

SUSTAINABLE ENERGY-EFFICIENT GREEN OPEN SPACE DESIGN IN WINONG PERMAI RESIDENTIAL COMPLEX, SUDIMARA TIMUR SUBDISTRICT, CILEDUG DISTRICT, TANGERANG CITY, BANTEN PROVINCE

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ABSTRACT

Winong Permai is a residential complex located in Sudimara Timur Subdistrict, Ciledug District, Tangerang City. The complex has a single green open space. Currently, the green open space is in an unmaintained condition. In fact, such a space is highly important as it serves public needs by functioning as a refreshing area within the neighborhood. The availability of green open space is a mandatory requirement for housing developers in accordance with government regulations. Moreover, the demand for electricity supply in this green open space has become an urgent necessity that must be addressed immediately.

Keywords: Design, Green Open Space, Electricity Supply, Winong Permai

1. INTRODUCTION

Tangerang City is a rapidly growing urban area that functions as a supporting city for the capital, Jakarta. Rapid population growth and increasing land demand have reduced the availability of public open spaces, which are vital for sustaining urban development from a sociological perspective. According to the Regulation of the Minister of Public Works No. 05/PRT/M/2008, open spaces must fulfill both quantitative and qualitative requirements to ensure their proper provision and utilization. Winong Permai Residential Complex, located in Sudimara Timur Subdistrict, Ciledug District, Tangerang City, was established in 1995 and represents one of the urban housing areas facing such challenges.



Figure 1. Winong Permai Complex Area

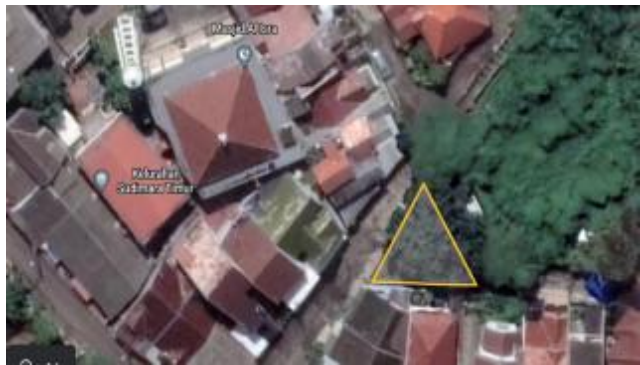


Figure 2. Area of green open space in the complex

The Winong Permai Residential Complex contains a single green open space, which also serves as a communal gathering area for residents. Located in Sudimara Timur Subdistrict, Ciledug District, Tangerang City, Banten Province, the area spans approximately 120 m² with a triangular configuration. At present, the space remains poorly maintained, reducing its functional and ecological value. Given the importance of green open spaces in supporting social interaction, environmental balance, and urban sustainability, the lack of proper management poses a significant challenge. Therefore, the development of an energy-efficient design for this green open space is essential to enhance its usability, ecological contribution, and long-term sustainability.

The phenomenon of urban areas in Indonesia today tends to face similar issues, particularly the high rate of population growth driven by urbanization, which places increasing pressure on urban space management. The continuously growing urban population has significant implications for the intensified demand and use of urban space, thereby requiring special attention in urban spatial planning. This is especially relevant in relation to the provision of residential areas, public and social facilities, as well as urban public open spaces. In general, public open spaces in cities consist of green open spaces and non-green open spaces. Urban Green Open Spaces (RTH) are a part of the open space system within an urban area that is filled with plants and vegetation (both endemic and introduced species), designed to support ecological, socio-cultural, and architectural functions, while also providing economic benefits and

contributing to community well-being. Meanwhile, non-green open spaces may include paved open areas or blue open spaces (RTB), such as rivers, lakes, and designated retention basins.

The provision of Green Open Spaces (GOS) in urban areas is categorized into three aspects: provision based on land area, provision based on population size, and provision based on specific functional needs.

a. Provision based on land area

Urban green open spaces consist of public GOS and private GOS. The proportion of GOS within an urban area must be at least 30%, comprising 20% public green open spaces and 10% private green open spaces. If the total area of both public and private GOS in a city exceeds the minimum requirements stipulated by regulations or legislation, this proportion must be maintained. The 30% proportion serves as the minimum threshold to ensure ecological balance within the city, including hydrological system balance, microclimate regulation, and other ecological systems that enhance the availability of clean air needed by the community, while simultaneously improving the aesthetic value of the city.

b. Provision based on population size

The availability of GOS must also consider the number of residents living in the urban area. This ensures that every inhabitant has fair and adequate access to open spaces for daily activities such as recreation, sports, social interaction, and relaxation. The provision based on population size also helps distribute open spaces proportionally across densely populated neighbourhoods to prevent overcrowding and environmental degradation.

c. Provision based on specific functional needs

In addition to land area and population considerations, GOS provision must also respond to particular urban functions and needs. This includes spaces for children's playgrounds, sports facilities, pedestrian paths, urban farming, ecological corridors, and disaster mitigation areas such as retention basins or flood control zones. By addressing functional needs, GOS can contribute not only to environmental quality but also to social, cultural, and economic sustainability within the urban setting.

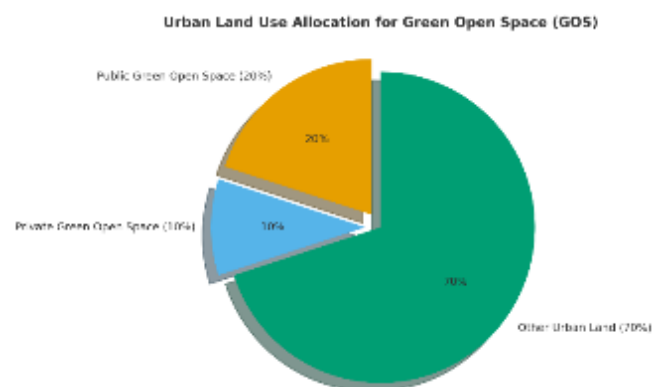


Figure 3. Urban Land Use Allocation for Green Open Space (GOS)



Figure 4. Presents the existing condition of the Green Open Space located within the Winong Permai Complex, Sudimara Timur Subdistrict, Ciledug District, Tangerang City

The green open space in the Winong Permai Complex has a triangular shape. At present, the condition of this open space requires a redesign to make it more aesthetically pleasing and comfortable for use by the community in general, and by the residents of Winong Permai in particular. To maximize its utilization, the proposed redesign of the green open space will also be equipped with energy-efficient facilities.

This community service activity focuses on designing an energy-friendly green open space in the Winong Permai Complex, encompassing floor plans, elevations, sections, and energy-efficient 3D modelling visualizations. The design is expected to serve as a reference for residents in implementing the renovation of the open space.

2. METHOD

The method of this Community Service activity adopts the Architectural Design Process approach with participatory stages, involving lecturers, students, and the local community. The activities are carried out through the following stages:

- a. Preparation
 - 1) Conducting internal coordination between the team of lecturers and students.
 - 2) Obtaining permission from the local RT/RW (neighbourhood and community leaders) in Sudimara Timur Sub district, Ciledug District, Tangerang City.
 - 3) Preparing the activity schedule and necessary supporting instruments (survey tools, camera, simple questionnaire, and drawing equipment).
- b. Field Survey and Problem Identification
 - 1) Observing the existing condition of the green open space in the Winong Permai Complex.
 - 2) Identifying the main problems, namely: the neglected condition of the open space, its suboptimal function, and the absence of energy-friendly facilities.
 - 3) Collecting primary data (field observations, interviews with residents and neighbourhood/community leaders) and secondary data (regulations on green open space, literature on energy-efficient design).
- c. Formulation of Design Concept
 - 1) Developing a park design concept based on community needs, covering recreational, social, sports, and ecological functions.
 - 2) Formulating the application of energy-efficient concepts through the use of solar panels as a power source.
 - 3) Preparing alternative design proposals to be discussed with the residents.
- d. Design Development
 - 1) Producing a park design that includes a site plan, floor plan, elevations, sections, detailed working drawings, and 3D visualization.
 - 2) Integrating public facilities such as a children's playground, jogging track, reflexology path, seating areas, and solar-powered lighting systems.
- e. Design Socialization to the Community
 - 1) Presenting the design to the neighbourhood/community leaders (RW) and residents to obtain feedback and approval.
 - 2) Revising the design according to community needs and aspirations.
- f. Report Preparation and Publication
 - 1) Preparing the final report of the community service activity.
 - 2) Producing working drawings and 3D documentation as references for the community in implementing the park renovation.
 - 3) Disseminating the results of the activity through academic forums and the information media of Universitas Budi Luhur.

3. RESULTS AND DISCUSSION

The implementation of the Community Service activity "Energy-Friendly Green Open Space Design at Winong Permai Complex" was carried out by lecturers and students of the Architecture Study Program, Universitas Budi Luhur, at Sudimara Timur Sub district, Ciledug District, Tangerang City, Banten. The output of this activity consists of the Working Drawings of the Winong Permai Garden Design and 3D visualizations of the Winong Garden.

The activity began with a site survey and obtaining permission from the Head of Neighbourhood Unit (RT) 03, Community Unit (RW) 05, Sudimara Timur Sub district, Ciledug District, Tangerang City, Banten. Based on the site survey, permission was granted by Mr. Nurtavi Priyohandoyo, the Head of RT 03 RW 05, to provide the garden design service required by the residents. The survey was conducted to understand the condition of the land designated as the garden. Below is an illustration of the site condition for the Winong Permai Garden.



Figure 5. Existing Condition of the Site Planned for Winong Permai Park

Winong Permai Park is designed according to the needs of the community or residents of the Winong Permai housing complex, who require a communal space and a green open space. The residents of Winong Permai desire a park that not only functions as a green open area for rainwater absorption but also serves as a place for gathering and socializing, playing, relaxing, and exercising.

Based on the aspirations of the local residents, the facilities provided in the design of Winong Permai Park can be seen in the facility requirements table below.

Table 1. Facility Requirements for the Park

No	Activity	Facility	Material	Type of Materials
1	Relaxing	Seating area	Garden bench	Hard material
2	Socializing	Open space (grass)	Grass	Soft material
3	Playing	Playground	Fiber/Plastic and steel frame, concrete floor with synthetic rubber finish	Hard material
4	Foot exercise	Air Walker	Fiber/Plastic and steel frame	Hard material
5	Running exercise	Jogging track	Paving block	Hard material

6	Foot reflexology	Reflexology stones	Natural stone and cast concrete	Hard material
7	Waste disposal	Trash bin	Plastic with steel frame	Hard material
8	Water absorption	Open space	Grass and trees	Soft material
9	Lighting	Garden lamp	LED lamp with solar panel (Photovoltaic)	Hard material

Winong Permai Park is designed according to the needs of the community and residents of the Winong Permai Residential Complex, who require a park as a communal space and as a green open space. The residents of Winong Permai expect the park to serve not only as a green open space for rainwater absorption, but also as a place for gathering, socializing, playing, relaxing, and exercising.

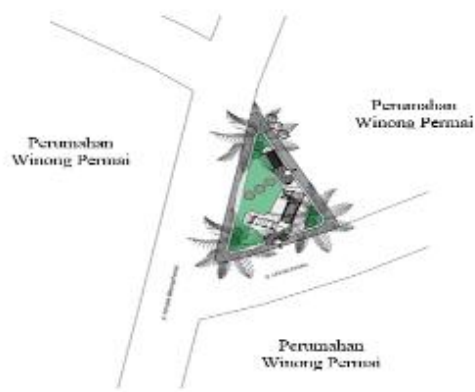


Figure 6. Site Plan of Winong Permai Park

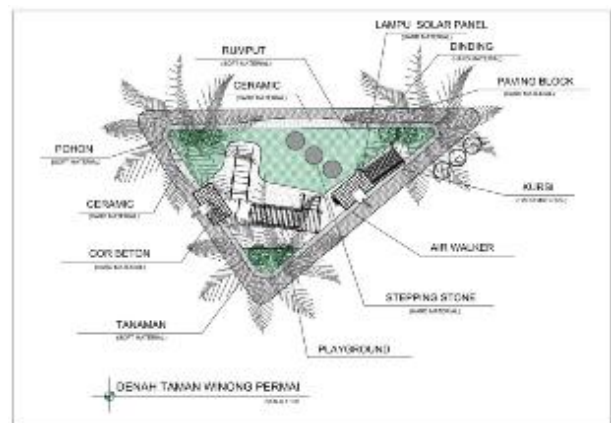


Figure 7. Layout Plan of Winong Park



(1)



(2)



(3)



(4)



(5)



(6)

Figure 8. 3D View of Winong Permai Park

Electrical System

The design of Winong Permai Park incorporates an energy-efficient electrical system. Energy efficiency is essential because fossil fuels, which are commonly used as energy sources, are gradually depleting. Moreover, regenerating new fossil fuel reserves takes an extremely long time. Therefore, renewable energy becomes the right solution to overcome the limitations of fossil energy. The proposed source of electrical energy is renewable energy derived from solar radiation. The device used to convert solar radiation into electrical energy is a solar panel.

The proposed lighting system consists of solar-powered lamps with specifications including a polycrystalline solar panel and a VLRA battery for energy storage, with a capacity of 30 WP. For the lamp specifications, a 7-Watt LED (equivalent to 35 Watts) is used, with a colour temperature of either warm white 2700–7000 K or pure white 6000–7000 K.

The working principle of the solar-powered lamp is as follows: the solar panel absorbs photons from sunlight and converts them into electrical energy. Since the voltage generated by the solar panel is unstable, a battery charge regulator is required to regulate the charging current, and to prevent overcharging and overvoltage. The battery stores the electrical energy collected by the solar panel during the day and releases it at night to power the lamp. Additionally, the battery supplies power to the load when there is no sunlight. The recommended type of battery is VLRA, which is maintenance-free and has a valve for gas exchange to maintain optimal internal temperature and extend battery life.

Most lamps commonly available are AC-based, whereas the output from solar panels is DC electricity. Therefore, an inverter is required to convert DC (Direct Current) into AC (Alternating Current).

1) Advantages of Solar-Powered Lamps:

- a. A sustainable energy source that is obtained for free as long as the sun is shining.
- b. Environmentally friendly technology.
- c. Easy installation.
- d. Independent system, without the need for an electricity grid connected to the state utility (PLN).

2) Disadvantages of Solar-Powered Lamps:

- a. The power output decreases during cloudy conditions in the daytime.
- b. Higher initial investment cost compared to conventional garden lamps.
- c. Solar panels must be cleaned regularly to prevent dirt and dust from reducing their electrical performance.

Submission of the Winong Permai Park Design

In the implementation of designing Winong Permai Park, several design revisions were carried out to achieve a design that met the needs of the residents. After the design process was completed, the next stage was the submission of the Winong Permai Park design to the community partner, in this case, the Head of RT 03 RW 05, Sudimara Timur Sub district, Ciledug District, Tangerang City, Banten. During the submission, an explanation was also provided regarding the materials used as well as the facilities included in the Winong Permai Park design. The following is the documentation of the design submission, which took place in July 2023.



Figure 9. Design Presentation to the Winong Permai Park Management



Figure 10. Submission of the Design Drawings to the Winong Permai Park Committee

4. CONCLUSION

Based on the results of the Community Service Program (PPM) in providing the design of a Green Open Space in the form of a park for the residents of Komplek Winong Permai, the following conclusions can be drawn:

- 1) The design of Winong Permai Park aligns with the needs of the residents of Komplek Winong Permai.
- 2) The design of Winong Permai Park applies an energy-friendly concept through the use of solar panels (photovoltaic) for the park lighting system.
- 3) The design of Winong Permai Park includes facilities for children's play (playground), sports facilities (air walker and jogging track), foot reflexology facilities, and seating areas.

Recommendation

The Community Service Program, namely the provision of energy-friendly green open space design services in Komplek Winong Permai, Kelurahan Sudimara Timur, Kecamatan Ciledug, Kota Tangerang, Banten, needs to be further developed so that future activities can be improved and contribute more significantly to the enhancement of PPM, which is an essential part of implementing academic knowledge. The design ideas prepared by the PPM team have been well received by the park management of RT 03 RW 05, Sudimara Timur, Ciledug, Tangerang. In addition, feedback from the surrounding residents has broadened the team's insights, creating a harmony between academic knowledge and real conditions in the field.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to Universitas Budi Luhur and the Institute for Research and Community Service (LPPM) for the support provided in the implementation of this Community Service Program (PPM). Special appreciation is also extended to the residents of Winong Permai Residential Complex for their active participation, valuable feedback, and cooperation during the design process of the Green Open Space (RTH) – Winong Permai Park. This work would not have been possible without the collaboration of the academic team, students, and community stakeholders who have contributed their time and expertise. Their dedication has been essential in realizing a park design that integrates community needs, energy efficiency, and sustainable environmental concepts.

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