

# Solar Energy for Sustainable Year Round Production

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**Situation:**

The trend among many U.S. consumers to “eat fresh” and “eat local” has stimulated the popularity of farmers markets and community supported agriculture systems. Success in these markets has permitted many producers to center their work in these two ventures without turning to additional sources of profit.

However, cool weather during winter months prevents many farmers from producing. Not only do farmers suffer financial setbacks, consumers at farmers markets, CSAs, schools and other institutions lose access to healthful produce.

Santa Cruz Farm, which grows more than 70 different varieties of organic fruits and vegetables on its 3.5 acre farm at 5,800 feet at Espanola, New Mexico, found it difficult to supply enough produce to its market during winter months to stay financially secure.



Winter crops thrive in greenhouse beds.



Winter greens

**Objectives:**

With its Western SARE Farmer/Rancher grant, Santa Cruz Farm sought to:

- Increase the supply of organic vegetables during winter months using solar energy
- Share results with the agricultural industry through presenting its solar energy system as a potential model, by conducting tours and workshops



Greenhouses under construction at Santa Cruz Farm and Greenhouses

**Actions:**

The solar energy system implemented at Santa Cruz Farm and Greenhouses is a root-zone thermal heating system consisting of:

- Five solar panels 5 feet by 8 feet
- A 750-gallon underground water storage tank
- Copper and plastic tubing for closed-loop circulating systems
- Pumps and gauges needed for circulation the fluids

Here’s how the system works: The sun heats a water/glycol solution to 190-210 degrees. Glycol is the system’s antifreeze, keeping water from freezing in winter or turning to steam in summer. A two-loop closed system prevents the possibility of glycol leaking and polluting the soil.

The heated water flows through copper tubes to the underground tank, increasing the water temperature to 180 degrees. The tank water is circulated through plastic tubing running underneath the greenhouses in raised beds, increasing root-zone temperatures to 48-52 degrees through the winter, even when temperatures outdoors are below freezing.

This greenhouse atmosphere is enhanced with two insulating sources:

- A cold frame structure that shelters plants from wind and cold night temperatures
- A polyester blanket covering plants at night to direct warmth near the soil surface

**Results:**

The system requires only a minimal amount of electricity to circulate the water/glycol through the system.

During the first winter of use in 2005-06, the system cut the cost of fossil fuels previously used to heat the greenhouse from \$1,900-2,000 a year to zero. Results were the same in 2006-07.

Yields from greenhouse crops increased 30-40% in 2005-06. Yields were even more abundant in 2006-07.



Workers help install solar panels.

**Benefits or Impacts on Agriculture**

The system allows producers to enhance plant diversity. For example, the solar system has allowed Santa Cruz Farm and Greenhouses to add cooking herbs to the farm’s current mix of 72 plant species.

The increase in plant yields using solar energy raises earnings for producers while at the same time reducing the amount of fossil fuels required to run greenhouses and transfer food to selling destinations.

Hundreds of guests and producers have toured the greenhouses, and several have expressed interest in using the Santa Cruz Farm and Greenhouses model to build their own solar heating systems. In addition, Bustos has received inquiries from across the United States.



A tour visits the solar facility and greenhouses at Santa Cruz Farm.