

Solar Cooker Green Cooking

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Abstract:

Food is one of the fundamental needs of mankind. Food preparation requires fuel which may be wood, coal, cow dung, liquid petroleum gas, and electricity consuming induction heaters or microwave oven. Availability of these non-renewable sources is a burning task. Moreover, it produces pollution which leads to the imbalance in nature. Solar cooker shall be a solution for cooking food. Solar Cooker is used for cooking food by sunlight only. No need fuel. Only sunlight is enough to cook a day's required food for an average family of Bangladesh. Bangladesh is situated underline of cancer as a result whole year has enough sun to cook the meal for a family by using Solar Cooker. There is a huge opportunity to use solar cooker in a village, suburban even some time in urban also.

Introduction:

Bangladesh is a highly populated country. We have around 170 million people in Bangladesh out of the 60 percent live in a village. The main food of our people is rice and curry. Village people are used to using wood, leaf, residual of crops and some time Bottled LPG for their cooking. There are very few Bio Gas plants are in village areas. Most people do not know about Co2 emission and environmental effect but they understand the cost. Now the above-discussed fuels are costly and emit CO2 gas which is hampering environment. They also lose their working hour and money to collect the fuel and the mothers lose their health to cook with the above fuels because that creates a lot of smoke which contaminate with air and hit their lungs directly.

We Orbit Solar Energy introduce a solar cooker considering food quantity of a family by using Solar Evacuated tube thermal cooking. We have two types of tube cooker with different quantity of food cooking at once.

Type OT-170:

The diameter of the tube is 170mm and the length is 900mm, there are three equal pots which capacity are 1.8 liters each. It can cook 5.4 liters foods at one time. This is portable and enough for a family contain 6-10 people

Type OT-125

The diameter of the tube is 125mm and length 800mm. there are three pots which capacity is 1x1.6 liter one and 2x0.8 liter. It can cook 3.2-liter foods at one time. This is portable and enough for a family of 4-5 people.

Technology& Design:

Solar cookers utilize the simple principles of reflection, concentration, absorption, glazing, insulation and the greenhouse effect to produce heat. **Solar Oven Evacuated Tube works as the same principle of solar cooking.** The evacuated tube style solar cookers are somewhat new on the market and in the solar cooking world, though they have been used for solar cooking by tinkerers and inventors for a few short

years they have not been largely available to the commercial market until now. The older style box (ovens) cookers panel cookers and parabolic cookers have been around for much longer, some as long as fifty years, but now there is a new and very effective method of solar cooking in the form of the compact and very fast evacuated tube solar cookers.

We know that in a sunny day the sunlight energy per square meter is around 1KW, here we use the technology that direct light and reflected light is trapped (Greenhouse technology) in an evacuated tube which has very high thermal insulation, the trapped light turned into heat and this heat can cook food. The temperature rises up to 300 Degree centigrade.

Tube Glass

The tubes are made from a type of glass called Borosilicate. Borosilicate glass has the characteristic of being very strong and also has excellent light transparency (>92% @ 2mm thick).

Efficiency

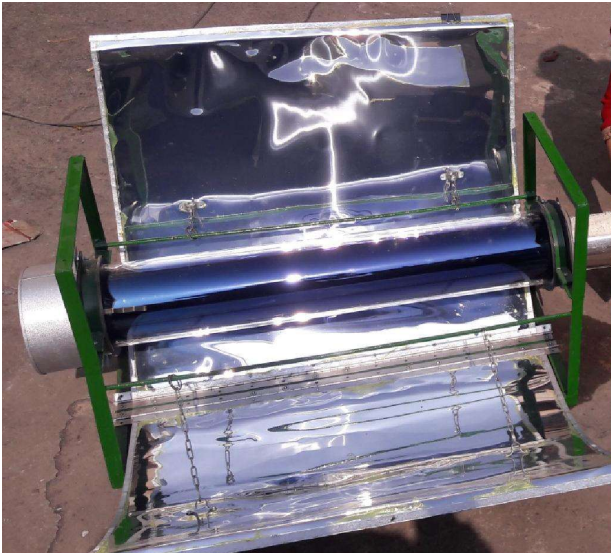
The combination of the highly efficient absorber coating and the vacuum insulation means that the coating can be well over 200oC / 392oF and the outer glass is cool to touch. In strong sunlight, each evacuated tube can provide over 60 Watts / 204 Btu of water heating output.

Vacuum Insulation

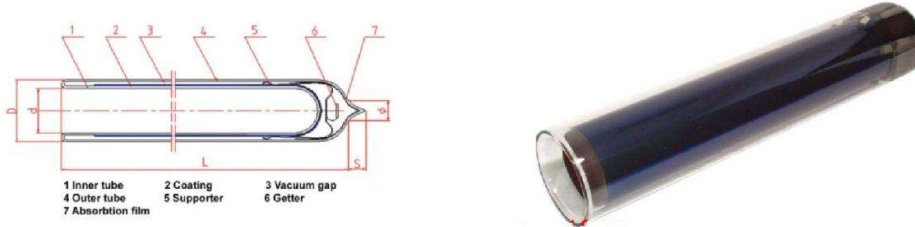
The name "evacuated" is used to describe the process that expels the air from within the space between the glass tubes, forming a vacuum. A vacuum is an excellent insulator against heat loss, and so evacuated tubes are able to operate very efficiently

Evacuated Tube Oven Design:

The Stove showed here



Tube:



The evacuated tube design has an advantage in that it holds and retains its heat better than any other style of solar cooker, and it will heat up quite well even in less than optimum conditions.

Tube Dia: 125mm & 170mm

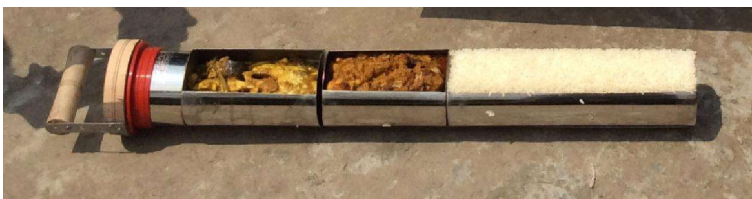
Length: 785mm & 900mm

SS Drum:



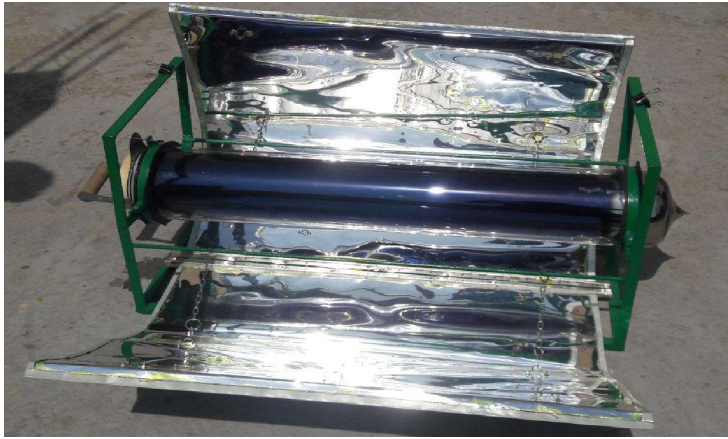
Inside the vacuum tube, there is a protection barrel inserted as the cooking chamber, which is made of stainless steel. Cooking Chamber, protect the tube from thermal shock.

Food Tray & Food Pots:



Made from SS and use for food holding and cooking, it's easy to load and unload these solar cookers using a sliding tray to place food inside.

Frame and Reflector:



One metal frame holds the tube over ground and support to parabolic anodized aluminum mirror reflector. The material of the reflector panel is the aluminum reflector, hard-anodized. The material of the backboard for the aluminum reflector is hot dip galvanized sheet. The material of the support structures is colored MS Bar.

This solar oven tube allows you to cook anything that you can cook in a conventional oven. The inside and outside tube are nice clean Pyrex type glass with no coatings on it. This makes cleanup a breeze. It can be washed normally. If you are cooking a roast, you can use either an elongated tray or aluminum foil to hold the meat and allow you to slide it in and out. If you are boiling water, just fill pots with water and insert into the tube and put it in the Sun. The same goes for soups, stews, etc. Cooking temperatures regularly reach up to 120 degrees without reflectors, or if you add a reflector, temperatures can reach 200-300 degrees centigrade.

The Orbit Solar Oven Evacuated Tube:

Highly transportable

Compact

Mid-weight

Easy to set up

Easy to load

Cooks at high and fast temperatures

Retains heat well due to evacuated glass tubes

Cooking Option:

With the Orbit Solar Oven Evacuated Tube style cooker you can cook almost any kind of food that you desire, including:

Chicken, Fish, Meat, Breads-rolls and cakes, Soups, Vegetables, Pasta, rice and more.

Cooking Process:

Rice:

Clean rice, put rice in the pot with required water.

Fish and Meat or Chicken:

Clean, Mix with spices and vegetable.

No water or minimum water as per requirement and taste.

Vegetable:

Clean and mix with spices, no water required.

Boiling of Egg/Vegetable:

Clean and put into the pot and insert to a cooker, no water required.

Baking:

You can bake cake, biscuit and etc.

Cooking Time

Cooking Span: Whole day, best time from 8 am to 4 pm

Cooking Time: 1-2 hours depending on load (quantity of food)

Spending Time: 5-10 minutes for one cooking

Cooking days in a year considering Bangladesh weather is 280 days

Benefits:

No Fuel required, Energy from Sun is free

Direct saving Tk 1000-2000/month

Time-saving 2hours /day

No monitoring

Long Life 10-15 years

Maintenance free

No chance to burn food if there is a delay to take out the food.

Energy Savings:

As we discussed that the energy of sunlight per square meter is 1kw, our covered area is 0.8m square (appx.), considering 50% efficiency, total trapped power is 400w.

Total trapped Power in a day - 2.4 KWh

Total Trapped power in a year- 672 KWh

Environmental Benefit:

No fuel burn so no Smoke and no Co2 produce at cooking

Co2 emission saving = 0.82kg/KWh (Avg for KWh Electricity Generation)

Considering above calculation total Co2 emission saving is $672 \times 0.82 = 551$ kg/ year

Social Effect

No monitoring required for cooking, Women can save their time to other works, it will be honored and empowered our mothers. Around 2 hours can be saved for cooking per day and $2 \times 280 = 560$ hours per year.

Around the globe, hundreds of millions of people have limited access to cooking fuels [source: SCI]. In most cases, electricity and gas are out of the question; only charcoal and firewood are within reach, and even charcoal can be too expensive. So we're left with wood. The problem is that in many poor, rural areas in places, trees are scarce. It takes a lot of wood to cook meals for an entire family every day, and what few wood sources there are continue to dwindle. Families have to walk for hours to collect cooking wood, and they end up spending what little money they have on their fuel, leaving less money to buy food.

Solar cookers are useful during times of disaster or power outages. A solar cooker can be used at any time of the year, any place in the world. They're great for family camping trips since they're lightweight and easy to transport. But solar cookers are also smart to have on hand during disasters.

Nutrition Benefit:

It can result in healthier cooking. Solar cooking doesn't use smoke that can contain carcinogens or microwaves that expose your food to potentially dangerous radio waves. When you cook over a campfire, the smoke can irritate your eyes and respiratory system, and open fires present dangers to children.

Plus, when you cook in a solar appliance, the nutrients stay in the food and don't leach out. That's because you don't use water in solar cooking. And, the temperatures in a solar oven are moderate – around 325 F – so nutrients aren't destroyed during cooking at a high temperature like on a grill or over an open flame.

Health Benefit:

Another problem that can be solved by solar cooking has to do with the simple act of burning wood. Fires release pollution into the air. This smoke, filled with particulates, is bad for the environment, but it's even worse for the people who are breathing that air. When people use open fires to cook indoors, they end up inhaling microparticles that can cause all sorts of health problems, including both lung and heart disease. One estimate puts the number of people who die from this type of air pollution at 1.5 million per year [source: Madrigal]. A solar cooker eliminates the need for an open flame, meaning cleaner air.

Geographic Benefit:

Bangladesh is situated under Line of Cancer (23.5 deg north) as a result whole year has enough sun to cook a meal for a family except disturbance of weather. There is a huge opportunity to use solar cooker in the village, suburban even some time in urban also.

Prospect:

Bangladesh is a small country by area but in population, it is very big, geographically and weather wise very much suitable for a solar cooker. There are few units we provide to people and they are happy with the performance of cooker.

The challenges are as follows:

This is a very new concept for people. It is required huge campaigning. People are used to traditional cooking habit. The initial price of Solar Cooker is high compared to traditional cookers. People cannot cook at night and windy day, we made a solution by using an Electric heater inside the tube for the night and windy days (Evacuated Tube Hybrid Solar Cooker).

Life of Cooker:

Since it is made of glass, it will last virtually forever if it isn't chipped or otherwise broken.

Safety:

Use gloves or cloth at put on and off the tray from the tube.

Do not put a hand inside the tube because the temperature may rise 300 degree centigrade.

Our Mission:

Our mission is to aware people to use solar cooker all over the country.

Pilot Cooking:

In a village rice Cooking:



Roof Top at Dhaka City:



In a Fair at Dhaka:



Reference:

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