



## Design of Integrated Electrical Installations with Solar Panel in Muhammadiyah Ibtidaiyah Madrasah Building in Jurangono, Gemantar Village, Mondokan-Sragen

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### Abstract

The Muhammadiyah Mondokan Branch Leader has a charity business in the field of elementary school level education or often known as MI Muhammadiyah (MIM). MIM Gemantar was founded in 1978 with a basic education level. In carrying out its activities, MIM Gemantar is under the auspices of the Ministry of Religion. Accredited B on November 9, 2017. MIM Gemantar has the most worrying building condition compared of the four other MIMs in Mondokan. On Monday, according to Central Java news inews.id, it was reported that the roof of MI Muhammadiyah Gemantar collapsed, resulting in the headmaster and 2 students being injured. The collapse of the classroom roof occurred during teaching and learning activities or KBM taking place on Monday, January 9, 2023 at around 08.15 WIB. For the last four months, students from three classes have been put in one room. The room whose roof collapsed was used by three classes because the number of students was small, namely classes II, IV and VI. The aim of this research is to design an integrated electrical installation with solar panels in the MIM Gemantar building which will be renovated. This has several benefits, including as a form of utilizing renewable energy and also as a learning medium for students in grades 4 - 6 with the theme of renewable energy. The method of this activity is for the team to get a floor plan of the building to be built, then carry out a design, the implementation process is as simple as it is easy to update capacity, draw a single line and plan the cost budget. Currently, the MIM Gemantar Mondokan Sragen building has completed building 4 classrooms, so it still requires the construction of 2 more classrooms. Currently, the electricity source for the 4 classroom building's electrical installations all use electrical energy from PLN. In the future, if funds are available and the management wants to install solar panels, then only add them according to the design results of a single line electrical installation that is integrated with solar panels on grid (can be done in stages of 200 Wp, 400 Wp or even up to 1,000 Wp). The capacity of solar panels does not have to match the planned capacity, meaning that capacity can be carried out in stages according to the conditions of the funds provided.

## 1. Introduction

The history of the founding of MIM begins with the establishment of the Compulsory Learning Madrasah (MWB) in 1952 on the initiative of Kyai Muh. Badarudin. He is a community figure in the Jurangombo Area. MWB was originally a boarding school and madrasah. Concern for the world of education and sincerity in educating students led him to open a class which later became the forerunner of MI Muhammadiyah Jurangombo (MI Muhammadiyah Terpadu Harapan; now). The name Madrasah Ibtidaiyah (MI) Muhammadiyah is based on the Charter of Recognition of the Religious Education Department's Learning Obligations issued by the Ministry of Religion of the Republic of Indonesia with serial number: A/9/5466 dated April 1 1968 in Jakarta. On that basis, MWB is managed by Kyai Muh. Badarudin changed its name to MI Muhammadiyah led by Mr Margono (led MI Muhammadiyah Jurangombo in 1970-2000), Kyai Muh. Badarudin remains active as the manager and advisor of the Islamic boarding school as well as a teacher at the madrasah (MIM Terpadu Harapan).

MI Muhammadiyah (MIM) Gemantar is one of the 5 MIMs in the Mondokan Sragen area, namely MIM Pare, MIM Taraman, MIM Jambangan and MIM Jekani 2. MIM Gemantar was founded in 1978 and is one of the educational units at the MI level in Gemantar, Mondokan District, Sragen Regency, Central Java. In carrying out its activities, MIM Gemantar is under the auspices of the Ministry of Religion. Accredited B on 11-09-2017.

MIM Gemantar has the most worrying building condition of the four other MIMs in Mondokan. According to Central Java news inews.id, it was reported that the roof of MI Muhammadiyah Gemantar collapsed, resulting in the headmaster and 2 students being injured. The collapse of the classroom roof occurred during teaching and learning activities or KBM taking place on Monday, January 9, 2023 at around 08.15 WIB. Member of the Muhammadiyah Mondokan Branch Leadership, Aan Mei Yazuki, explained that for the last four months students from three classes have been put in one room. The room whose roof collapsed was used by three classes. Because the number of students is small, namely classes II, IV and VI. Two premises have been built, one room has not been built and its roof has collapsed, as in figure 1.



Figure 1. MI Muhammadiyah Gemantar Mondokan Building After the Roof collapsed.

The research team from the Muhammadiyah University of Surakarta carried out the design of the MIM Gemantar building that will be built. The building design consists of 2 floors as an effort to optimize the land owned by MIM Gemantar. The team has also coordinated with the MIM management in designing the new building, so it is hoped that the design will have Islamic characteristics and be able to increase student productivity, as well as the use of alternative energy as a form of effort to create a modern building and reduce electrical energy consumption to PLN (Wastu, 2015; Adrell et al., 2021; Purwoto et al., 2018)

## 2. Methods of Implementation

The first stage of this activity is to conduct a survey of the MIM Gemantar Mondokan location (looking at the potential source of the nearest electricity network, availability of sunlight intensity at the location and access). The next stage is to coordinate with the planning team for the building to be built (using ceilings, floor height with 2<sup>nd</sup> floor), using glass doors as a medium to provide access for sunlight into the room. The third stage is to design the electrical installation on the plan of the building to be built. The installation design has been designed to be integrated with solar panels that utilize On Grid System technology. The fourth stage is to explain to MIM Gemantar and the construction implementer regarding the plan for the building to use solar panels, although currently the implementation is only an electrical installation that utilizes energy sources from PLN, while the final stage is making a progress report, publishing articles and making a final report. The flow chart of this activity is depicted in figure 2.

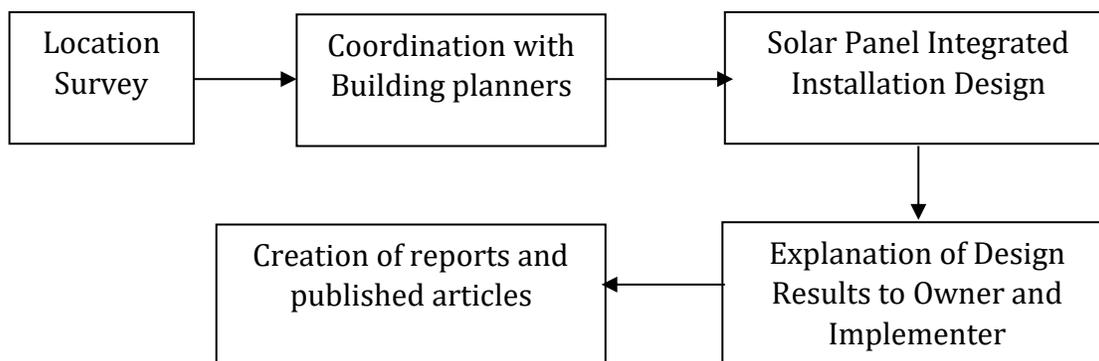


Figure 2. Stages of Community Service Activities

The installation of electrical installations in the new building has been completed, the details of this service activity are as follows:

- a. The location survey was carried out on february 7, 2023.
- b. Coordinating with building planners (10–21 february 2023).
- c. Designing electrical installations integrated with solar cells in new building plans (23 february – 17 march 2023)
- d. Explanation of electrical installation design documents to MIM Gemantar management and building implementers (contractors) (March 23, 2023).
- e. Monitoring the implementation of electrical installations in new buildings (april-june 2023).
- f. Commissioning test of electrical installations in new buildings (june 2023).
- g. Preparation of progress reports and publication articles.

### 3. Results and Discussion

The building design that has been designed by the architectural planner becomes a reference in planning electrical installations. This building is planned to have 2 floors. Floor plans 1 and 2 are shown in figures 3 and 4. Figures 3 and 4 also show the design results for installing light points in each room on the 1st and 2nd floors.

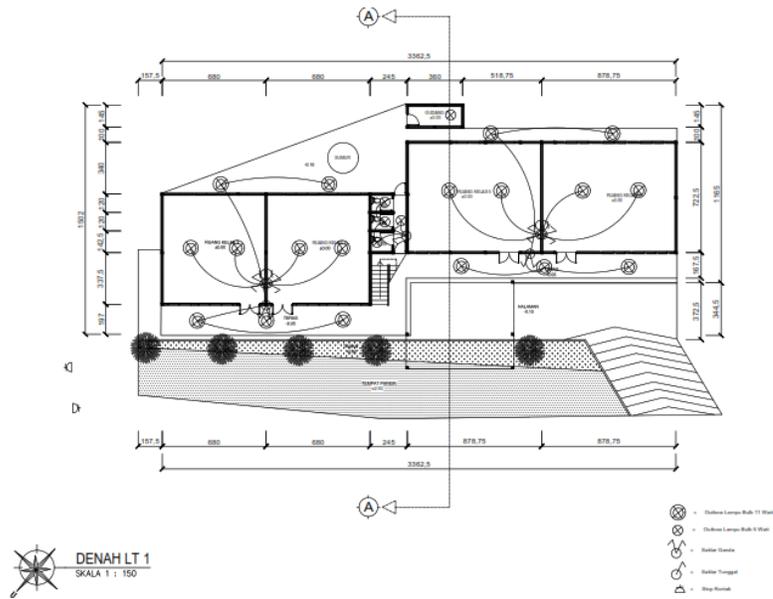


Figure 3. Light and socket installation design on the 1<sup>st</sup> floor

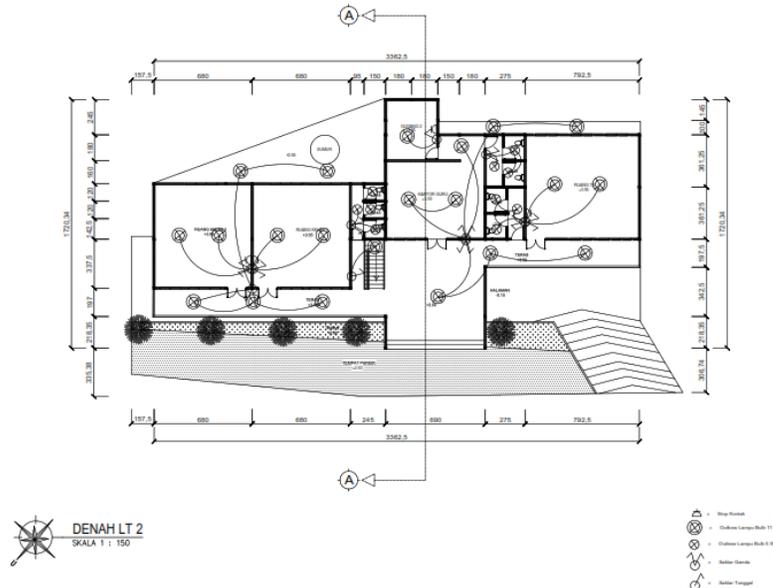


Figure 4. Light and socket installation design on the 2<sup>nd</sup> floor

Meanwhile, pictures 5 show an example of a room where light points have been installed. The classroom has 2 light points according to the design, this is still sufficient in terms of light

intensity in the classroom because of the high intensity of sunlight (natural light) that enters the room through the glass candela area as seen in the figure 5.



Figure 5. Light Points in the New Classroom and Installation of light points in the stair area to the 2<sup>nd</sup> floor

Figure 3 is a single line image of the MIM Gemantar Building's electrical installation system which is integrated with solar cells. Currently, the building has not yet installed solar panels because it is still constrained in terms of funding, but in the coming year, if the management has enough funds, then the process of installing solar panels on the system will be very easy. It's easy, this is because you can directly connect the installation to the existing installation without carrying out repairs or reinstallation.

#### 4. Conclusion

This service activity has been carried out well and smoothly, so there are several conclusions, namely:

- a. The electrical installation in the new building is in accordance with the design results of this service activity.
- b. Currently, electrical installations have been installed that use PLN electrical energy sources. However, in the coming year, management can install solar panels on existing installations without making changes (connected directly), and the capacity to be installed can be done in stages.

The suggestions for this activity are as follows:

- a. Installation of solar panels is prioritized, funds can be allocated by the management or seeking donors or grants from other sources.
- b. Solar panels can be installed in stages and placed in areas that are easily seen by teachers and students, so that they can be used as a learning medium related to renewable energy, especially solar panel technology.

## 5. Acknowledgements

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