

SPREADING SOLAR GREENHOUSES IN BOLIVIA TO INCREASE CROP PRODUCTION IN COLD CLIMATES

In the Bolivian highlands, the ecological solution of Solar greenhouses (*Carpas Solares*) has been successfully promoted over the last ten years by the Ministry of Rural Development and Lands MDRyT of the Government of Bolivia and by the Governments of different Departments and Municipalities, to improve the production and consumption of vegetables and other productions in these territories characterized by extremely low temperatures.



Carpa Solares are a kind of solar greenhouse infrastructures that allow the generation of an environment with a microclimate suitable to the cultivation of vegetables, legumes, fruits, aromatic and medicinal plants. With a good management of the greenhouses it is possible to maintain temperatures between 17° C to 27° C during the day and not less than 5° C during the night. These temperatures are suitable for growing different species of vegetables and other productions.

This solar greenhouse is a simple construction whose roof is made of a material that lets sunlight in, facilitating the accumulation of heat during the day, and releasing heat during the night, when temperatures drop drastically. In this way, the temperatures inside the greenhouse during the night will always be higher than those outside. In its longitudinal part the greenhouse should be oriented east to west so that it has more exposure to the sun. The roof of the greenhouse, which is sloping facing north, is made of a material (agrofilm) which allows a greater concentration of heat and reduces loss of the water generated by the evaporation of the soil and the transpiration of the plants.



In Bolivia different models of Solar Greenhouses are used. Some models are built on the surface and others are semi-subterranean, built by excavating the ground. The ones built on the surface can be one fall models, two fall models or tunnel models. In all cases, greenhouses need to be built on sites where there is a permanent availability of good quality water, where they can receive at least 5 hours of sunlight a day and the soil is suitable to grow vegetables and other plants.



The construction of a *Carpa Solar* is simple and uses low cost materials found in the territory: adobe, stone and mud for the walls, wood or iron for the roof frame. Nevertheless, the basic characteristics of the *Carpa Solar* have been improved over time with new technological measures, like the cisterns of water storage with photovoltaic systems in the Department of Oruro.



[The Autonomous Departmental Government of Oruro](#) made in 2018 a very positive evaluation of the 182 *Carpas Solares* functioning in the territory and took the decision to implement other 118, with their systems of panels and water cisterns, investing funds from the Departmental Government and contributions from the Municipalities. With this system

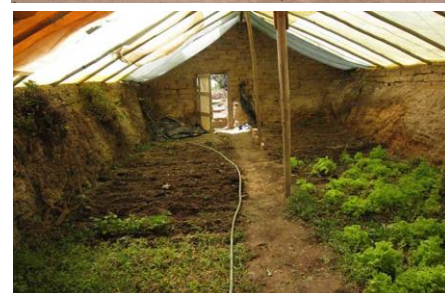
of 300 Solar greenhouses, the Plan aims at an annual production of 600 metric tons of vegetables. Among the results of impact achieved by the *Carpa Solares*, the Departmental Service of Agriculture of Oruro has emphasized the production of different foods, taking advantage of the potential of soils for agricultural activity and the fact that the cultivated vegetables had the quality to be certified as organic products. Based on the Plan approved in 2018, the Departmental Service of Agriculture will contribute to the processes of production and commercialization through local and national fairs, and will also facilitate the procedures of the farmers to obtain the certification of organic product, granted by the National Service of Agricultural Health and Food Safety (Senasag).

Carpas Solares are also used to produce ecological food in urban gardens within the framework of the [National Programme of Urban and Peri-urban Agriculture](#) of the Ministry of Productive Development and Plural Economy. The Programme has been designed so that low-income families in urban and peri-urban areas can become producers of food, generating income and improving their eating habits. Implemented in 2003, [this Programme has achieved impact results](#) in very different cities and contexts throughout the country. [Solar greenhouses were also essential for gardening in the Municipality of El Alto](#). In their *Carpas Solares*, families cultivated up to 32 recommended plant species, including nutrient-rich vegetables that were previously unknown and pesticides were not used.

FAO has accompanied national efforts to implement the greenhouses as a sustainable solution to mitigate vulnerability to food insecurity in the highland regions. Among its initiatives, in 2012 FAO collaborated with the Ministry of Rural Development and Land for the production of the [Guide for the construction of greenhouses](#). The Guide presents technical elements and the steps to follow for the construction of greenhouses of one fall. In 2012, in collaboration with the Ministry of Rural Development and the European Union, FAO has also produced a [Guide for the construction of Wallipines](#) for pasture production. Wallipines are semi-subterranean greenhouses which can be used for the cultivation of different plants and this Guide is a useful tool presenting in detail technical characteristics, the necessary materials and procedures for its construction.

These semi-subterranean greenhouses are currently being promoted for their [energy efficiency within the framework of advanced bio-construction trends](#). By taking advantage of the average annual temperature of the soil, which is more stable and warmer than outside, they manage to create a more stable microclimate indoor, favoring crops all year round. In addition, they minimize water consumption, because the underground walls of earth help to retain humidity. The potential of these structures for sustainable agriculture is been highlighted in various specialized magazines.

Various associations and professional groups of ecology and sustainable agriculture in Bolivia support the development of solar greenhouses by providing funds, technical assistance, disseminating manuals and guides for their construction and for organic crops. These solutions have been implemented to ensure that low-income communities in the cold regions of the plateau have the possibility to diversify the food they consume and increase their economy by generating income from their sale. However, they have demonstrated a great potential and are now among the most advanced means for agro-ecology. These greenhouses can be managed by families, cooperatives, or commercial enterprises and their development will contribute to the transition towards sustainable agriculture, favoring the cultivation of vegetables and other organic, local and high-quality products in all territories characterized by cold climates.



To know more

[Plan de Carpas Solares en Oruro 2018](#)

[Carpas Solares y Huertos Urbanos](#)

[Carpas Solares in El Alto Municipality](#)

[News in FAO Bolivia 2015](#)

[Huertos Urbanos Oruro in Facebook.com](#)

[Agriculturaurbanaelalto.blogspot.com](#)

[Carpas Solares in remar.org](#)

[Carpas solares en losguardianesdelatierra.wordpress.com](#)

[Guía para la construcción de invernaderos - FAO](#)

[Guía para la construcción de Wallipines-FAO](#)

[Constructing passive solar greenhouses in cacilm.org](#)

[Como construir un invernadero subterraneo in ecoinventos.com](#)

[Invernaderos subterráneos in climabio](#)

[Manual de construcción y manejo de Walipines in simientedisidente.com](#)

[Carpas Solares in Peru Acorde Facebook](#)



LA PATRIA



CARPAS SOLARES Y HUERTOS URBANOS
una opción para producir nuestros
alimentos ecológicos

