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Solar Dryer

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[Submitted Paper]

A solar powered herb dryer has been designed by David Coleman and the Rural Industries Research and Development Corporation are backing Dave and Living Waters to develop a herb industry and the experimental dryer.

To develop the industry, Living Waters is presently encouraging farmers and landowners to consider farming herbs on a large scale basis. Australia imports over \$18 million worth of herbs each year and we should be capable of reducing that considerably. A nursery is to be built to provide large quantities of herbs for farmers to get started and many varied herbs and plants will be considered for drying including fruit and vegetables.

Producing herbs as mono crops could easily be foolhardy with large potential for pests and diseases. As permaculturists we hope to encourage totally organic herb production which will not only produce a superior organically grown plant but assist in the building of suitable guilds and designed plant integrations providing natural pest and disease control. For example the growing of marigold species (*Tagetes*) in between grape vines reduces the need to spray for nematodes and adding wisterias help fix nitrogen and disguises grapes from bird attacks. Parsley, oregano, sage and camomile can provide a productive and protective ground cover in between vines, reducing the effects of grasses and weeds. Plus all are harvestable and useful. Research into suitable plants for drying is already under way at Living Waters and other interested bodies involved in the project.

The solar powered herb dryer has to have the capability to dry 500kgms of herbs per day from a 78% moisture content down to below 15% before packing or processing can take place. Half a tonne of herbs freshly picked will be brought to the dryer and be carefully dried with slowly passing warm air about 30 – 38°C.

The solar dryer will have a solar collector built in as part of the roof and cover some 120 square meters. An average of 300 watts per square meter over a 6 hour day will produce large amounts of heat that can be transferred into thermal storage accumulators similar to electricity being stored in batteries. As the energy is required it

can be resourced and delivered to the drying room and through the herbs reducing their moisture content in the process.

The solar collector roof and the thermal storage units are both revolutionary in design and application. The collectors are 90% efficient compared to a black chrome hot water collector being 78%. Also it is part of the roof, saving money on roofing, and is made from non-destructive, off-the-shelf materials, ie polystyrene, polypropylene pipes and cement. An outer coating of bitumen mixed with latex is sprayed over the cement and provides not only flexible water proofing but a very good heat transfer to the cement and water pipes.

Water heated by the roof collector is pumped down to the accumulators which contain eutectic phase change material in the form of salt. Yes, hydrated salt. SO₄ 10#20. The phase change materials (eutectic salts) are capable of storing huge amounts of latent heat, far more than any other substance known to humans. For example 10 times more heat stored than concrete of the same volume and 8.5 times that of water.

How does this work? When heat is added the salt reaches a temperature at which it will melt, and change into a liquid over a period of time absorbing Latent heat. It takes a long time to melt. The melting point can vary according to the application.

For example: Salts melt at 90°C. This is perfect for:

- Under Floor Heating: 29°C = Room Temp 25°C
- Herb Drying: 50°C = Dryer temp 30 – 40°C
- Hot Water Heating: 58°C = Water 58°C
- Desalination: 90°C = Water 90°C
- PLUS: 10% of external heating to bring to boil and crack sea water.

Horticultural propagation beds, animal housing. So many different applications, even cool ones to keep your beer cold.

Some extra spin-offs from using Eutectic heat accumulators:

- Automatic temperature control is built into the substance.
- A child cannot be scolded by hot water at 58°C. 64°C and you can feel the burn.
- All systems can be backed by a combustion stove or chip heater.
- Several different systems can be placed in series with the heat supply from the collectors or the back up supply.
- Once installed the savings far outweigh the initial cost, probably in the first year and it's all auto sun fed. Eight times less fire wood to cut. What a bonus!

A Demonstration of some of these applications will be at the Permaculture Conference and on site at Living Waters Permaculture Foundation, Denmark.

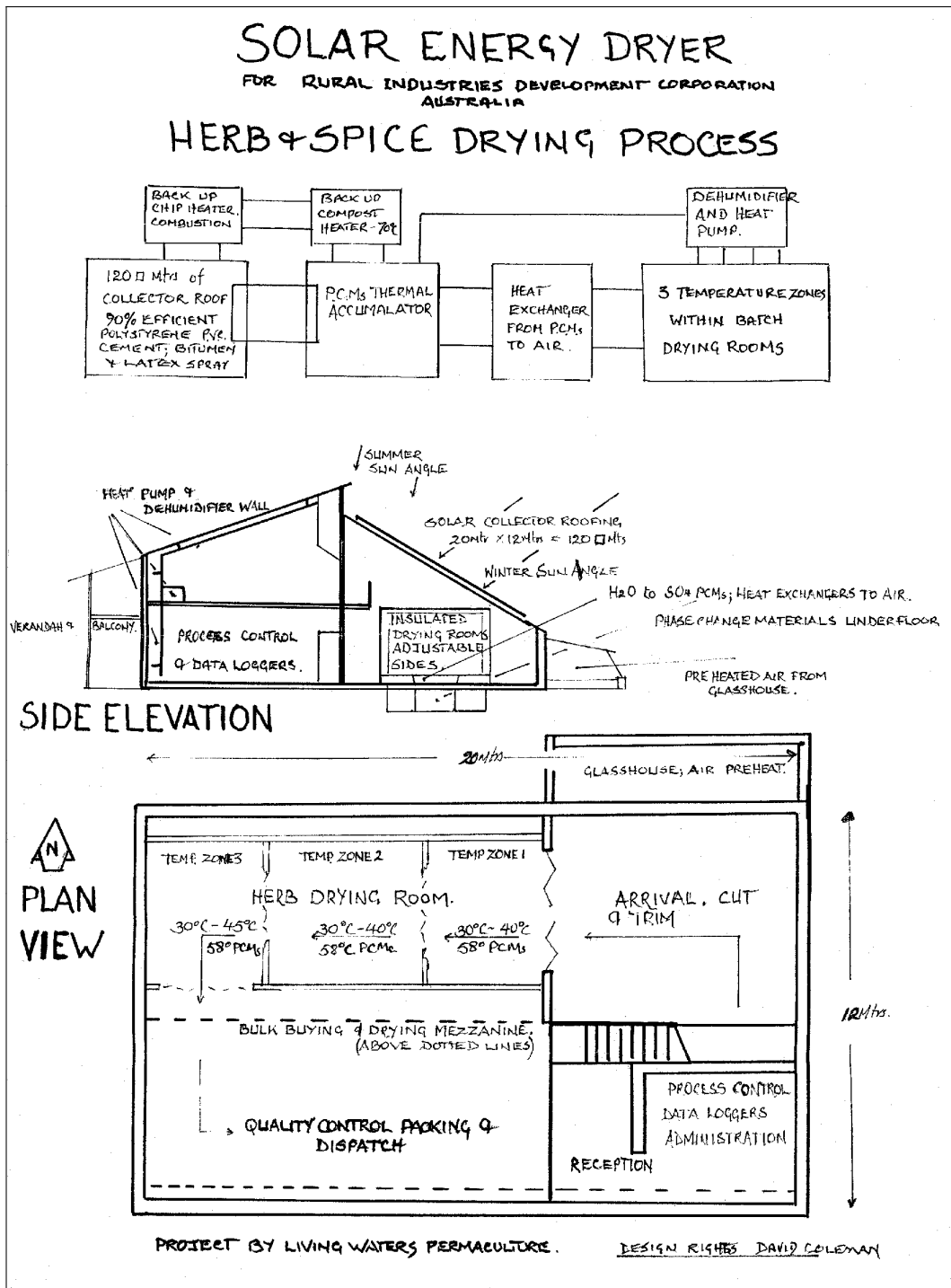


Figure 1: Solar herb dryer - process and building design.