

Extension of shelf life of fruits and vegetables from the Kaiserstuhl area through utilization of solar thermal drying and regional marketing of the products

The project described in this abstract shows the essential aspects to be considered in order to attain sustainability in food processing. It is also a prime example that could lead to a strategy for how industry could cut down energy consumption and CO₂ emissions.

The newly (2013) founded trade „Sonnenobst“ (sun fruit) sets high standards for the sustainable preservation of food by drying. Fruits and vegetables are purchased and harvested at regional ecological farms and gardens. The drying process is driven by solar energy. Finally, the sale of the products is run by regional marketing networks.

The raw materials i.e. fruits and vegetables are purchased from regional partners from the “Kaiserstuhl” region near Freiburg, Germany. They are exclusively ecological working gardeners and wineries. The effect of processing regional products is, that they can be used in further ways in addition to being sold as fresh fruit and vegetable. On the long run, this could strengthen the still fairly insecure financial situation of ecological farming. Right now in Germany, ecological farming is declining due to economic pressures.

In addition to purchasing raw products from farms, the staff of “Sonnenobst” harvests from orchard meadows with standard height trees and seasonally also cares for these important wild life habitats.

In a second step, the fruits and vegetables are dried to extend their shelf life by using an innovative food drying system powered by solar energy. The system consists of the following components:

- Evacuated tube air collector (24m²; ~16.8 kW)
- Hot air stone storage tank (1,5 tons)
- Food drying chamber (75 kg per batch)

The measurement and control system is designed in such a way that in combination with the heat storage tank the use of solar energy is prolonged. Excess heat produced during peak sunshine hours can be used during times without sun. The control strategy allows an accurate temperature setting inside the drying chamber depending on the type of product being dried. The way this renewable energy powered system is used gives an example for a strategy which could open up a much larger potential for the integration of renewables in the industrial sector.

The „Energiewende“ in Europe is often rated by the market penetration of renewables within the electricity energy market only. Heat accounts for 70 % of the energy consumption within the industry. The market penetration of renewables within the process heat sector is below 1 % [1]. This means a huge and neglected problem within the public perception on the way to a sustainable society. Keeping the world's 2°C target in mind, and holding on to the commitment agreed upon by 100 nations, substantial measurements need to be taken in the

industrial sector. This would mean that industrial energy consumption and CO2 emissions would have to be strictly regulated and deprived of governmental incentives.

Another barrier to a rapid decrease in energy consumption and further deployment of renewables in the industry is the latter's continuous demand for energy. Production processes are mostly designed as „batch processes“ or „just in time“. Especially in large companies, energy is demanded throughout all steps at all times, making those processes unadaptable to the irregular nature of renewables. In contrast, agriculture, for instance, is a large sector where production times largely depend on environmental conditions. In farming, there is a season for sowing and a season for harvesting.

„Sonnenobst“ gives a practical example of a food production process free of fossil energies through a solar-only powered system. This is achieved by synchronization of production with solar energy availability.

The products remain eatable for a year and more. Drying technologies in contrast to prolonging shelf life by cooling make it possible to save a substantial amount of energy. The product is of course not the same anymore. However, the addition of preservatives such as sulfur is avoided.

Conclusion:

The positive effects on nature conservation and climate protection the trade „Sonnenobst“ aims to pursue are:

- Regional use of raw products saves energy expended for transportation.
- Purchasing products from organic farms and gardens only and thereby supporting these. Organic farms are preserving living space for animals by extensive farming, avoiding pesticides etc...
- Within the drying process of the trade „Sonnenobst“ it is also possible to process fruits which are not fit for the market because of size or looks. This can make regional organic farming more profitable as fruit and vegetables are used which might otherwise be thrown away.
- Direct use and care for orchard meadows with standard tree heights. These are important to be preserved as they are important wildlife habitats.
- Non fossil fuel fired food processing saves energy.
- Regional marketing saves energy expended for transportation.
- Concerning some of the above mentioned topics, information is given on the packaging. This is for advertisement purposes on the one hand but also in order to give an example and raise awareness of the possibilities for sustainable food processing. It furthermore gives a signal to the food processing sector which uses up a high fraction of total industrial energy consumption.

It needs to be admitted that regional fruit processing by solar drying and regional marketing of the same can not solve the problems our society faces. Pepper, for example, can not be grown regionally in an adequate way. It also only shows a niche with easy applicable ecological processes. Nevertheless, it is a step forward and a succesful lighthouse project on the way to a sustainable society.

Working with a solar only system with only regional processes and marketing makes the brand „Sonnenobst“ independend from energy and transport prices and is thus comparatively resilient.

In the future we plan to combine the dried fruits and vegetables with e.g. Muesli, pickled tomatoes, fruit cake and other regional products. These are further steps towards a regional food market.

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[1] Mauthner F, Weiss W, Solar Heat Worldwide. IEA, Solar Heating and Cooling Programme, 2011, edition 2013, Gleisdorf, Österreich.