



San Luis Valley Ecosystem Council Renewable Energy Briefing Sheet - Solar Energy

Decentralized Solar Energy

- San Luis Valley residents have been using solar energy for +30 years to heat their homes and water, and to grow food.
- Currently, Valley residents produce electricity on-grid and off-grid.
- Colorado allows homeowners to send power that is produced with photovoltaic panels into the grid. This is called decentralized energy. The utility companies can pay homeowners for the extra power produced.
- Photovoltaic panels have no moving parts and have a life expectancy of 20 years.
- Colorado utilities offer rebates to homeowners, and a federal tax credit is available for those who send power into the grid.
- Off-grid users are not eligible to apply for rebates.
- Energy consumption could be reduced by as much as 57% by employing well-insulated structures using energy efficient appliances.

Commercial Solar Energy Use in the San Luis Valley

- **The SunEdison photovoltaic plant PV is:**
 - 80-acres
 - 8.2 MW PV that generates power for Xcel.
 - Sited next to an existing sub-station and powers directly into the grid, reducing transmission costs
 - Non-consumptive regarding no water or use fossil fuel
 - A good example of small scale concentrated distributed power generation.
- There are 31 sub stations (Xcel & SLVREC) located throughout the entire San Luis Valley

Concentrating Solar Power (CPS) Plants



Artist Rendering of a Parabolic Trough CSP Plant

Background to Industrialize Solar:

For decades the Department of Energy (DOE) spearheaded scientific analysis in the Southwest to pinpoint areas with high levels of solar insolation (meaning measure of solar radiation impacting the earth surface directly).

In 2002, Congress mandated DOE to increase “new parabolic trough, power tower, and dish engine solar capacity.” Two years later the Western Governor’s Association authored a plan to organize Southwestern states to collaborate on solar power production of electricity. Using satellite imagery, geographic data, and sophisticated engineering models the National Renewable Energy Laboratory (NREL), closely associated with DOE, mapped and quantified states with superior solar potential including:

- ✓ Arizona (19,279 square miles with over 5.8 million gigawatt (GW) capacity);
- ✓ New Mexico (15,156 square miles with over 4.588 million GW);
- ✓ California (6,853 square miles with 2 million GW); and
- ✓ Nevada, (15,156 square miles with 1.6 million GW).

Later, NREL incorporated Colorado, Texas, and Utah into the network.

- ✓ Colorado was listed sixth among seven states with a potential of 2,124 square miles equaling 643,105 GW capacity.

“Connecting Colorado’s Renewable Resources to the Market” REPORT

Under the auspices of Colorado Senate Bill 07-0911, which created a Task Force, the original figure for “San Luis Valley and areas south and east of Pueblo” (landbase) for renewable energy production became a “hypothetical” 1,300 GW, without screening for sensitive land. The Report states “the entire area would be covered with [solar] equipment” to produce electricity at this scale. If 2 percent of the “land base” were put into production, according to this report, it would accommodate 26 GW of capacity. When other factors are analyzed (ex: sensitive land) a more realistic figure is 5.5 GW for production capability.

- 1000 kilowatts (kW) = 1 megawatt (MW); 1000 MW = 1 gigawatt (GW).
- 100 MW would supply power to roughly 40,000 homes

Utility-scaled Concentrated Solar Power Plant (CSP’s) plans for the Valley:

Parabolic-Trough: In operation for 25 years in California, this system is considered ready for industrial application at the GW capacity. Trough systems are composed of thousands of elongated curved mirrors called collector panels. Collector panels have a long absorber pipe running through the center to heat fluids like ethylene glycol, oil, or water. Oriented north and south, collectors are mounted on steel frames to track the sun as it moves through the sky. Once the fluid is super-heated, a transfer generation system produces high-pressure hot steam. Steam is passed through a Rankine turbine generator cycle to produce electricity. Reprocessing steam requires standard condensers, heat exchangers, feedwater pumps, and wet cooling towers.

To store energy after dark, there is experimentation with transferring the hot fluid into insulated holding tanks filled with molten-salt, which can then produce steam at night to generate power. Because molten-salt is very corrosive, metal components can experience problems. Mirrors are vulnerable to dust and wind. Parabolic-trough systems use fossil fuel backup, such as natural gas, to maintain levels of power and to be cost effect. This is called “hybridization.”

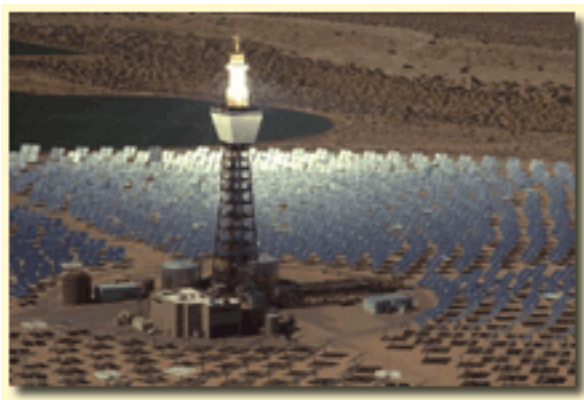
Concentrating Solar Power (CSP) plants operate in a similar manner to conventional power plants and require structures 15 to 50 feet high.

Water Use Trade Off

While California CSP plants used 1.3 acre-feet of water annually per acre of solar field for producing steam, for periodic cleaning of collectors, and for plant operations, NREL estimates that a CSP plant will use 1 gallon per kW hour produced for the wet cooling, and 0.1 gallon per kW hour for dry cooling. In a 2008 assessment, NREL stated that CSP plants require 750 acre-feet of water for every 100 MW produced for a wet cooling system and 75-acre feet for a dry cooling system. Though wet/dry (hybrid) cooling is possible, efficiency is lowered and energy costs are increased by 10% when less water is used. This is why the Western Governor's Association cautioned that use of "water" by CSP's is a "significant issue."

CSP Facts:

- Impact is created when producing electricity.
- A one gigawatt-sized trough plant will need 5,000 or more acres of flatland.
- A cost effective land base to place a CSP must have a 1% slope or less.
- CSP's with storage capability require more land.
- According to NREL, CSP plants typically use "quasi-hazardous fluids" in absorber pipes.
- California plants annually used 15,000 gallons of these fluids;
- California plants have experienced occasional accidental spills due to pipe and equipment malfunction;
- Like conventional power plants, CSP's use chemicals to treat water, for the cooling tower, and for boilers.
- NREL and DOE state that "sites with sufficient aquifer or other water resources" are a consideration in siting CSP plants. The report notes that one CSP trough plant at Kramer Junction, California, which sells power to Southern California Edison, uses aquifer water to operate.



Power Tower is the second type of utility-scaled solar thermal generator proposed for the San Luis Valley. This system uses large mirrors or reflective membranes (heliostats) to focus sunlight on a center tower, or receiver, filled with molten-salt or other fluids. Like the trough system, the power tower uses a conventional steam generator to produce electricity. SkyFuels is proposing to construct this system in the Valley. Though the heliostats are different and the power tower

may be hundreds of feet high, this CSP plant functions similarly to the parabolic trough.

CSP Plants Require Large Transmission Lines

Unlike SunEdison and panels on homes and businesses, which send solar power directly into the existing grid, CSP plants require high-voltage transmission lines to export electricity. Low-voltage transmission lines currently in the Valley can't carry the load required to export power.

To produce power on a utility scale, CSP requires 230 kW line, according to NREL. Transmission lines cost \$1 million per mile or more to build, according to the Colorado Energy Forum. To underwrite costs, the Colorado legislature allows utilities to charge **customers** for transmission lines as they are being built. Current plans are underway to increase lines to a 230 kW voltage. This would require at least a 100 foot right-of-way.

Recommendations:

- **State and federal governments need to offer better tax incentives for residential off-grid and on-grid for production of electricity.**
- **The public needs to inform itself about the trade-offs regarding Concentrated solar vs. Distributive solar systems**
- **The San Luis Valley is facing a tremendous opportunity but caution must be exercised regarding industrialization of the valley floor.**

