20 YEARS OF SOLAR COOKERS IN CHILE
20 años de cocinas solares en Chile

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Solar cooker transference processes and new technologies are 20 years old in Chile, a long country with many different cultural, climatic and systemic situations. Evolution in methodologies for appropriate social, cultural and environmental transference for solar cooker and solar oven models have a long process, with professional design approaches and participative collaboration from the user's experience. This paper includes an historic view of the different models used in Chile, user's results, and an analysis of different transference methodologies used for social diffusion programs between 1975 and 2005.

Keywords: Solar cookers, ovens, Chile, history, designs, transfer methodologies.

RESUMEN

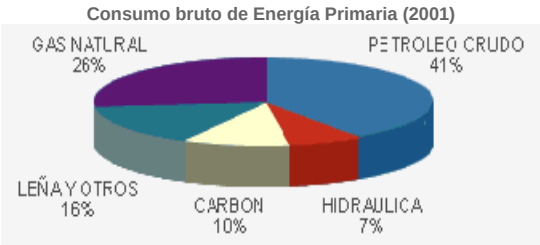
El proceso de las cocinas y hornos solares y nuevas tecnologías en Chile alcanza ya los 20 años. Un país muy largo con diferentes situaciones climáticas, culturales y sistémicas. La evolución en torno a las metodologías para la transferencia social y cultural de modelos solares ha tenido un largo proceso, con diseño profesional y una participación colaborativa por parte de la experiencia de los usuarios.
El documento incluye una mirada de los diferentes modelos usados históricamente en Chile, los resultados con los usuarios y un análisis de los métodos de transferencia usados para los programas de difusión social entre los años 1975 y 2005.

1. INTRODUCTION

To understand the history of solar cookers and ovens in Chile, it is necessary to appreciate that Chile is an extremely long country, and therefore has an array of all the climates present on the planet, from the driest desert in the world, to the southernmost city in the world. This implies that the viability of solar equipment is, firstly, framed within the restrictions posed by the different climates found in the country. Secondly, the largest portion of the population is concentrated in the central zone of Chile between and around 30 to 35 º S and live in cities permanently supplied with conventional energies. Also, Chile has developed considerably, achieving acceptable levels of "quality of life" and income for its inhabitants. That is, the classic niches for the diffusion of solar cookers in Latin America, such as a a poor population and the needy groups, are more of an exception than the rule in Chile.

Nonetheless there are two characteristics that support the idea of expanding the use of solar ovens and cookers: The first is that the northern half of Chile is an arid desert territory with small inhabited valleys which used to be green but that are in a frank process of desertification due to the intense use of wood as firewood. The second is that, while Chile is a country rich in sustainable energies such as solar, wind, biomass, geothermic and oceanic energy, it presents the great contradiction of sustaining its energetic demands on contaminating non-renewable energies depending on international markets that it does not control. Better said, the current national energy matrix is unsustainable, non-renewable, geopolitically fragile and economically expensive and has considerable negative environmental impacts.

Gross energy consumption in Chile 2001 (source: CNE)



For the above reasons, the solar cooker and oven programmes in Chile have targeted strategies aimed against desertification in rural territories and support development policies for needy rural or periferic-urban communities in high isolation zones.

On the other hand, these types of programmes never received the attention of the government funded programmes that are committed to the transnational energy lobby, which explains why promotion of alternative energy sources have remained in the NGO community and through projects financed with the cooperation of the international agencies.

However there is hope, since 2005 the State has shown renewed interest in reformulating the long term energy policy, and some government social development agencies are 'discovering' the socially appropriate technologies, especially solar, as effective tools of improving the quality of life of vulnerable communities.

From research to social programmes

Cooking with the sun is an ancient activity. In the Universidad Santa María there are records of cooking experiences in the 1950's using an old aviation reflector and also the first greenhouse solar boxes around the 1960's. All this was the work of students in the field of thermodynamic research.

The author developed two solar models in 1976, one with a parabolic cylinder reflector onto a greenhouse box and a rotating paraboloid used as a reflector for solar cooking in the Universidad de Chile in Valparaíso, also in the academic field.

The first solar cookers in use for social programmes were developed by the author in CETAL in the early 80's, with no further developments except the for trainings in international schools for monitors in appropriate technologies (1980-1984).

2. THE STORY

Historically, the first national effort to develop more massive solar cooker programmes was made by INTA, the National Institute of Food Technology, with a group made up of three professionals interested in food development processes.

2.1 Villaseca

In 1989 the INTA carried out the first national contest where solar cooker inventors presented 14 models, most of which have a solar greenhouse box. In this contest, the most effective, most economical, and replicable model was a solar box made by Víctor Pinto (Engineer from the Universidad de Chile), which in the coming years was the energy basis of the first entirely solar powered restaurant in Chile in 1994. One internationally renowned project and emblematic in the field is a restaurant developed by the Solar Craftsmen of Villaseca. Villaseca is a town in high altitude in the Elqui River Valley, a highly desertified zone in the 30ºS latitude. This project has received support from INTA, Canelo de Nos, Global Environment Facility (GEF), etc., and has been the center of solar development in the surrounding valleys. Its creators have also been first-hand monitors in other solar projects and cookers:

Solar cookers type greenhouse boxes : Mod. V. Pinto; in the Villaseca Solar Restaurant: (photo PNUD) (2003)

Parabolic cooker **C05 Artesol in Villaseca (1989)**

The Villaseca solar oven has a absorption area of 250 cm^2, common aluminum paper reflectors, double glass, and insulation (3cm). It cooks a portion for 5 people in 2 hours, in 30ºS latitude and 560 m above sea level. There are 340 days a year that are completely sunny in Villaseca, and it is one of the zones on the planet with highest radiation levels.

The parabolic cooker has an absorption area of 1.1 m^2, on a 60 cm radius and 50 cm focus rotation. The reflecting

surface uses is a common commercial mirror, that has turned out to be better, more washable, and does not turn opaque with time (proven for 10 years) compared with metalized sheets. This cooker reproduces the thermic parameters of a domestic gas burner (1,3 KWH) and boils 3 liters of water in 20 minutes.

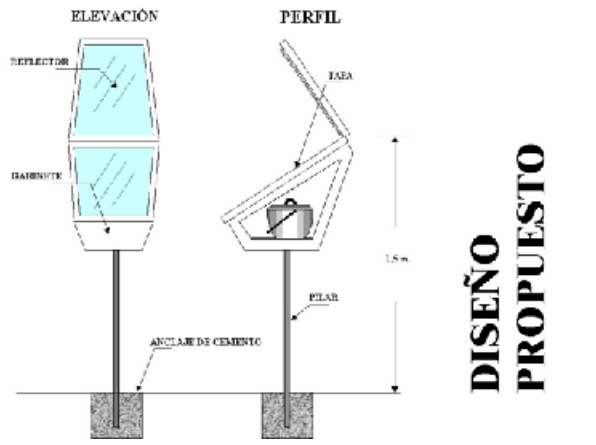
Both cooker projects have been developed in Villaseca since their beginning until 2006, accumulating 20 years of experience. This project has irradiated the concept, the methodology and the technology of many other projects in the national and international field.

2.2 Pichasca

Pichasca is a small locality of the Río Hurtado Borough, a valley south of Villaseca, where a project against poverty and desertification is being developed, supported by the European Union and implemented by the Canelo de Nos Corporation.

The use of solar energy for the drying of products, heating of water, sanitary management and solar cooking are developed in this project, parallel to community development and the fight against desertification. Other activities include a radio station -Terral- that complements the idea of territorial identity. In this project, an advanced model of a greenhouse box solar cooker is used, developed and designed by the engineer Oscar Nunez M. This model provides advances over the Villaseca model. Its metal is more durable and serial production has begun for the first time in Chile.

Modelo Pichasca, Corporación el Canelo 2003



Cookers in use:

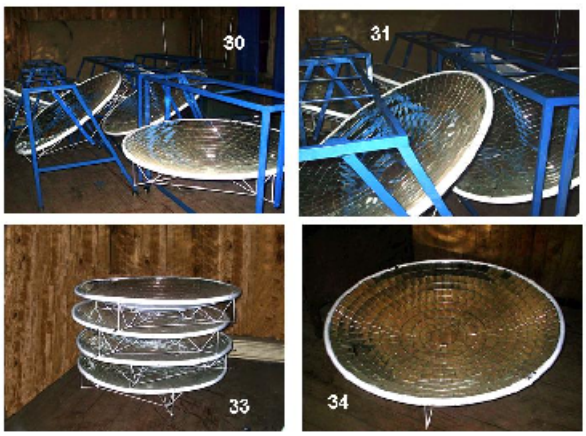
The series production models allow the development of transference programmes, where the beneficiaries can participate in the assembly of pre-made parts that later, with practice and a larger investment, can give way to small local businesses that have the models and the technological know-how.

2.3 Calama

In this case, it is a parabolic solar cooker educational transference project in a city in the Chilean desert: Calama, in a high altitude valley (1000m) of the Atacama desert on the Tropic of Capricorn latitude. It is a mining city in an old oasis of the Inca Trail. There are rural inhabitants in the peripheral part of the city that live in extreme poverty, and paradoxically use wood as combustion.

In this case, with the support of PNUD and a small grant from GEF, the complete transference of construction processes and use of parabolic solar cookers, based on the CS05 Artesol model implemented in 1989 in Villaseca, is being developed. The new model has a metal structure, a parabolic shell made of polyester reinforced with fiber glass. The reflecting cover is still a common mirror cut into exact pieces

Parabolic solar cookers Calama 2007



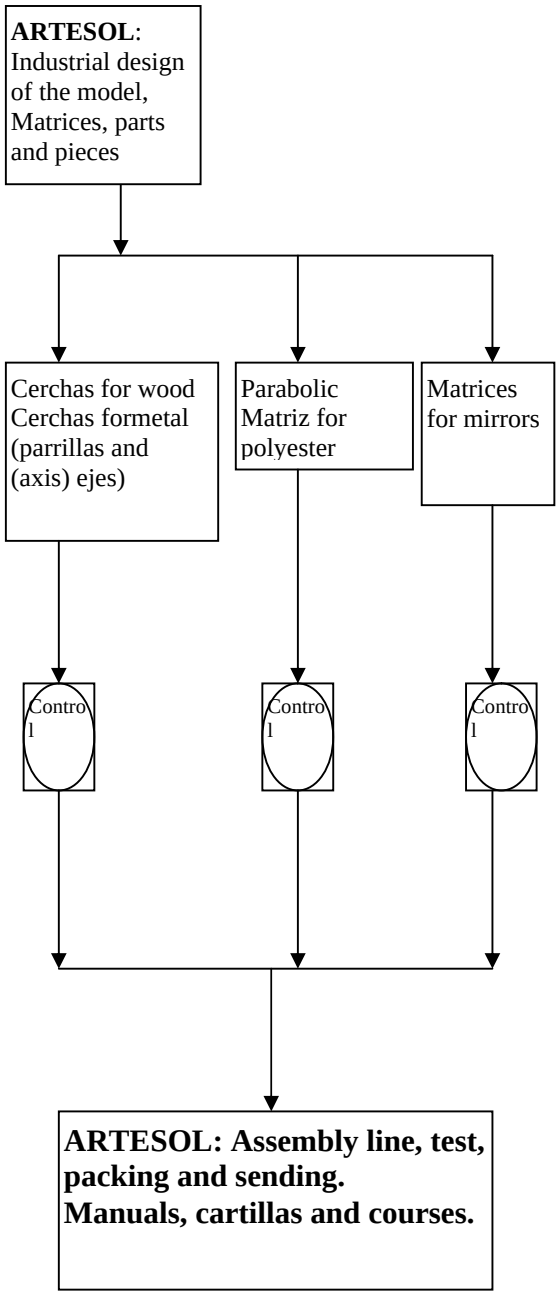
Molde definitivo de paraboloide en Calama

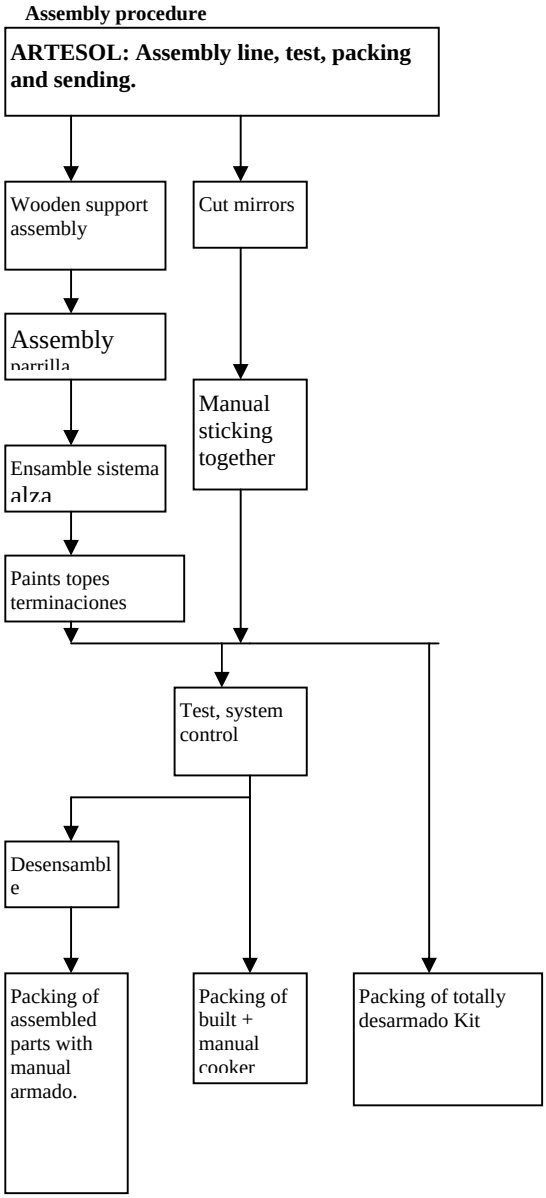
Placing the mirrors, Calama 2007

The importance of these initiatives is that there are already massive production models capable of locally developing good quality production, based on tested technology that has been successful in the last 20 years. The most important thing to mention here is that in any case, the technology is worthless unless it is accompanied by a social development and educational programme, that usually takes longer and is more complex than the technology itself. This is always a difficult issue to establish when there is a government that works politically around statistical numbers and not generating capabilities. Nevertheless, the Canelo Corporation has been able to sustain the idea of social projects where technology always has a complementary place.

Also, the procedures concur in the idea of "Joint-ventures" of popular characteristics. That is, the designs are built with the input of parts from different local micro-businesses, to which technology has been transferred educationally. This is an outstanding feature of the historical development process of solar cookers in Chile.

Typical diagram of the serial production of CS05 by local micro-businesses (artesol 1998)





This procedure, with some differences, is the one still being used in current development programmes that use solar ovens and cookers as part of their technological offer.

In Chile today (2006) 4 regional programmes with solar cookers are being developed, and there are development institutions that manage technology, all of which are based on the Villaseca experience and the original Artesol designs in the decade of the 1980s.

3. CONCLUSIONS

In spite of the fact that nowadays Chile has good numbers in relation to its development state, compared to other countries in the continent, solar cookers still have a special relevance in certain niches because of the geography, climate and social situation. Maybe the most important achievement is the development of extremely tested designs, of very good quality, solid and excellent construction, that can be done in small business, accompanied by social and educational programmes.

Another important achievement is that in the last two years there has been increasing interest from government institutions for the results with solar ovens and cookers projects. The latter assures new financing possibilities and possibly larger scale production. The last 20 years have meant a process of constant advances that will possibly give its more political fruits during the first ten years of the century.

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