

Solar Dehydrator as an Export to Nepal

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Introduction

Nepal is an isolated, landlocked country between China and India that has had great trouble establishing adequate infrastructure (The World Factbook, 2015). With the country's mountainous geography and recent natural disasters, establishing electricity and roads in many regions of the nation - especially in the higher altitude regions – has proven to be very difficult (World Highways, 2015). Currently, only 90% of the urban population and 30% of the rural population have access to electricity (World Bank, 2011) and, due to poor investment in electrical infrastructure, regions that do have electricity experience power shortages of up to sixteen hours a day during the dry season (World Bank, 2011). Approximately 33% of Nepal's population lives at least two or more hours away by foot from any major maintained road (World Highways, 2014). People in the higher altitude regions need to get to the towns with fresh produce to trade and they are restricted with how much produce they can purchase. These limitations are not necessarily due to financial restrictions, but rather a storage restriction, as the produce they are able to purchase such as fruits and vegetables spoil within a matter of days due to a lack of refrigeration and electricity. Unfortunately, providing electricity to the higher regions of Nepal would be an extremely expensive method of food preservation. However, there is a much easier and cost-efficient solution; solar dehydrators is an ingenious method of food preservation that uses the free power of the sun.

Part 1: Product Info

How the Solar Dehydrator Works

The solar dehydrator is quite simple as it essentially uses the power of the sun to dehydrate fruits and vegetables. Finding the right design was very difficult; by looking online, one can ~~you will~~ see these massive contraptions that are very expensive or ones that use fragile and expensive material. I based my design off of an image in Jacinto Dementoverde Jr.'s article "Solar



Food Dryers Saves Food for Tomorrow" seen as the image to the right. This type of dehydrator is classified as a "hot box" which is essentially a wooden box with a translucent material at the top. My design is much simpler as it incorporates a wooden box that will have one layer of clear plastic at the top to magnify the sun's rays and a black layer at the bottom to put produce on and absorb heat. The design magnifies the sun's rays and dries the produce over a period of 1-4 days depending on the climate. There will also be two holes: one at the top to let the hot air out and one at the bottom to let the cool air in.

Details of the Dehydrator

As I stated above, the solar dehydrator works by magnifying the sun's rays onto the produce. This removes the moisture, but, will leave the vitamins and nutrients behind for the consumer and will significantly prolong its shelf life (Dementoverde, 2015). Since this works off of the power of the sun, the only cost is the initial purchase making it affordable to most people. If the owner takes good care of the product then the dehydrator will last for many years.

When researching this idea I had to cover two main elements: function and cost efficiency. To lower the cost to the Nepalese, individuals will not receive the finished product. Instead they will receive a bundle containing everything they need to construct the dehydrator as well as an instruction manual on how to build it. This bundle will contain: nails, lumber and magnifying plastic needed as well as the instruction manual which will have pictures on how to construct it. The only thing the Nepalese people will need to have in advance is a hammer and their time. I constructed a version of the dehydrator that I would like to use with nothing but a hammer and some nails just to be sure it would in fact be possible for the Nepalese people. By cutting out manufacturing costs, and just having the producer in Canada and the Supplier in Nepal, the product can be much more affordable and available to a wider demographic. The hotbox design may not be the most time efficient design, but to keep it affordable I had to substitute time efficiency. The hotbox design should work though just not as quickly as some might hope.

Production

The lumber used will come from British Columbia as with being on the west coast shipping cost will be reduced and this is also where the majority of Canada's lumber industry is. The lumber will be cut into the appropriate length and sanded by a company called CARRIER FORREST PRODUCTS LTD. This company is located at Prince George, British Columbia, Canada and can manufacture the wood to fit our needs. They will first use their saw mill and then the lumber clusters can be shipped to port. The clear plastic sheets will come from a company called ROBERTSONS PLASTICS which is located in Vancouver BC; the acrylic plastic shall be manufactured here and then also shipped to port. The nails needed for the

production of the solar dehydrator shall be provided by a company called K2 Fasteners, located in Burnaby BC which borders Vancouver.

Target Demographic

The target demographic for this product will be the population of Nepal in the higher altitude regions, the people in rural Nepal and the people without electricity. This product is not restricted to this population but this demographic is where it would have the most benefit. The people without electricity would benefit from having a simple method to store their produce the most.

Rural electricity access in South Asia (as of 2009).

Country	Total population ^a (millions)	Population without electricity ^b (millions)	Rural electrification ^b (%)	Per capita GDP PPP ^a US \$
Afghanistan	28.4	23.8	12.0	600
Bangladesh	156	95.7	28.0	1300
Bhutan	0.69	0.2	40.0	4100
India	1166	403.7	52.5	2500
Nepal	28.5	16.5	52.5	1000
Pakistan	176	68.0	46.0	2400

Country	Total population ^a (millions)	Population without electricity ^b (millions)	Rural electrification ^b (%)	Per capita GDP PPP ^a US \$
Sri Lanka	213	4.7	75.0	3900

(Palit & Chaurey, 2011)

As seen from the chart above the rural electrification is just above half, and it is likely that the majority of that population is from the lower regions of Nepal. However, it is also worth pointing out that according to the chart above that over half the population of Nepal is without electricity. The solar dehydrator will benefit this portion of the population substantially, allowing them to store produce for long periods of time without need for power. Regardless if one is in a rural area or not, this product is incredibly beneficial to all.

Inputs

This product will need a few inputs that the suppliers above will all provide. These inputs are labour, lumber (for frame), steel (for nails), Acrylic plastic (for magnifying sun's rays), and hydro for the production of all of these. Conveniently, the producers include all of these costs of production in their quoted price, therefore, we would only need to pay each of the suppliers for the products. Other inputs include transportation and distribution costs; the transporters will use up fuel to bring the product too Nepal. Trucks and ships will contribute to this cost and be included it in their bill.

Target Demographic

This product would be very useful to many people of Nepal but the issue is that at the beginning the people may not understand the product. Only people with a higher level of education will know how the product will work and they are most likely the ones who will not need it. It is the uneducated people and farmers that will get the most use out of this product, which is troublesome because the most difficult issue will be bridging the gap between those who know how it works and those who need the product the most. 30% of the rural population of Nepal has access to electricity (WorldBank, 2011) and this is the group this product will benefit the most. This is an issue as this demographic as I stated above will be tough to reach, but, if we pull it off then both Nepal and Canada will benefit.

Benefits to Canada

Most of the benefits, if not all, will contribute to British Columbia. British Columbia is already the world's largest supplier of softwood lumber to world markets. More than 40% of British Columbia's regional economies are based on forestry activities. They Support 55,000 direct jobs in more than 7,300 businesses and several of the world's largest lumber companies are based in BC (Government of British Columbia, 2014). This trade should improve Canada's already strong ties in south Asia, while supporting local businesses and producers. If the product is successful then the producers may have to hire more employees to keep up with the growing demand.

Effects on the Environment

The dehydrator is going to need materials to construct it. It will require lumber, acrylic plastic, and steel for the nails. The major material needed for this product is lumber as the frame

will be made of lumber and the frame is the largest part of the dehydrator. This lumber will also come from British Columbia in Canada which is good for the lumbering industry, but does cut down ecosystems. What reduces the economic impact of this product significantly is the provincial laws put in place by the provincial government regulating the industry. British Columbia has some of the strictest environmental laws in the world regarding forestry; the government prides itself on its forestry industry being fully sustainable for future generations (Government of British Columbia, 2014). Due to these strict laws put in place, the environmental impact shall be much smaller.

Part 2: Product Info

Benefit to Nepal

Fruits and vegetables have many vital nutrients. Over the winter seasons in the colder regions of Nepal it may be difficult for the residence to be able to have these fruits and vegetables that hold vital nutrients. In particular is Vitamin A deficiency (VAD). Vitamin A deficiency has been viewed as a public health issue in developing nations (Akhtar et al., 2013). Vitamin A deficiency is a very serious problem that can lead to many related health issues. Many of these problems include tissue development, metabolism and resistance to infections, and in severe cases can cause xerophthalmia which results in blindness in young children (Akhtar et al., 2013). You may be asking yourself why tell me this? Well Vitamin A is most commonly found in dark green, yellow, orange, and red vegetables as well as fruit (Dietitians of Canada, 2014). While it may be easy for us to simply go to the grocery store and pick some fruits and vegetables -as I stated above- it is not so easy for many people in Nepal. In the mountain region for example the most common crops grown are barley, buckwheat and potatoes as seen on the statistics

provided by the Nepalese Government (Government of Nepal, 2013). Grain crops such as barley and buckwheat are very deficient in Vitamin A and so are potatoes (Dietitians of Canada, 2014). If the people of the mountain regions diet consists of primarily grain crops and potatoes, as well as occasional meat products, then the people of the mountain region are bound to suffer from Vitamin A deficiency. To solve this problem, one could simply encourage cropping of more fruits and vegetables, but the short growing season and low temperature results in reliance of harsh climate grain crops (Smith, 2015).

My solar dehydrator targets the higher altitude population of Nepal where fruits and vegetables are harder to come by. The lower regions of Nepal can grow vitamin rich crops, the hill regions grows some and the Terai region can grow tropical fruits (Smith, 2015). My idea provides the people in the higher regions the option to go to the lower regions to purchase their own fruits and vegetables, put them in the solar dehydrators they possess, and store them over the off crop season. This product will also help the people in the lower regions with a cost effective way to store their fruits and vegetables between harvests.

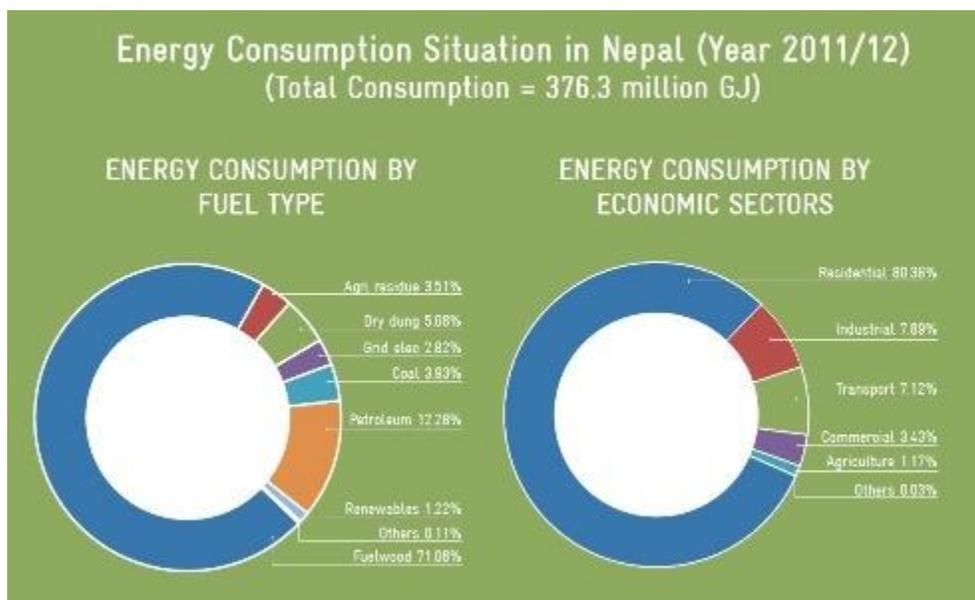
Transportation

The parts needed for this product are all manufactured in different facilities. Conveniently though, the acrylic plastic and the nail producers are located in and around Vancouver. The lumber which is located in Prince George BC will need to ship the lumber products to Vancouver by truck. The nails, acrylic plastic, and lumber will all meet up at Port Metro in Vancouver where it will be loaded onto a freight ship. The bundles will then be transported across the Pacific Ocean to Port Haldia in India. Once unloaded, the bundles will be loaded on to transport trucks and hauled to Nepal where they will be distributed across the country.

Market Strategy

The solar dehydrator will be a bit difficult to market. If you are an uneducated Nepalese farmer from the higher altitude regions you may have trouble realizing the use of this product. This product will be fairly inexpensive due to it not being manufactured yet which may attract consumers to purchase this cheap and useful product. The product will first be sold in larger towns and cities at hardware stores such as Harati Maa Hardware Store. In the event that the product is successful to that demographic, then we shall move the product to the more rural towns making it available to those who need it most. The product needs to catch on first before we sell it to the smaller demographics, if news travels around about this useful food storing product, then those in the farther regions will be more likely to purchase it; this may take a few months to gain momentum though.

Environmental Benefits to Nepal



Bringing this product to Nepal reduces the people's reliance on electricity and reduces their energy consumption. As seen on the Chart provided by Nepal

Energy Efficiency Program (NEEP), 71.08% of Nepal's energy comes from fuelwood, 12.28% comes from petroleum, and 3.93% of their energy comes from coal. This totals to 87.29% of

their energy from environmentally hazardous non-renewable sources (NEEP, 2015). Since the nation gets their energy from these non-renewable sources, reducing the demand in any way would prove beneficial to the environment of Nepal. Nepal gets the majority of its energy from fuelwood; a source that is very inefficient and threatens Nepal’s forests. The Chart below provided by the Food and Agriculture Organization of the United Nations (FAO) the area of Nepal’s forests have been decreasing (FAO, 2010). The use of solar dehydrators instead of traditional refrigeration would reduce energy consumption and protect Nepal’s forests.

Extent of forest and other wooded land			
FRA 2005 categories	Area (1000 hectares)		
	1990	2000	2005
Forest	4,817	3,900	3,636
Other wooded land	1,180	1,753	1,897
Forest and other wooded land	5,997	5,653	5,533
Other land	8,303	8,647	8,767
...of which with tree cover	-	-	-
Total land area	14,300	14,300	14,300
Inland water bodies	418	418	418
Total area of country	14,718	14,718	14,718

Chart Provided by the Food and Agriculture Organization of the United Nations

Initial Financing

The project will need financing to get the first few waves of the product produced and shipped to Nepal. Since our product does not need a facility, there would be very few fixed costs.

The majority of costs that do occur will come from production, transportation and distribution.

We would have to contact a major bank to get a loan for the start of the project. Fortunately, due to our low fixed cost for the device, we will only need one at the beginning until our business is sustainable.

Cost and Pricing

The bundle that people will purchase after production I hope to cost them 15 USD – 40 USD which might be a bit expensive for some of the people there, but, the purchase will only need to be made once if they take good care of the product. The value you save from not having produce spoil will mean that this purchase will soon pay for itself. In selling the bundle as a package containing all necessary materials, I am able to sell the product for less and increase its availability to the lower class and rural population of Nepal.

Future of the Product

The product will go one of two ways: it will either be a complete success and a benefit to all the people of Nepal or it will not catch on and progress will not be made towards mass production and sales of the product. During the first stage of the project when it can only be found in larger towns and cities, we will base our decision to expand to the rural population off the success of the product in our first quarter.

Conclusion

My idea to provide the people of Nepal with a cost-efficient means for storing their produce over long periods of time will be a benefit to many people in Nepal. This product will not just help people store food but it will indirectly help many other factors in Nepal. The people in the higher altitude regions will gain a variety in their diets and an increase in vitamins, the

demand for fruits and vegetables will increase supporting the cash crop industry in the lower regions and it reduces Nepal's reliance on non-renewable energy sources. Overall I believe that this idea, if managed properly, can really benefit the population, especially the rural population without electricity. I would like to see this idea become a reality and help the residence of Nepal.

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Businesses

Lumber Provider - CARRIER Forest Products Ltd.

Clear Plastic Screen Provider – Robertson Plastics

Nail Provider – K2 Fasteners

Image Sources

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