat the building in winter and keep it cool in summer, through careful placement and sizing of windows and thermal mass. This works fantastically well in New Mexico. See the links below for guidelines on this topic. **Note:** Don't wing it! Badly designed passive solar buildings overheat in the day, and freeze at night, whereas a well-designed passive solar building cuts heating and cooling costs by 80% or more, and is incredibly comfortable. Use the guidelines available for this!

Where to Find Further Information

Incentives Information & Policy Action:

- **Coalition for Clean Affordable Energy;** www.CFCAE.org. Incentives are described in detail on this website. Also, if you're interesting in policy advocacy, join the CCAE's Clean Energy Network to receive updates on NM policy developments. The Coalition actively advocates for renewable energy and energy efficiency policies at the State Legislature and Public Regulation Commission, and works to develop clean energy projects in New Mexico.
- New Mexico Energy Conservation and Management Division: www.emnrd.state.nm.us/ecmd/

Technical Information by the New Mexico Solar Energy Association:

- Passive Solar Guidelines: www.NMSEA.org (Click on FAQs section).
- Education info: www.NMSEA.org/Curriculum/Listing.htm
- Net-Metering: www.NMSEA.org/Grid_Interconnection/Interconnection.htm

Locating Renewable Energy Services/Businesses:

- Solar Business Directory: www.NMSEA.org (then see menu-bar on left side)
- Renewable Energy Industries Association of New Mexico: www.REIA-NM.org

Workshops and Energy Fairs offered by the New Mexico Solar Energy Association:

- **Solar Fiesta!** Two days of comprehensive workshops and exhibits held by the NMSEA in late September in Albuquerque. A great way to get to know the solar energy community as well.
- **Solar Village:** Exhibits held in conjunction with the Taos Solar Music Festival.
- **Albuquerque Chapter of the NMSEA (see NMSEA website).**
- **School Visits:** Contact the NMSEA at info@NMSEA.org.

Chapters of the New Mexico Solar Energy Association: (Contact the Association at info@NMSEA.org for contact information)

- Santa Fe Chapter ("Santa Fe Circle")
- Alamogordo Chapter
- Las Vegas Chapter ("Heavenly Bodies Club")
- Taos Chapter (closely linked with Sustain Taos!)
- Los Alamos Chapter ("Los Alamos Sustainable Energy Network" or "LASE Network"): http://www.lasenergy.net/
- Albuquerque Chapter

Other New Mexico Clean Energy Organizations:

- Rebuild New Mexico: http://www.rebuildnewmexico.org/
- UNM Students for Clean Energy: http://www.unm.edu/~cleannrg/
- Regional Development Corporation: http://www.rdcnm.org/pRenewableEnergy.aspx