American Journal of Humanities and Social Sciences Research (AJHSSR)
e-ISSN :2378-703X
Volume-5, Issue-4, pp-326-331
www.ajhssr.com
Research Paper Open Access

Green Technology On Slope Of Mountain Housing Based On The Optimization of the Solar Sun Potential Utility

VG Sri Rejeki[1], Budi Santosa[2], Yovita Indrajati[3]
[1]*Architechture Department, Architecture and Design Faculty, Soegijapranata Chat Univ, Semarang, Indonesia*
[2]*Civil Department, Engineering Faculty, Soegijapranata Chatolic University, Semarang, Indonesia*
[3]*Law Department, the Law Faculty, Soegijapranata Chatolic University, Semarang, Indonesia*

ABSTRACT : One of the result of qualitative research on some slope of mountain settlements of Central Java , Indonesia presented that in vernacular the slope of mountain society have been the Sun potential haversting for green technology. The limitations times of sun shines every day be adjusted by solar energy and narural light to support the house energy and natural radiance. The Sun shines only 4-5 hours (at 7.00-11.00 AM) everyday. The people used optimally, that are:
- Solar energy absor bed through the black tin roof building. This solar energy be used to air heater on *pogo* and the upper of plafond. The Pogo that was heated while preserving the harvest of corn.
- Sun light that shining several hours utilized the light the sky with making openings in the roof and at the top of the building

The Green technology base on the solar resourse potenstion found in some slope of mountain setlements in Central Java

Keywords: *settlement on the slope of mountain, the optimization potential of solar recourse*

I. INTRODUCTION

Advanced technologies in the globalization era from time for time areal ways increasing. Some technology developments that do not care about the sustainability of natural life tend to lead to environmentaldestruction. Some general impacts of the construction and development of unsustainable technologies include the existence of global warming and environmental destruction. Based on several years of research (Rejeki 2009, Rejeki, 2010) argued based on vernacular concept by Reimaretall (2003), there are some mountain side villages in Central Java which have there solution strategy of built environment based on the specific potential of mountain nature. Some village simple the strategy including the settlement of the villages on the slopes of Mount Merapi, Mount Merbabu, Mount Sumbing, Mount Sindoro, and Dieng Mountains. The communities address their existence in relatively high mountainous areas (higher than 1000 meters abovese a level) as part of their lives with limited timeand the number of sun rayand light each day.The strategy pursued in addressing the limitations of feeling the sun is one form of green technology presented in this paper.In the other hand, In the green employment organization, Janadari propose that the system of the human resource management have some focus, are management of green human resource, spirit of environmental performance, training or learning of green live style, green recruitments and environment behavior in organizational citizenship (Janadri, 2021). Similar Janadari, this research explored some local principle by community, especially based on spiritual thinking.

From there search conducted and some opinion of local technologies characters that lead to green technology are acquired including the local technologies which address solar resource potential optimally. For sustainability of the wisdom of the mountain side village construction system, the arrangement of areas and buildings needs to adapt to 3 things, namely adjusting to water, life patterns and marbles (Zhou,2018). In the other hand Santoso et al (2019) argues that the shape of mountainside farm farmers house and arounds, are influenced by topography, economy and safety needs. Meanwhile, according Supriyono et al (2018), in the achievement of comfort in the

life style, the slope of mountain community is dependent on the wind movement, humidity and temperature, so that the pack of body coverings used affects comfort. On the other hand, Shukurov et al (2018) argued that by topographical conditions, the slope side, are affect greatly the shape of the structure of the houses. From some of these opinions, there are not explore the resource sun naturally, namely solar sun and sunlight also affects the pattern of settlement system.

In particulary, Karyono (2010) said that one of the indications to obtain the green settlement principle concerning environmental sustainability, energy saving, local materials. in line with this, traditionally, mount side communities always bequeathed to the descendants, so that it can still be implemented, including in saving energy and the use of energy in the building. The existence of slope of mountain settlements is dominated by open spaces that can capture / receive tropical sunlight optimally. This is in contrast to the middle of the city where the condition of the room is small and the city area tends to be dense (more than 50% woke up (Brontowiyono, 2016). In case, there is a hypothesis that the solar sources should be more optimal in the mountain side settlements. In detail, the utilizations of sun light potential conducted in the villages on the slopes of mountain are in the form of: two focus, are 1) Utilization of the day light source and 2) Utilization of the solar sun source

II.MATERIALS ANDMETHODS

The study material at this time is related to the local wisdom in building houses in the villages on slope of mountains in utilizing solar resource supporting the lives of the people, particularly related to the local technologies in utilizing the potential of the sun, namely the solar energy and its daylight potential applied in houses. Priyanto et all (2000) has shown that in the Javanese houses, especially the roof constructions, has the special material receives sun radiation for 11.5 hours per day.

There search process used naturalistic – qualitative method, namely qualitative assessment and utilizing the natural setting of houses in several villages on slope of mountain. Some measures taken in this research included several methods in both the data exploration and analysis. The data retrieval method wasconducted by datamapping andphysicaldepiction naturally (without engineering),unstructured interview, and Focus Group Discussion. It was conducted because there search material is in the form of exploration of cases naturally according the research objectives to explore the potential owned by local community. The data domination was primary data, and then the data exploration was conducted as follows:

- The depiction of the buildings in order to obtain the information of the building typology related to the utilization of energy sources and sunlight. The interviews were about the river system, spatial and building planning, and local wisdom. Some data in accordance the focus can only be obtained by interview method. The interviews were conducted to the informants of community figures and leaders which were set purposively, in accordance with the needs for specific data as well as the referrals/ recommendations from previous informants.
- The Focus Group Discussion / Workshop was required to determine the validity of the data from informants and information expansion related to the research focus, and the implementation of FGD was very helpful for the additional data entry required.
- Peer group discussion was conducted in order to obtain the information about the theories related to the findings. Given the research findings related to technology of water distribution based on community's local knowledge, the relevant theory exploration was carried out together with the experts in their fields. For this purpose, hydrologists and environmentalists were taken.

The process of setting the case of house was conducted purposively derived from the direct observation in field. In cases were obtained in the houses with certain characters that have the content of technology utilization based on solar resources in house. The analysis method was conducted qualitatively by categorizing the results, such as the finding of quite unique and creative technologies in the field. The findings are in the form of residential building types that utilize sun resources to support life in the house

III.RESULT

Several things found in the green technology study based on the source of the sun potential on the residential houses in the settlements on slope of mountains is the green technology based solar heat and sunlight.

The green technology in the residences on slope of mountain based on solar heat is in the form of roofing material use to heat the space and preserve food stuffs. In the other hand the basis of Green technology for natural lighting in the houses on slope of mountain also very vital since sunlight effectively only shines for a few hours (7:00 AM to 12:00AM). The utilization of sunlight can be managed through the roof, glass windows, making ventilation, and making the ventilation/ glass window located in the east of the building.

3.1. Greentech Based on SolarHeatForPreserving Foodstuffs

Green tech Based on Solar Heat for Preserving Food stuffs can be found in some observed villages including in the villages of Kapencar, Candiyasan, and Reco. Most of the staple food in the villages on the slope of mountain with the altitude of 1000 meters above the sea level is corn. Many homes in the mountain slopes have a room specifically to store and preserve corn called *pogo*, namely the space above the stove of *pawon* and tin roofed. *Pogo* existence is always under black tin roof with the intention that the hot sunlight on the roofs of the houses can be absorbed by the black tin and channeled down in order to heat the corns stored in *pogo*. The existence of *pogo* above the kitchen stove can also help corns be preserved from the bottom so that the corns are heated from two directions; from the bottom in the form of the kitchen stove and from above in the form of zinc roof (show in **Fig 1**).According to the people and the results of the field measurements, the effective distance to het the heat of the furnace of *pawon* is ± 2-2.5 meters and 1-1.5 meter from tin roofing. Yet, according to the information from some residents who joined the FGD, the position of *pogo* for the most optimal drying for corns is indeed on the stove of *pawon* and under the black tin roof. *Pawon* position is above and below the tin roof to heat the corns so as to remain stable in good condition for 2 years (the people information in FGD, 2014).

Figure1: the position of black tin, pogo, and stove as the green technology of preserving food stuffs.

3.2. The green tech based on solar heat for warming the room

The Greentech based on solar heat for warming the room is also found in some villages with an altitude of 1,000 meters above sea level, such as on the slopes of Mount Sindoro and Mount Merapi in the form of the absorption of solar heat for warming the room in the houses. Based on the opinion of some residents in Kabelukan sub-village who gathered during the FGD about the benefits of sunlight for heating the house, it is highly needed since solar heat is effective in Candiyasan village only from 07.00 AM to12.00 AM. Even in Kapencar villge, there has been no sunlight at 10 AM. In these conditions, the roofing materials in most of the roof structures in the villages of the mountain slopes, such as Kapencar and Candiyasan, use zinc material and painted in black color (see **Fig. 02**). Zinc material is selected to absorb the sun heat so that the inner space can quickly be heated. Likewise, the selection black color also considers that black can absorb heat. In case, it appears that there the limited sunlight and solar heat are optimized by absorbing the existing heat.

Figure02: Greentech of the use of black zinc material to heat the room in the houses due to the nature with little solar heat

3.3. The utilization of daylight through the roof and the top of the building

The utilization of daylight through the roof and the top of the building can be found in some houses of the villages on the examined slopes of mountain. **Fig**ure **3** below shows the example of the villagers' houses on the slope on the used of sunlight for their houses through the roof, both tilted and concrete roofs.

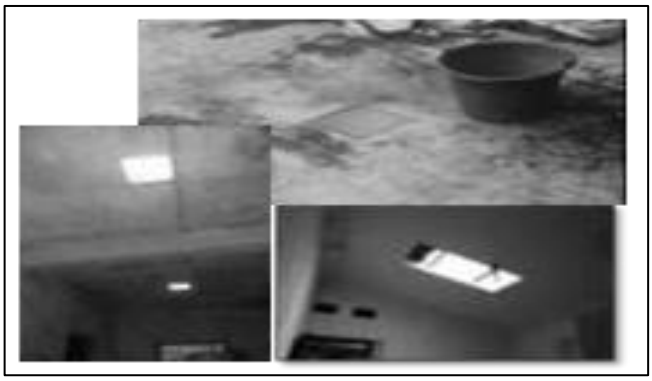

Figure 3: Green technology of the use of daylight or house lighting through roof and the titled and concrete roof

3.4. Utilization of daylight through transparent wall.

In addition for the roof, sunlight can optimally enter through transparent walls, the openings of upper wall, as can be seen in **Fig.4**. The sunlight is very useful to the society of Reco sub-village for lighting and heating the rooms in their houses. The followings are the opinions of some residents of Reco sub-village gathering at the time of FGD on the matter. Some creativities applied by Reco villagers in the utilization of sunlight into buildings, such as through the top hole, installing glass window, glasstile with the strategy that the glasses made are dead glasses so that the entering heat does not easily come out.

Fig4: Green technology of the utilization of daylight for house lighting through the transparent and the opening of upper wall

IV. DISCUSSION

Some interesting findings are that the character of the design / layout of the residential buildings on the slopes of mountain with the altitude higher than 1,000 meters above sea level is quite unique and different from the layout of the building on lower areas. Most of the unique layout of the buildings are based on the limitation of the revolution time of the sun source potential on the villages on slope of mountain which is only 5-6 hours each day.

The ways to preserve the staple crop of corns by placing them on black tin-roofed *pogo*, while the *pogo* above the kitchen stove is the design solutions that address the limitations of heat from the sun. The technology in accordance with the nature is different from the solution of building layouts in lower areas which perform corn preservation by drying, threshing, and then sold. The existence of *pogo* is the characteristic of house technological wisdom of the villages on slope of mountain. The creationof comfort in every residential building is also a form of green technology for the slopes of mountains with the altitude of 1,000 meters above sea level which are limited in receiving solar heat. With black tin roof, the rooms in the houses can rapidly be warm in the morning. This is different from the solution of the residential building design at lower areas (lowerthan1,000 meters above sea level) with the preference to use clay roof tiles so that the homes can be cooler. The utilization of daylight from different directions is performed in the residential building layouts on the slopes because the sunlight is not too strong. Daylight can enter by windows/glass, glass tile and openings on the top of building. In general, this method is also carried out in lower areas by more openings

V. CONCLUSION

There search conclusions areas follows: **1)** The solar energy absorbed through black tin roof of the buildings. Solar energy is used to heat *pogo* and the top of the ceiling. The heated Pogo can maintain the harvest of corns. The preservation of corn preservation over the/ *pogo* is simple but creative and has very big influence on the strategy of food security, in the effort of food security. **2)** Sunlight shining bright sky a few hours utilized by creating openings in the roof and in the upper part of the building based on green technology. **3)** The daylight of sun shining several hours is utilized by making the opening on the roof and the upper part of the building based on green technology. Based on the conclusion above, it can be concluded that in every building layout, particularly residential building, it is necessary to consider the character and willingness of the residents and the potential of the area. The building layout on slope of mountain which get limited sunlight and high humidity should catch the sunlight and natural light potentials optimally.

REFERENCES

[1] Brontowiyono, Widodo, Balance of Green Open Space to Suport Green Settlement in Yogyakarta Urban Area, Sains and Technology of Environment Journal, 2085-1227; 2502-6119 ; 8 (2)-68-79 (2016) acces: https://journal.uii.ac.id/JSTL/article/view/7322 , 24 Nov 2020

[2] E.Prianto, F.Bonneaud, P.Depecker and J-P.Peneau, 2000, Tropical- Humid Architecture In Natural Ventilation Efficient Point Of View. A Reference Of Traditional Architecture In Indonesia, *International Journal on Architectural Science,1 (2)*,2000, p.80-95, http://www.bse.polyu.edu.hk/researchCentre/Fire_Engineering/summary_of_output/journal/IJAS/V1/p.80-95

[3] Ghoxali, Achmad, Ratna, Rini; Retno, Dwi; Sustainable Green Settlement: The Arrangement Strategy of Tambak Wedi, Kampong Toward Sustainable Kampong, International Journal of Education and Research, 2201-6333, 2201-6740; 1(2); 1-10 (2013) acces https://www.ijern.com/journal/December-2013/57.pdf , 15 Dec 2020

[4] Janadari, 2021, Nexus of Green Human Resource Practices on Organizational Citizenship Behavior towards Environment, American Journal of Humanities and Social Sciences Research 2378-703X, 5 (3), 392-405, download https://www.ajhssr.com/wp-content/uploads/2021/03/ZR2153392405.pdf

[5] Karyono Tri Harso (2010), *Green Architecture: Pengantar Pemahaman Arsitektur Hijau Indonesia*, Raja grafindo Persada, 978-602-769-3- Jajarta, Indonesia

[6] M Ozaki, Y. Adachi, Y. Iwahori, and N. Ishii, Application of fuzzy theory to writer recognition of Chinese characters, *International Journal of Modelling and Simulation, 18(2),* 1998, 112-116. (8)

[7] Rejeki, VG. Sri and Pradipto, E, 2010, Pengaruh Ikllm Lokal Terhadap Bahan Bangunan Rumah Tinggal di Desa-desa Lereng Gunung(The Influence of Local Climate towards Housing Materials at Villages of Mountain Slope Area),*TesaArsitekturJournal, 8(2*). ISSN 1410-6094, Soegijapranata Chatolic University, Semarang, Indonesia

[8] Rejeki, VGSri;Indrajati, Yovita, Budi; Santosa, Budi, *Optimalisasi lokalitas (kearifanlokal) Terhadap perkembangan teknologi kreatif Desa- desa lereng gunung di Jawa Tengah*, The Report of Research ,Dikti, Jakarta, Indonesia., 2015

[9] Santoso, Dian Kertika; Antariksa, Utami, Sri, Typology of Farmhouse in Enclave Village, Bromo Tengger Semeru National Park, Ngadas, Malang Regency, ,Arsitectura Journal, 17 (2), 2019: 271-282. Accessed: :https://jurnal.uns.ac.id/Arsitektura/article/view/33140 ; 15 Dec 2020

[10] Schefold,Reimar; Nas,PeterJ.M; Domenig,Gaudenz, *Indonesian Houses, Tradition and Transformation in Vernacular Architecture*, Kitlv Press,Leiden,2003

[11] Shukurov, IC; Giyasov,A; Slepnev, IOP Publising P.A; The Residential Area for Mountain Elevation Settlements Choice With The Given Structural Features of The Houses, *IOP Conf. Series: Materials Science and Engineering 365 – 022010*, 1-8 (2018), doi: 10.1088/1757-899X/365/2/022010. Accessed: https://iopscience.iop.org/article/10.1088/1757-899X/365/2/022010/pdf, 30 Marc 2021

[12] Supriyono; Rejeki, VG Sri; Ardiyanto, A; Hapsari, Thermal Comfort for Vernacular Housing in Mountain Slope Case Studi in Kabelukan Candiyasan Wososobo Regency, Central Java, Indonesia, Tesa Architecture Journal, 1410-6094, 2460-6367, accessed 1/E/KPT/2015: 16 (1) 2088: 49-61, 2018.

[13] Zhou, Zhengxu; Jia, Ziyu Jia2; Wang, Nian; Fang, Ming, Sustainable Mountain Village Construction Adapted to Livelihood, Topography, and Hydrology: A Case of Dong Villages in Southeast Guizhou, China, *Sustainability* 4619,*10* (.1-24, *2018*