

Sazon del Sol.

Production of solar processed food in search of alternatives in nutrition, conservation, diversification and valorisation of resources in Oaxaca, Mexico.

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In the context of a solar cooking promotion project in Oaxaca/Mexico (“Cocina Solar Mexico”, since 2009), some four years ago banana has been dried and sold. This led to the idea of starting a small independent company selling solar dried products. One reason was to prove to the still reluctant population that solar food processing can be an interesting business. The micro-company kept growing, new products were added almost every week and production was extended to solar cooking and baking (as compared to the initial solar drying). Sale of the products in cafés and bakeries in Oaxaca started, as well as on events and in the 'solar office' (run by the promotion project).

The mission: “La Sazon del Sol is a project which is dedicated to the use of solar energy for production, design, innovation and handling of healthy food, leading to a low environmental impact in its production. The interest is that solar cooking is part of the daily life which directly reflects to ecology, economy, health and autonomy of the people.”

Actual situation: Various solar technologies are used and their advantages studied (parabolic cookers, box cookers, heat retaining bags and solar driers); trainings are held about the construction and use of such devices. The offer of products has been extended from sun dried fruit to a wide choice of gourmet products in jars, bottles and bags: flavoured mustard, marmalades, dressings, sauces (for pasta and spicy), syrup, pesto with dried tomato powder, ghee, chutney, pickles and much more. Three to four persons are working every day in the solar kitchen (8 persons have been trained in its history). These jobs have been created in rural Mexico, as the production facility is in a small village. All products are 100% natural without any chemical preservatives or colourants and the raw products are bought with priority from small local and organic producers. No white sugar is used anywhere, only agave syrup and raw brown sugar in a few mixtures.

Experience: The experience has shown that pure sundried fruit does not sell well in Mexico, so the fruit has been combined with other flavours (like mango with chilli, banana with cacao, apple with chai) and transformed into many new products (fruit bars, energy bars, cookies, even cosmetic). Other sundried products have been developed like bouillon powder based on dried vegetables, herbs and spices (a sales hit) and a variety of herbal tea mixtures (including dried fruit and flowers).

Future: In 2016, a lot of effort is made in the construction of a new kitchen building which will include a shop and a café.

Conclusion: It has been shown that with small scale solar technology a large variety of everyday and gourmet products can be processed and that there is a market for such products mainly in cities in Mexico.

1. History

In the context of a solar cooking promotion project in Oaxaca / Mexico (“Cocina Solar Mexico”, since 2009), experimentation began in construction of solar technology, specifically solar tunnel dryers [1]. From these experiments came the first sundried products; the first fruit was banana, it was processed and sold, opening the path to other fruits. This led to the idea of starting a small independent company selling solar dried products. One reason was to proof to the (still reluctant) population that solar food processing can be an interesting business. The micro-company kept growing, new products were added almost every week and production was extended to solar cooking and baking (as compared to the initial solar drying). Sale of the products in cafés and bakeries in Oaxaca started, as well as on events and in the 'solar office' (run by the promotion project).

At present, a house is rented in the village where the food is processed and where the workshop is situated. Adjacent to this, a little café was opened to expose the products and to offer various freshly cooked dishes (prepared on solar cookers). In addition, trainings are organised and catering is offered – yet more ways to promote and demonstrate what is possible with solar energy...

2. Concept and description.

La Sazon del Sol is a project focused on energy sustainability. It promotes the use of solar technology in the kitchen. Cooking and eating is a basic human need and induces daily energy consumption (gas, electricity, wood and/or charcoal) which can typically be reduced by 50% using renewable energy, lowering the environmental impact caused by fossil fuels and other non renewable power sources. The goal of La Sazon del Sol is to develop and provide healthy food of local and organic origin, processed with the sun.

Fruits and vegetables are procured from small producers from different regions and climate zones of the state of Oaxaca; benefiting from the fact that the state is rich in diversity, having mountains, coasts and valleys, where a wide variety of fruit is grown. Other goals are paying a fair price in the purchase of raw materials for solidarity and support of small farmers and the valorisation and preference of native chemical-free fruit.

La Sazon del Sol proposes to design foods that can be used at any time and that meet nutritional needs and to compete with industry, educating the population about nutrition and how to care for the environment. La Sazon del Sol wants to show the variety of food that can be prepared using renewable energy – specifically solar energy - and the resources that are at hand favouring autonomy.

3. Technical description.

The following devices are used for the food processing:

- Three solar tunnel dryers of different sizes are in use: the first is 6m by 1.2m with a capacity of 20 kilograms of fresh fruit per charge, the second is 2.4m by 1.2m with a capacity of 8 kilograms of fresh fruit per charge and a third is 1m by 2m, reserved for herbs and leafy vegetables, it's capacity is 5 kilograms per charge. Each device can do two drying runs per week, adding up to two loads per week per dryer.
- There are two small domestic solar cookers ('Hot Pot', [2]), with a capacity of 4 litres each. They are used to make jams, sauces and breads.
- There are also two parabolic cookers of 1m in diameter available, which serve for frying, roasting or cooking different foods and seeds.

- To prepare breads, granola, cookies, cakes, sterilizing jars, etc., a ULOG type box cooker was fabricated in the workshop of the 'Cocina Solar Mexico' project.
- Some devices belonging to the project 'Cocina Solar Mexico' can be used as well, for instance a solar steam generator [3] which serves for the sterilization and vacuum sealing of jars for jams and preserves.
- A "Scheffler" cooker [4] of 2,7m² serves for food sterilization and cooking in general.

With all this equipment a variety of food is elaborated and processed.



Picture 1. The author is filling one of the dryers.



Picture 2. The smaller solar cookers are exposed in front of the current production facility.

4. Organisational description.

The team at La Sazon del Sol varies. In principle three to four women work in food processing (8 persons have been trained in its history). The production is based on seasonal fruits and vegetables, looking for different recipes and applications to use the most of them. For example, apple can be prepared as dry fruit for snacks, its dry peel is used in herbal teas, and the core of the apple (containing a lot of pectin) serves for marmalades of fruit with low pectin content.

The products are distributed in different cafés, bakeries and community stores around the city of Oaxaca, they are sold on events about ecology or nutrition and by participating in a collective solidarity economy where products are exposed and exchanged using a local currency called 'Tumín'. Once or twice a year, the dried articles are sold in Switzerland to acquaintances, friends and partners of various projects.



Picture 3. Products are offered in a bakery.



Picture 4. A sales stall at a fair.

5. Offer.

La Sazon del Sol has two lines of offers which are *products* and *services*:

- The **products** made are focused on being healthy and nutritious foods that provide energy, health and at the same time compete with industrial products of their class, improving flavour and quality with the resources at hand. It is for this reason that every week a variety of recipes are tested and adapted to the available ingredients which must be seasonal, local and free of chemicals.
- Besides food, solar *technology* is also sold, such as solar ovens and dryers which are made to order.

The range of different foods processed with solar energy by La Sazon del Sol is compiled in the following table.

Product	Characteristics	Product	Characteristics
Dried fruit	Mango, papaya, banana, apple, pear, guava, starfruit, coconut, pineapple, orange, tangerine, all 'natural' or flavoured with with hints of spices; for example: cacao banana, mango chilli, apple chai, etc.	Consommé and seasoning	These are mixtures of various organic vegetables, sun dried and combined with amaranth, spirulina algae, sea salt and spices that serve to flavour the food and enhance its nutritional value. There are the following presentations: 'classical', 'with dried tomato', 'oriental' and 'Oxaquita' with herbs that are endemic to the area.
Marmalade and jam	These are made with the ripest fruit, combining different flavours and spices to increase the variety, they are sweetened with raw	Hot sauce	Different hot sauces with a variety of sun-dried or fresh chillies, packaged, they cannot be missed on any Mexican eating table.

	brown sugar or agave syrup for diabetics.		
Tomato sauce for pasta and soup	Spicy organic tomato sauce in a jar, enriched with different vegetables and dried mushrooms, to be served instantly.	Dressings	Made out of fruit, olive oil, apple cider vinegar and salad spices.
Chutney.	Mixed fruits and spices, most bought by foreign visitors.	Ghee	Purified butter, lactose free, long conservation time.
'Pestomate'	Pesto sauce with dried tomato; a combination of walnut, almond, sunflower seed, basil, dried tomato and olive oil.	Preserves and pickles	Fruit in syrup (sweet) or pickled vegetables (salty)

'Chocofruta'	Sun-dried chocolate bar made out of roasted cacao, fruit and agave syrup; 'candied orange', 'coconut mint', 'passion fruit', 'orange with chia seeds' and more.	Granola.	Mixture of grains, seeds and dried fruit sweetened with agave syrup. Varieties: 'chocogranola', 'spirulina algae', 'natural' and 'cinnamon apple'.
Energy bars	Fruit bar with special seeds and grains to provide energy.	Fruit bars	Fruit pulp mixed with spices or seeds, for example with chia seeds, chilli or cardamom.
Quick soup	Various combinations of vegetables, seeds, grains and legumes to prepare soups quickly, rich in nutrients and flavour.	Herbal tea and fruit tea	Mixed sundried fruits, herbs and flowers in different varieties: 'relajante' (relaxing), 'fresquita' (digestive), 'calido invierno' (for defences), 'armonia' (antioxidant) and fruit teas.
Powdered seed and fruit drinks	Powdered seeds and dried fruits to prepare vegetable milks, smoothies, 'atoles' and mash	Mustard	Grain mustard mixed with spices and dried fruit, dried chillies and herbs (different varieties).
Kombucha 'with a hint of something'	Probiotic drink based on green tea and brown sugar, sundried fruits, flowers and herbs depending on the recipe.	Syrup	Concentrated fruit pulp with brown sugar to produce fresh drinks and cocktails.
Balm	Lip balm based on beeswax, coconut oil, essential oils and sundried	Facial mask	Mixture of oat, clay, aloe vera, cucumber and calendula flowers for facial cleansing.

	fruits like carrot, beet, blackberry and strawberry.		
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Table 1. Solar food and some cosmetics produced by La Sazon del Sol.

- The **services** offered are a cafeteria which is open all week and a vegetarian menu three to four times a week. Bread, biscuits, vegetable stews and other soups, etc., are prepared with the solar cookers and ovens.
- Different types of trainings and workshops are organised as well. For example construction of solar ovens and dryers, vegetarian cooking, preparation of jams, etc.



Picture 5. Energy bars ready for sale.



Picture 6. A variety of mustards.

6. Experiences

- Throughout the life of the project it has been learned that dried fruit does not sell very well to Mexicans (they sell a little better with foreign tourists however). For that reason different foods are created where sundried fruit can be integrated (examples: herbal teas, biscuits or even cosmetics) and thanks to this the number of products grows and the offer keeps on improving.
- It was also found that there is some small-scale production of fruits and vegetables in the area which are little valued and under-utilised.
- In the Central Valleys of Oaxaca, where La Sazon del Sol is situated, there is a perfect climate for solar drying and cooking, since solar incidence is very abundant and covers almost all year. Even in rainy season there is sunlight, allowing to work almost all year and keeping solar food processing profitable.
- Product sales are better in cities, in the village sales are a little more difficult as the products are something new and strange to people. Gradually the villagers begin to know the benefits and are inclined to them. For export the choice of products is limited to lightweight products (dried articles) as heavy weight transport is expensive.
- As pure dried fruit does not sell well, mixed products have to be found with different spices or adding seeds; for example, mango with chilli, pineapple with coconut, pear with mint, banana with cacao, apple with chaï spices and others.
- It is very important to improve products and to be creative considering current needs and the resources at hand.
- The conservation of several local plants is promoted. These plants are gradually forgotten but they provide many nutrients and at the same time they grow easily

without chemicals and with little work. La Sazon del Sol introduces them into new recipes. Examples are chickpea, 'chepiche', 'chepil', 'rabbit grass', amaranth, 'epazote', etc.

- It was learned to use the maximum of each fruit at all degrees of ripeness as each one of them brings something different and can serve in many ways to other products. For example, apple is used as dried fruit or jam, apple peel serves for herbal teas, and the core to thicken jams of other fruits which are low in pectin. So we have a better use cycle where there is taken advantage of all the vitamins and all the energy in the processes.

7. Innovation in solar food

Some of the innovative recipes that were designed are loved by the customers for their great taste.

The following products show the best results in sales:

Consomé: Prepared with a great diversity of sundried vegetables it replaces certain products like "Knorr Suiza" (stock cubes, used a lot in Mexico) which are full of glutamate, salt and grease. The proposal of La Sazon del Sol has improved nutritional value and flavour.

'Chocofruta': A rustic chocolate with pieces of cacao and mixed with (confined) fruit and agave syrup, all together dried in the sun they result in a rich culinary experience for the customers.

Granolas: All of them full of different fruits and with a touch of spirulina algae or cacao or cinnamon.

Energy bars: An 'bomb' of seeds and fruit ready to provide real energy for children, athletes and anyone with a demanding lifestyle.

Quick soups: Rescuing many wild herbs soups are proposed that can be prepared in 5 minutes with all the nutrients and without artificial flavours or flavour enhancers.

Kombucha: A probiotic drink which is currently very popular gave the idea of mixing it with different dried fruits and herbal teas of the own brand.

Always looking for new uses of dried products (fruit and vegetables) now they are integrated in cosmetics, balms and face masks which are highly successful in sales.

8. Future

With great effort and support from two Swiss NGOs, the construction of a new processing centre has been started. It is specially designed and will be equipped for solar processes. It is currently under construction and waiting to be completed early 2017. There will be two storage zones (wet and dry), a kitchen with architecturally integrated solar driers which can be used from inside, a shop, a workshop and a cafeteria area which can also serve for cooking lectures. All building materials are natural. There will be a garden where a part of the vegetables, fruits and aromatic and medicinal herbs for the preparation of the products will be grown.

It is planned to increase production by 50% and generate more jobs and provide volunteer training opportunities to anyone who is interested in the processes and in solar cookers.

9. Conclusion

It has been shown that with small scale solar technology a large variety of everyday and gourmet products can be processed and that there is a market for such products mainly in cities in Mexico. The success of the products of La Sazon del Sol is – besides being solar processed - due to their innovative, healthy and tasty recipes, its incredibly wide choice of articles, its concept of using the most of each fruit, its consequent concentration on local and chemical-free fruits and vegetables and its integration of 'gradually forgotten' local plants.

References:

- [1] For large models see <http://www.innotech-ing.de/Innotech/english/TT-Dryer.html>
- [2] <http://www.ollasolar.com.mx/>
- [3] Presented in 'If no one copies it or tries to steal it – is it worth nothing? State of the art of small automatic parabolic trough steam systems for food processing', Michael Götz, same conference
- [4] <http://www.solare-bruecke.org/index.php/en/die-scheffler-reflektoren>