

ClimateSmart

Solar Electricity

Clean, renewable and reliable, solar photovoltaic (PV) panels are an increasingly important means of generating electricity, for both commercial and residential use.



Did you know....?

- With over 300 sunny days per year and new financial incentives available to help decrease the cost of installation, Colorado is a great place to reap the benefits of solar power generation.

THE BENEFITS OF SOLAR POWER

The amount of energy from the sun that reaches the Earth in one day is enough to meet the entire planet's power needs for an entire year! With unstable and increasing energy prices, and the economic and health effects of pollution and global warming becoming more prominent, the benefits from solar power generation are many. Over the long-run, harnessing this renewable, non-polluting energy resource provides benefits across all areas of society.

Clean solar energy reduces the need to generate power from more polluting methods, such as coal-fired power plants. Solar energy reduces our dependence on fossil fuels and promotes a healthier economy, creating good, high-paying jobs in a renewable industry. For every megawatt of solar PV installed, more than seven jobs are created, compared to about one job for every megawatt of coal-fired energy.

Solar electric systems are among the most reliable power sources available. They require very little maintenance, few spare parts and no fuel. Solar energy is immune to rising or unstable energy prices. Although the cost of solar is still significant, rebates and tax incentives are making it more affordable than ever. Over half of the cost of a solar electric system is covered through state rebates and federal tax credits. Over time, a solar system will pay for itself in energy savings; imagine having your meter run backwards as you sell excess energy to your utility! A solar system also increases the value of your home.

Benefits of a 3 kW PV system

A 3 kW PV system will frequently provide 50% or more of the electricity needs for the average Colorado home.

Recurring Benefits (every year for 30+ years):

Annual electricity production:	4,375 kWh/year
Annual CO2 emissions reduced:	8,634 lbs/year
Equivalent reduction in vehicle miles:	9,444 miles/year
Equivalent number of trees planted:	332 trees

Year 1 Economic Benefits:

Annual electricity bill savings @ \$0.1/kWh:	\$422/year
Total increase in home real estate value:	\$8432

Year 10 Economic Benefits:

(Assume 5% annual increase in electricity prices)

Annual electricity bill savings @ \$0.163/kWh:	\$687/year
Total increase in home real estate value:	\$13,735

THE MECHANICS OF SOLAR PV:

The term “photovoltaic” literally means “converting light to electricity.” PV cells are comprised of semi-conducting material, usually silicon, which absorbs light energy and converts this energy into DC electricity. PV cells are generally combined to make modules, more commonly known as PV panels, which are combined into solar arrays. A solar array can be designed to meet almost any electric power need, large or small, provided a few important criteria are met to ensure maximum efficiency:

Siting – To generate electricity efficiently, solar panels should be oriented toward the southern sky, with a clear line of sight to the sun. There should be no obstructions (such as roof overhangs or trees) that impede direct sunlight at any time of the year as the position of the sun moves across the sky.

Tilt & Mountings – As the sun travels across the sky from east to west and the sun’s angle changes during different seasons, a solar array’s output and efficiency varies as well. Special mountings can automatically adjust a solar array for these variations, but these add to cost and maintenance; most home solar systems forego these additions. Instead, most panels are installed at the optimum average tilt angle of 35° to 40° -- which will allow the system to maximize power generation across all seasons.

Irradiation – Irradiation is a measurement of energy given off by sunlight in a given area, based on climate and geography. Colorado’s dry, sunny climate provides above average irradiation levels that make it the fifth most productive state in the country for solar generation.

Inverter – The PV array must be connected to an inverter, which converts the D/C electricity produced by PV modules to A/C electricity, the type of electricity we commonly use. The inverter is generally connected directly to the home’s utility meter.

TYPES OF SYSTEMS:

Grid Connected – Most often, household solar arrays are connected to the utility-owned powergrid. In this case, the grid stores excess power when the PV system generates more than is needed and the meter runs backwards (this is known as net-metering). If more power is needed than the PV system is generating, electricity can also be provided from a utility power source.

“Off-Grid” – In remote locations, connection to a conventional power grid may be impractical or impossible. In this case, a stand-alone solar array with battery storage can provide sufficient electricity to power to a whole household.

Battery Storage - An essential component of a stand alone system, many people are opting to use battery storage with grid connected solar electric systems as well. In grid connected applications, excess output from the PV array can be directed first into a backup battery before flowing into the grid. Homeowners often install battery backup systems to power essential systems (such as the refrigerator or computer) in case of blackouts. The number and size of batteries depend on the system and the user’s needs.

LEARN MORE

Center for ReSource Conservation: www.conservacioncenter.org

National Renewable Energy Lab:
www.nrel.gov/pv/ and http://www.nrel.gov/learning/re_solar.html

Colorado Solar Energy Industries Association: www.coseia.org



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