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SOLAR POWERED VENTILATOR FOR TOFU MAKERS IN GONDANGLEGI MALANG

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ABSTRACT

A considerable amount of tofu production whether small or medium scale industry level has been easily found both in villages and cities. Tofu can be produced via traditional or modern process. The modern tofu processing consequently requires large investment but relatively environmentally friendly. Traditional tofu processing exploits firewood hence emits smoke and generates excessive heat in a confined space. This community service designed to assist tofu makers in Gondanglegi in reducing internal smoke and heat on production processes by building economic solar ventilator.

KEYWORDS

ventilator, pollution, smoke, solar energy

INTRODUCTION

Tofu considers as a popular food both in urban and rural areas. This soy-based food has been existed for a long time even in Japan. Tofu could be consumed as snack or side dish as it is nourished with vegetable protein act as substitute of animal protein.

Favored both in cities and rural areas, tofu manufacturers in any scale traditional or modern wise is easily found in Indonesia. Entrepreneurs with big capital will mostly choose tofu modern processing..

Tofu home industry are easily found in Krajan, Putat Lor village, RT 09 RW 03, Gondanglegi District, Malang, as the village common small scale business. Since 1997, the village has processed roughly 80-90 Kilograms soybeans as raw materials into tofu in daily basis. Raw tofu then fried before directly sent to wholesellers in the market, delivered to home consumers or sold personally in the market. Four people are hired: one employee fries the tofu in confined space with minimum ventilation above the frying pan. They use high temperature traditional burner in a sultry space.

Another tofu maker is found in Lumpang Street, Putat Kidul village, Gondanglegi. The passed-for-generations traditional home industry provided up to 100 kilograms soybean. The processed tofu, as the previous home industry stated, then fried using local firewood to be directly marketed afterwards. The tofu is fried in the afternoon to be sold the next day around 2 AM in Kebalen market, MalangThe home industry has 5 employees with one female employee specifically hired to fry the tofu.

The utilization of firewood in tofu production would cause air pollution leading to various diseases [1]. Solving the problem by using farm residues, animal waste such as cow, and coals seems equally impractical because the materials are more suitable for home consumption and

cooking in cooler areas. The level of pollution is also higher compared with liquid natural gas.

TBC and Malaria is commonly related as diseases caused by smoke and natural fuels, especially to women and children in developing countries. Women and children habitually be in the kitchen during cooking time has been prone to air pollution related health problems

Exhaust fan (ventilator) serves as polluted air suction from a room and replace it with fresh air into the room. It also serves as a volume air circulation controller to meet the health requirement which different based on the size of the room. For example, bedroom needs air exchange every 2-4 hours, while bathroom 6-10 times, and kitchen 10-15 times. Ventilator also a complementary for air-conditioned room as it dehumidifies a room while air conditioner cools it.

Assisting ventilator installation helps inadequate room air circulation and sees as a mechanical effort to optimize air circulation on the room. Ventilators could be mounted on the wall, glass windows, and ceilings. Wall ventilator should have an open area behind it for exhaustion process.

The ventilators selected on this community service were wall-mounted model with 45-75 watts electric power range. The required power was suited the power harvested from solar panel installed.

The ventilator was selected based on air circulation needs in a room based on its spatial size (length X width X height). For example a kitchen with 3 metres length, 3 metres wide, and 2 meters height or 18 m^3 size will use per cubic meter measurement.

As the dimension of tofu frying room as the example above is 18 m^3 needs 13 times air exchange, the ventilator should have the capability to change 234 m^3 air.

Science and technology program for community (Kegiatan program ipteks bagi Masyarakat, IbM) employed solar energy generated air ventilator to cut tofu production cost for the makers. Beside improving employees health condition by decreasing in-house air pollution and heat excess in Putat Lor dan Putat Kidul village, Gondanglegi, this community service was a civitas akademika respons for ensuring public health for the home industry employees.

Figure 1. Tofu Frying Room.

MATERIALS AND METHODS

Implementation method to provide solution for tofu makers involved several phases: (1) survey to tofu makers in Putat Lor village, Gondanglegi district, Malang in order to identify their problems such as the level of air pollution or heat temperature during tofu production, (2) plan and design the ventilator and install it with solar panel, (3) promotion and training to make tofu makers understand about the prototype and its working principles. Visiting the workplace and directing the employees on how to operate and maintaining the tools were how the promotion and traning conducted. In this period, input from the partner or tofu maker employees were collected.

RESULT AND DISCUSSION

After conducting field survey on partner condition, exhaust setting and installation system were planned in production room.The team installed the solar panel system on 12 July 2016 at Mr. Surani'sand Mr. Jiono's tofu production places at 09.00 AM Indonesian Eastern Timefor Mr. Surani and 12.30 AM Indonesian Eastern Time for Mr. Jiono.

Solar panel and ventilator installed in Mr. Surani's narrow 7m x 5m x 4 m room by 3 people. While in Mr. Jiono comparably wider space 12m x 6m X 5m, tere were 8 people were involved. There were no significant problems in the installation process. The solar panels were directly placed on the rooftop

Picture 2. Solar Panel Installation.

After solar panel installation finished, cable controller connected to the battery box was placed.

Picture 3. Charge Controller. Battery in One Box.

Once controller with LED connected to the battery cables, the LED supervises battery charging by solar panel and its readiness to channel DC current to the ventilator or the load. The load or the exhaust fanneeds inverter to convert DC current into AC[2] [3].

Picture 4. Exhaust fan.

CONCLUSIONS and SUGGESTION

It is concluded that; (a) it is useful to collaborate solar panel technology with exhaustfanto help reducing air pollution inside the tofu production room (b) The least benefitis decreasing polluted air and excessive heat in production room, the bigger the size, the more room needs exhaust fans (c)introducing environmentally friendly solar powered electricity to the locals(d) The solar energy could also be used for other load such as lamp or cellphone.

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c. Mr. Surani and Mr Jiono as tofu production owners in Putat Lor and Putat Kidul, Gondanglegi as active partner in this IbM.

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