GOBESHONA

Making Research on Climate Change in Bangladesh More Effective

Design and Implementation of Solar Powered Induction Cooking System to Reduce Carbon Emissions and Health Hazards.

Keywords- Renewable Energy, Solar PV, Induction Cooker, cooking, Carbon Emission

Presented By: Saila Ishrat Annie

E-mail: ishrat_annie@yahoo.com

Department of
Electrical & Electronic Engineering
Independent University, Bangladesh

OUTLINE

- **Solar Energy and its Potentials**
  - ✓ Motivations and Objectives
  - ✓ Solar Irradiation Pattern in Bangladesh
- **Existing Cooking System of Bangladesh**
  - ✓ Conventional Cooking System
  - ✓ Diminution of Gas Storage
  - ✓ Problems Faced by Users
- **Solution by Implementing a Solar Powered Cooking System**
  - ✓ Design Methodology and Working Principle
  - ✓ Cost or Budget
  - ✓ Benefits of Proposed Design

Motivation and Objectives

✓ Motivation

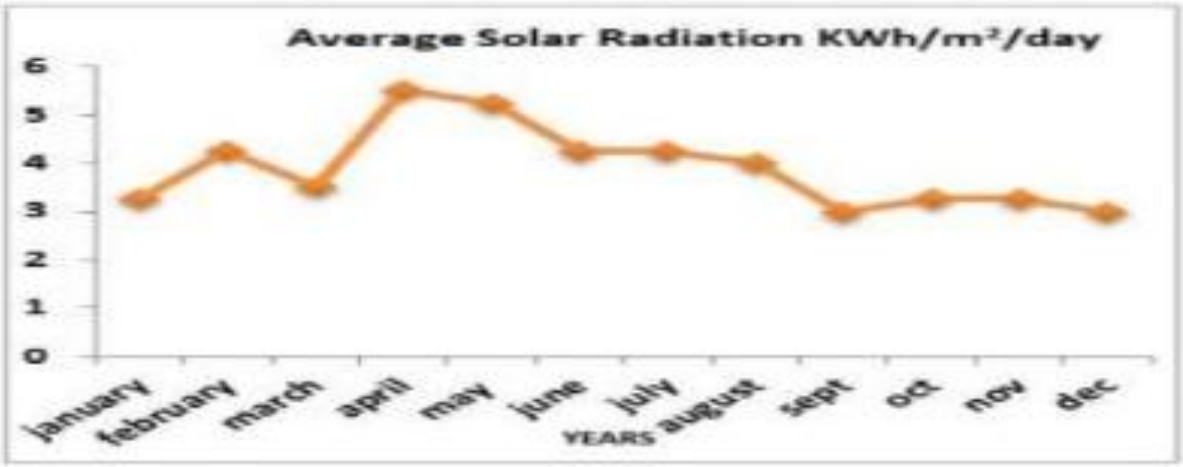
- **Urban areas: Natural gas, which is depleting gradually and is becoming expensive and scarce.**
- **Rural areas: Wood, charcoal, agricultural wastes and animal dung which produces smoke due to partial burning of fuel and causes respiratory illness due to inhalation. The harmful gases generated and cutting down of trees resulting in deforestation also causes global warming. Kerosene and gas cylinders are also used which are costly and harmful for health.**

✓ Objectives

- To install a solar powered induction cooking system of a specific capacity with appropriate design and technology.
- To utilize installed rooftop panels in more effective way.
- To provide a cost effective and environmental friendly cooking system for people in both rural and urban areas.

Solar Irradiation

Solar radiation varies from season to season in Bangladesh. Bangladesh receives an average daily solar radiation of 4-6.5 kWh/m^2. Maximum amount and minimum on November December-January in the following figure 2. Bangladesh is situated between 20.30 and 26.38 degrees north latitude and 88.04 and 92.44 degrees east which is an ideal location for solar energy utilization.

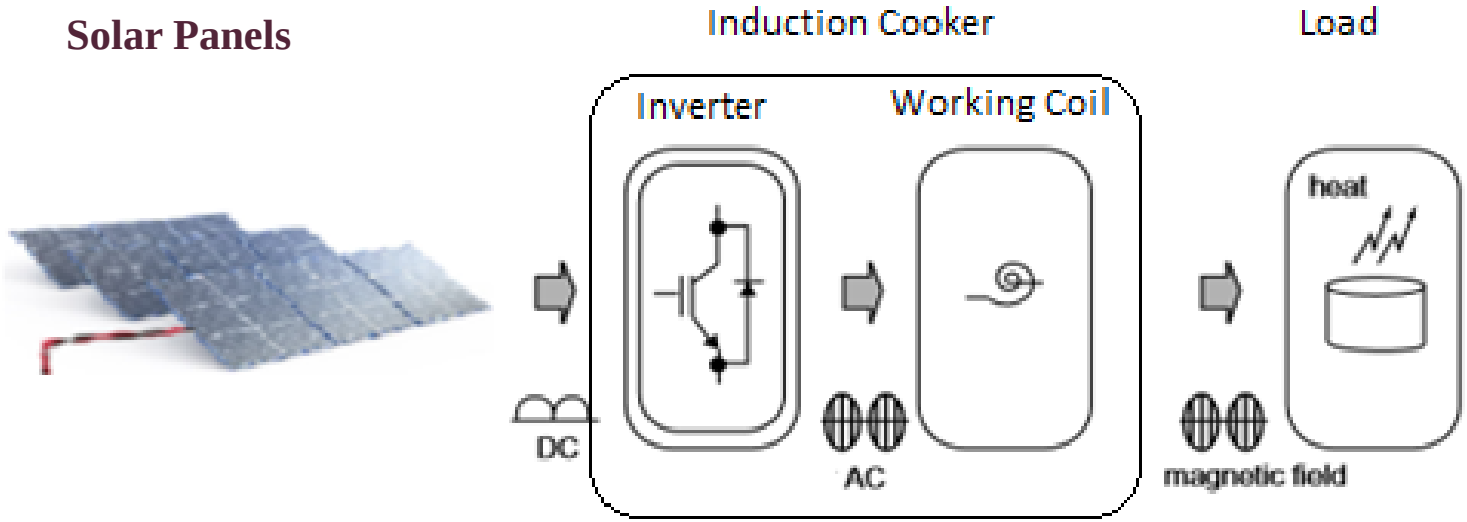


Conventional Cooking System

Problems Regarding Conventional Cooking System

- ✓ Health Hazards

Methodology



Installation of a Thin Film Photo Voltaic Module could be a good solution to operate an induction heater that can be used for cooking purposes at domestic level. The dc voltage of the PV modules is applied directly to the induction cooker. An in-built inverter is used to run the heater by inverting photovoltaic DC to high frequency AC.

This system consists of photovoltaic (PV) panels, Induction Cooker, and a load.

Data Analysis

Water boiling

Time	Vdc (V)	Idc (A)	Wdc (W)	Water status
11:20	250	1.9	475	25 degrees
11:25	250	1.9	475	Very small vapour
11:30	250	1.9	475	Small vapour
11:35	250	1.9	475	Water starts to boil
11.40	250	1.8	450	Water at 98 degrees
11:45	250	1.9	475	Water fully boiled (100 degrees)

✓**Took 25 minutes to boil 1.5lit water**

Data Analysis

Mixed Vegetables with Rice

Time	Vdc (V)	Idc (A)	Wdc (W)	Water status
12:50	230	1.7	391	Vegetables added; Cooking started
1:20	150	1.1	165	Vegetables almost cooked
1:30	230	1.7	391	Rice added
1:40	190	1.5	285	Rice starts to boil
1.50	160	1.2	192	Rice almost done
2:00	170	1.3	221	Rice almost done
2:10	190	1.4	266	Cooking complete!!

✓**Took 90 minutes to complete cooking**

Cost Analysis

✓ Cost

Equipment	Taka
Thin Film Solar Panel (10 panels x 95W)	45,000
Induction Cooker	2,000
Mounting & Others	3,000
Total	**50,000**

BEP (Break Even Point)

- ❑ Compared to LPG, we can find out the BEP of the proposed system.
- ❑ 2 Cylinders can provide cooking fuel for 30 days for a 5-member family.
- ❑ Though, initial price of LPG cylinder is 1600 taka, but refueling cost is 1200-1400 taka.

Considering a 5 persons family which indeed of 2 LPG Cylinders per Month of taka 1300 each, we can calculate BEP.

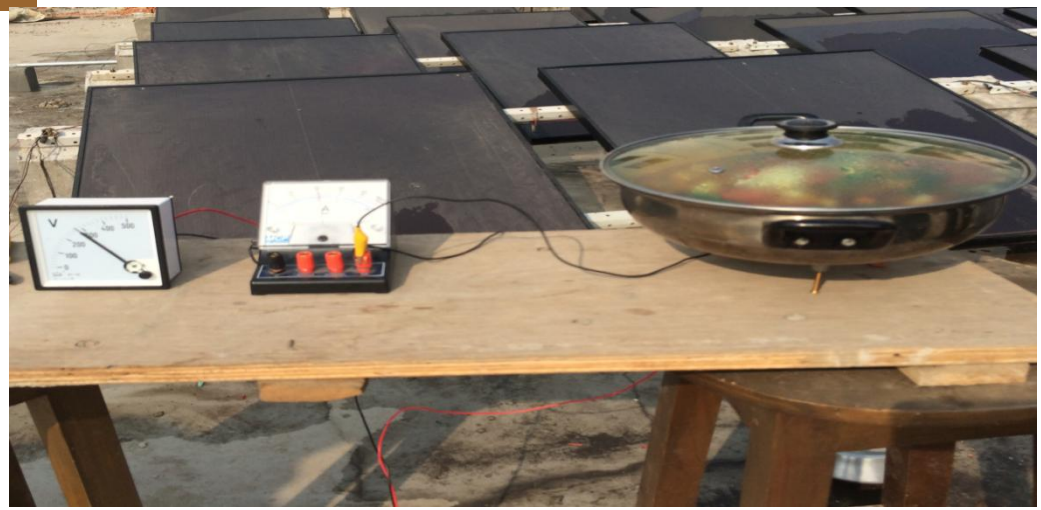
Cost per unit =2600 BDT/month
Cost per year = 31,200 BDT/Year

$$B.E.P. = \frac{\text{Total Price}}{\text{Per year cost}}$$

$$B.E.P. = \frac{50{,}000}{31{,}200} = 1.6 \text{ years}$$

http://en.prothom-alo.com/economy/news/68927/Price-discrimination-hinders-use-of-LP-gas

Field Testing



[redacted]

Benefits

- Natural gas crisis can be mitigated as solar energy will be used instead of gas for cooking purpose.
- Deforestation will fall drastically as firewood will no longer be needed for cooking.
- Environmental pollution will be reduced dramatically with reduction of fuel burning.
- Health problems such as, respiratory illness, caused by the smokes from fuel burning will also be mitigated.
- Cooking can be completed from the kitchen itself by connecting wires to the rooftop solar panels.
- We can have huge carbon credits for cultivating green energy.
- Foreign investors will be interested more as we will be supplying green energy.

Limitations

- Cooking has to be done during daytime
- If cooking has to be done at night, then additional costs will have to be added for battery storage
- Cooking time will vary in accordance to the weather conditions
- Initial cost of this project is high

Department of
Electrical & Electronic Engineering
Independent University, Bangladesh

Thank You for your Attention

Any Suggestions !

For your valuable comments and further query:

email: ishrat_annie@yahoo.com