

# **Sustainable Development of the Campus**

## **Environment**

The university sets the five goals of safety, security, suitability, smart, and sustainability as the main axes of campus space and landscape environment management. The main achievements of the sustainable development of the campus environment in recent years can be summarized as follows:

### **(1) Smart Building Planning and Design**

#### **1) Purpose**

- A. The intelligent design concept of the newly built Xuesi Building (teaching and research building) and Erya Building (student dormitory) has two aspects: “user-friendliness” and the integration of “environmental” facilities.
- B. In terms of users, starting from “humanization,” convenient and comfortable daily use can be provided through network technology with an in-depth understanding of user needs.
- C. In terms of environmental management, intelligent sensing and automation guidance were well and flexibly used in the operation and maintenance of electrical, telecommunications, water supply and drainage, air conditioning, disaster prevention, waterproofing, and anti-theft systems in buildings to improve the effectiveness of energy saving, safety and disaster prevention, and facility management.

#### **2) Strategy**

- A. According to the usage characteristics of buildings, plan and integrate the required systems, supplementing with a user-friendly user interface (UI).
- B. Set up an energy management system to monitor and control electricity and water equipment, which can automatically reduce power loads when necessary.
- C. The monitoring and management system helps the university

to achieve remote monitoring through the connection of personal computers and devices into the campus network.

- D. Obtain statistics on electricity and water consumption through graphical programming tools, benefiting the analysis and management of energy consumption.
- E. Integrate access control, fire protection, emergency rescue, and monitoring systems to improve the safety of students and faculty and provide disaster prevention and early warnings.

### 3)Benefit

- A. The Building Energy Management System has graphical management tools for the analysis of the electricity consumption of buildings.
- B. Separate air-conditioners, which meet the CSPF Grade 1 for energy efficiency classification, are installed in the dormitories of Erya Building. The best energy efficiency is achieved by using the variable frequency conditioners together with the space load.
- C. The ice storage central air-conditioning system installed in Xuesi Building adopts the form of full ice storage at night off-peak time and daytime ice melting. Furthermore, the building is also equipped with a central air-conditioning monitoring system and uses the off-peak electricity price of Taiwan, which can effectively reduce the maximum power demand during the day to achieve savings on electricity bills.

(The platform for the building energy management system)



(The central air condition monitoring system)



## (2) Green Building Planning and Design

### 1) Purpose

- A. To promote symbiosis and mutual benefits among buildings and the environment, and sustainably manage the living environment.
- B. To implement energy conservation in buildings and continuously reduce energy consumption and carbon dioxide emissions.
- C. To develop technologies to improve indoor environmental quality and create a comfortable and healthy indoor living environment.
- D. To promote the reduction of construction waste to reduce environmental pollution and its hazards.

### 2) Strategy

- A. Design strategy: The Xuesi Building and Erya Building adopt a green building design to minimize energy and water consumption, improve natural ventilation and sunlight, reduce their heat transfer, use renewable energy, etc.
- B. Building material strategy: Use green building materials that have the standard certificates (ordinary fiber cement board) to

reduce the impact on the environment.

- C. Energy-saving strategy of the building: Adopt energy-saving techniques and equipment, such as a high-efficiency lighting system (two-wire LED lighting system), building heat insulation (roof solar panels, green plants), high-efficiency ventilation system (air handle unit, total heat exchanger and exhaust fan), etc., so as to reduce energy consumption.
- D. Water resource strategy of the building: Use water resource management techniques, such as rainwater harvesting (watering system), low-flow sanitation equipment (water-saving toilets, water-saving faucets, etc.), to achieve water resource conservation and reuse.
- E. Base water retention facilities: The first one is a “direct infiltration design” to achieve water conservation through soil; the second one is a “storage infiltration design” to temporarily retain rainwater on the base: a rainwater recycling pool is built to store rainwater for plant watering.

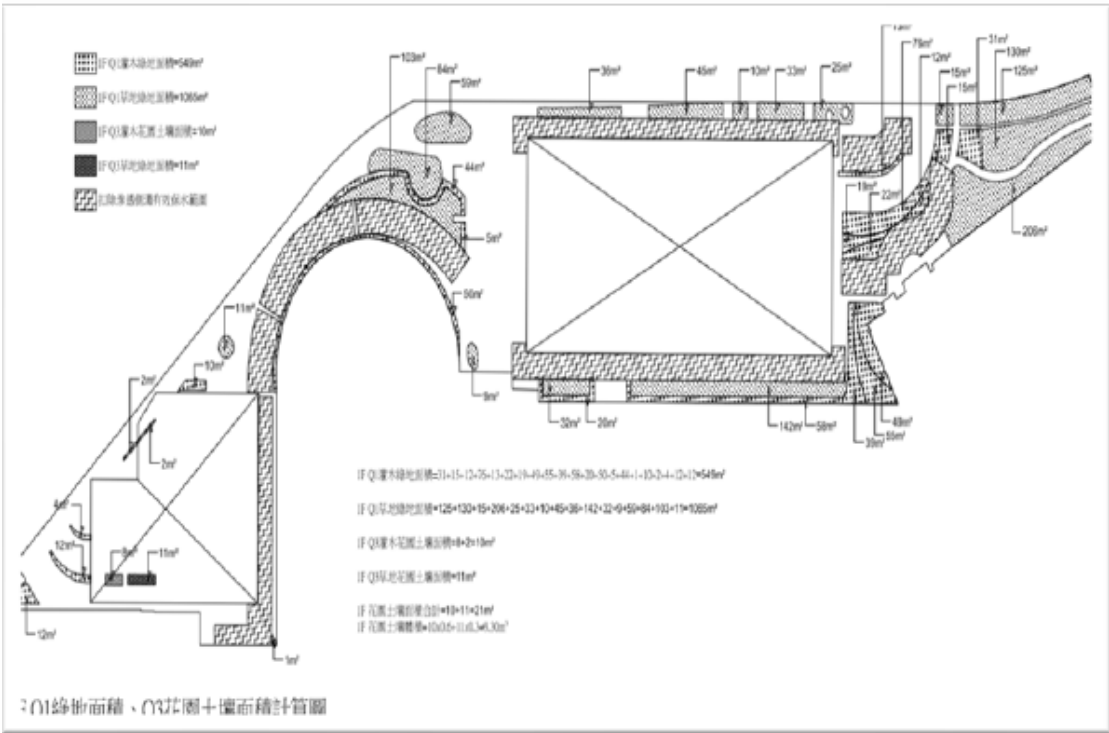
### **3)Benefit**

- A. Set up a central controlling and monitoring system to efficiently use and save electricity, as well as to reduce labor operating costs.
- B. The use of an ice-storage central air-conditioning system can significantly reduce energy use and carbon emissions.
- C. Carbon dioxide detection and two-wire LED system provide fresh air, which ensures both human health and comfort, improving the quality of teaching and building usage.
- D. By combining the base water conservation with the existing green environment of the campus, flooding disasters on campus caused by heavy rain can be prevented.

(The ice-storage central air-conditioning system)



(Map of the green area and garden soil area around the Xuesi and Erya Buildings)



### **(3) Green Energy Power Generation Scheme: Solar**

#### **Photovoltaic Power Generation Equipment**

##### **1) Purpose**

- A. In line with Taiwan's overall development, energy utilization, and environmental sustainability programs, the vision of energy security, green economy development, and environmental sustainability will be achieved in order to promote energy diversification and autonomous power generation and increase green energy power generation.

##### **2) Implementation Methodology**

- A. The rooftops of eight buildings in the university were leased out to companies to install solar photovoltaic power generation equipment. In October 2017, in coordination with the Executive Yuan's "2-year Solar Power Promotion Plan," the rooftops of four buildings were selected for the first phase of equipment installation, with a set capacity of 339.84kWp. Later in 2020, in coordination with the new construction project of the Xuesi and Erya Buildings, together with the rooftops of the existing two dormitories, the second phase of equipment installation was carried out, with a set capacity of 199.32kWp. The total set capacity is 539.16kWp. The equipment layout of each building is shown in the table below.

## Solar photovoltaic power generation equipment installation

Year	Installation location	Installation area (m <sup>2</sup> )	Set capacity (kWp)
2017 (Phase one)	1. Science and Technology Building	614	99.12
	2. Administration Building	628	99.12
	3. Library	341	56.64
	4. Teaching Building	504	84.96
Subtotal		2,087	339.84
2020 (Phase two)	5. Xuesi Building	130	25.08
	6. Erya Building	82	15.84
	7. Lanxin Building	408	79.2
	8. Huizhi Building	408	79.2
Subtotal		1,028	199.32
<b>Total</b>		<b>3,115</b>	<b>539.16</b>

Remarks: The first period of the lease was from November 14, 2017 to November 13, 2027; The second period of the lease was from November 3, 2020 to November 2, 2030.

### B. Evaluation of the installation location and construction plan

Requirements for a suitable location:

- Large enough area (the total installation area is at least 1,000 square meters)
- Structurally safe
- Minimal impact on the landscape from pipeline configuration

### C. Select 8 suitable locations

### D. Construction method

- Heavy concrete construction for support foundation
- Avoid damage to the waterproof layer on the roof for the convenience of future maintenance

### E. The first and second phases completed the parallel connection



operation with Taiwan Power Company and started generating electricity on June 27, 2018 and June 21, 2021, respectively.

### **3) Outcome benefits**

#### **A. Free installation and maintenance assistance**

The university does not need to make an additional budget to bear the cost of equipment and construction. Instead, it only needs to provide the place for installation, and the companies are responsible for the construction of the solar photovoltaic power generation system and subsequent operation and maintenance.

#### **B. Make good use of space to generate income**

- a. The idle space on the rooftop has been effectively utilized, and the companies are responsible for the construction of the solar photovoltaic power generation system and subsequent operation and maintenance, revitalizing state-owned assets, enjoying fixed rental income, and creating a win-win situation.
- b. The amount of power generation and rewards in the past five years of the university are shown in Figure 1. Since 2021, the average annual generation capacity is approximately 600,000kWh, and the annual reward is approximately NT\$220,000.

#### **C. Sunshade and heat insulation save electricity and lower costs**

Installing solar panels on the rooftop has a thermal insulation effect for the top floor, reducing the temperature by approximately 3°C and the electricity consumption of the indoor air-conditioner by approximately 18%, saving energy and electricity costs.

#### **D. Energy saving, carbon reduction, environmental protection, and sustainability**

1kw of installed solar energy can reduce carbon emissions by 652.5kg per year. Taking practical actions to implement energy conservation and carbon reduction and respond to green energy and environmental protection initiatives is



the best example of the university investing in environmental education and sustainable development.

- E. Solar photovoltaic power generation information (daily overall amount of real-time power generation)  
<https://tatungsolarweb.azurewebsites.net/tv/1120031/>
- F. Aerial photos of solar photovoltaic power generation equipment installed on the rooftops of the buildings at the university (Figures 2–4)

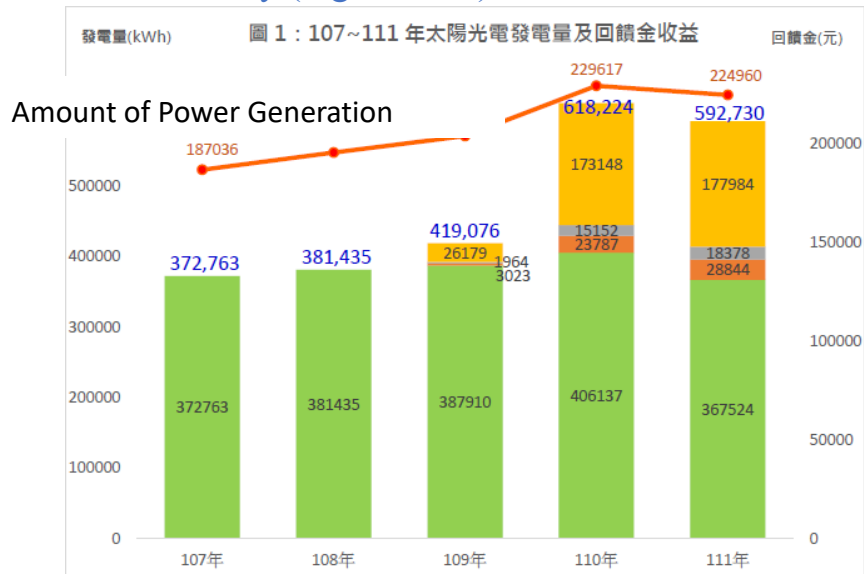


Figure 2 The first phase of installation of the solar photovoltaic power generation equipment



Figure 3 The second phase of installation of the solar photovoltaic power generation equipment (Xuesi Building)



Figure 4 The second phase of installation of the solar photovoltaic power generation equipment (three student dormitories)



Benefits: 1. Solar panels generate electricity  
2. Sunshade and heat insulation cool down the outer side of the roof and reduce the load of indoor air-conditioning

## **(4) Public Art**

### **1) Purpose**

- A. In order to create the entrance image of the campus living area and in response to the future commercial space use plan, a friendly and pleasant urban landscape and environment will be created.
- B. Public art with diversified uses, multi-level street greening, and strip-shaped spaces that complement the new construction project will enrich the campus landscape.
- C. Create a strengthened friendly relationship between the campus and the community and new possibilities for visual flow and interaction in the neighborhood.

### **2) Strategy**

- A. The public art project incorporates three campus characteristic concepts. With proximity to the natural environment such as Datunshan and Yangmingshan, green tunnels and rich plants are indicators of the campus's hope for the sustainable development of the campus ecology and continuing the concept of a "green environment" on the campus.
- B. The second-level environmental concept, "human environment," was created in the belt-shaped space in the second section of Shipai Road by demolishing the existing walls and breaking the original facade configuration during this new construction project, creating an attractive and friendly pedestrian walkway space.
- C. The "water environment" space next to the spa is a friendly water environment for the university, linking "Water (Blue Ribbon)" with the story of the campus in the past, present, and future. It is hoped that this art project will bring the third-level key concept, "water environment," and the concept of environmental protection and sustainability can be implanted using public art works.

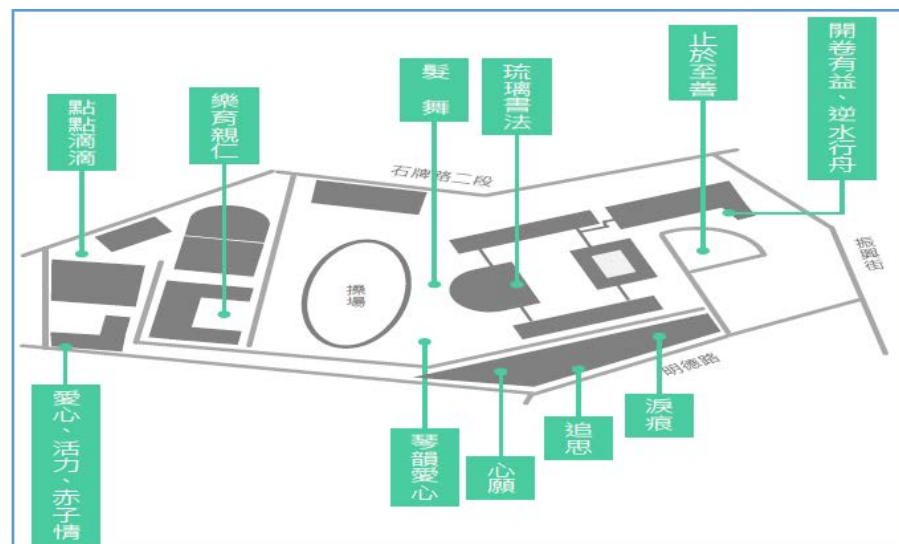




### 3) Achievements

#### A. Current situation of existing public art

There are 11 groups of public art works, most of which are sculptures using materials such as marble, copper, and glaze. Most of the outdoor works use plain colors, which are in harmony with the nearly 70% white buildings in the university, and are currently in good condition.



Public art project plan for the new construction of Xuesi and Erya Buildings - current situation of the Nursing Gardeners

The three works are Guardian Gardener Accompany until Recovery; Imaginative Gardener Cloud, Mountain and Water; and Healing Gardener

Mandala Gardener. They have different levels of viewing beauty and different concepts, from concrete to semi-abstract to abstract, from looking up to interacting with, bringing teachers, students, and the public into the art world of guardianship, imagination, and healing.



模擬圖

實景照



《守·愈》：

Accompany until recovery :taking the nursing flower alocasia as the starting concept, the heart of accompany gives birth to the “human” environment, the happy, educative, love and kindness environment of

National Taipei University of Nursing and Health Sciences. Students will inherit the pure quality of nursing staff in the National Taipei University of Nursing and Health Sciences. The sculpture also shows that life is like the blossoming and falling of flowers and the changing of the seasons. In the bright and dim path of life, the nursing staff of the National Taipei University of Nursing and Health Sciences will be there to guard and accompany.

### 《云山水》

:Cloud, mountain and water (8 pieces): Taking the three forms of water (solid/liquid/gas) as the starting concept, and taking the environment as the theater to create an imaginative environment in the noisy urban environment. From the flow and circulation of water, the environmental history of the “water” environment of National Taipei University of Nursing and Health Sciences can be conveyed, just like the flow from the Tamsui River (Neijiang campus) to the Southern Sulfur creek of Shipai (Shipai campus) both into the Tamsui River, echoing the continuous inheritance of the nursing ambition of the students of National Taipei University of Nursing and Health Sciences; also like the heavy traffic on Shipai Road. The landscape of mountain and water is the background of heavy traffic, which can be viewed and thought about from a long distance or a close distance. A landscape artistic conception can be imagined and created in the urban environment.

### 《曼達拉園丁》：

Mandala Gardener(3 pieces):The starting concept “Plant/Mandala” echoes the most characteristic “green” environment of the campus. The university is already rich in virgin greenery, so this sculpture starts from nature and offers an open imagination. The abstract extracted patterns of plants and interwoven colors seem to be scattered, but on the whole they are one, like a flower is a world, a sand is a heaven. This sculpture is created with mandala, which corresponds to the healing world of the mind and echoes the natural world, in accordance with the Chuang garden on the side of Mingde Road of National Taipei University of Nursing and Health Sciences. Greenery wander on the side of Shipai Road, adding

color to the campus in terms of function and vision, and symbolizing the growth and completeness of life start from here in terms of artistic conception.

## **(5) Energy-saving plan**

### **1) Purpose**

- A. In coordination with the “Energy Conservation Action Plan for Government Agencies and Schools” (2020–2023) approved by the Executive Yuan on January 3, 2020.
- B. The target of electricity saving is that EUI will not be higher than that of the base year (102.6) in 2015, and oil consumption is not included in the consideration.
- C. To achieve efficient energy use and improve the electricity usage environment.

### **2) Strategy**

- A. Improve electricity usage efficiency
  - a. Install an electrical monitoring system to manage and control the university’s power system.
  - b. All buildings need to be standardized to use first-class energy-saving air-conditioners, LED lighting, and energy-saving water dispensers.
  - c. Plan to replace energy-consuming equipment (such as air-conditioners, lighting, and central air-conditioning).
  - d. Set up a schedule for regular power switching, such as classroom lighting, air-conditioners, and central air-conditioning.
  - e. Set up an electricity payment system (air-conditioning, lighting, and other electricity usage) in the student dormitories according to the principle of users pay for what they use.
- B. Advocate electricity saving
  - a. Promote the concept of users paying for what they use and electricity saving when students check in to dormitories.
  - b. Regularly review the electricity consumption of teaching



and office buildings throughout the university.

C. Electricity-saving tracking and review:

- a. The Energy Conservation Group will meet twice a year to review the electricity, water, and oil consumption on campus that year.
- b. It will formulate reasonable energy reduction targets, action strategies, and schemes.

Meeting of the Energy Conservation Group



**3) Benefits**

- A. Through the implementation of various electricity-saving equipment and methods, the electricity consumption of the entire university has been reduced, and the university's electricity expenses have subsequently been reduced.
- B. The government's requirements for electricity saving have been met, and the electricity consumption of the entire university was reduced by 28.64% in 2022 compared with 2015.



POS machine for electricity payments in student



LED energy-saving lights in offices

## (6) Water-Saving Scheme

### 1) Purpose

Due to the abnormal changes in the global climate, awareness of water conservation is on the rise. As an educational institution, the university should respond to water conservation measures and show the effectiveness of water conservation at this university by implementing various water-saving measures in the lives and education of students.

### 2) Strategy

- A. Equip the Xuesi and Erya Buildings with rainwater filtration for green land watering.
- B. Install water leakage warning systems in the Xuesi and Erya Buildings
- C. Inspect the buildings, the top floor, the basement, and the water supply and drainage pipes every month (Figure 3).
- D. Have online reporting and repairing system and provide unimpeded reporting and repairing methods to promptly handle water leakages (Figure 4).
- E. Regularly publicize water-saving measures on campus.

### 3) Benefits

By continuing to promote relevant water-saving measures, the water consumption per person per day at the university in 2022 was 61.3 liters, which was lower than the reference value (64 liters/capita/day) for national technical colleges' water consumption liters/capita/day (LPCD) announced on the "Water Conservation Reporting Website for Government Agencies and Schools" by the Water Conservation Department of the Ministry of Economic Affairs. Through various measures, water-saving benefits have indeed been achieved.

#### The rainwater filtration system for plant watering



#### The water leakage warning system



## 2022 water consumption for the main campus

<b>Month year</b>	<b>Water consumption on campus (A)</b>	<b>Water consumption of subcontractors (B)</b>	<b>LPCD (liter/capita/day)</b>
January to December	190,886 tons	61,454 tons	61.3
LPCD in government agencies and schools at all levels is Item 5.1 The recommended LPCD volume for national technical colleges is 64 liters			<b>Conform</b>

Note 1: Calculation formula for LPCD (unit: liter/capita/day) = (total water consumption in 2022 - total water consumption in 2022 of subcontractors) ÷ (total number of faculty and students in 2022) ÷ 365×1000. (190886-61454)/(5784 people \*365 days) \*1000, (1 ton = 1000 liters).

Note 2: Reference value of LPCD for government agencies and schools at all levels, data source: “Water Conservation Reporting Website for Government Agencies and Schools” of the Water Conservation Department of the Ministry of Economic Affairs

## (7) Water-Saving Scheme

### 1) Purpose

- A. Implement a green lifestyle and use environmentally friendly products.
- B. Cherish resources and food and reduce food waste in kitchens.
- C. Do waste classification with your own hands, do not waste garbage, and make sure to recycle and reuse.

### 2) Strategy

- A. Implement resource recycling, classify, clean up, pack, and reuse in accordance with laws and regulations.
- B. Completely change student tableware to reusable stainless steel tableware.
- C. In accordance with the “Principles for the implementation of the Ministry of Education and its affiliated agencies and

schools to reduce the use of disposable tableware and packaged drinking water,” hold conferences and activities to reduce the use of disposable packaged drinking water and disposable tableware.

- D. Widely set up water dispensers to encourage faculty and students to drink more boiled water and reduce the purchase of disposable beverages.
- E. Strengthen the promotion of the concept of cherishing things and food and promote zero leftovers.

	
各大樓、各樓層皆設置資源回收箱回收紙類、鐵鋁罐、塑膠瓶、一般垃圾	
	
設置廚餘回收桶	廣設飲水機

### 3) Effects

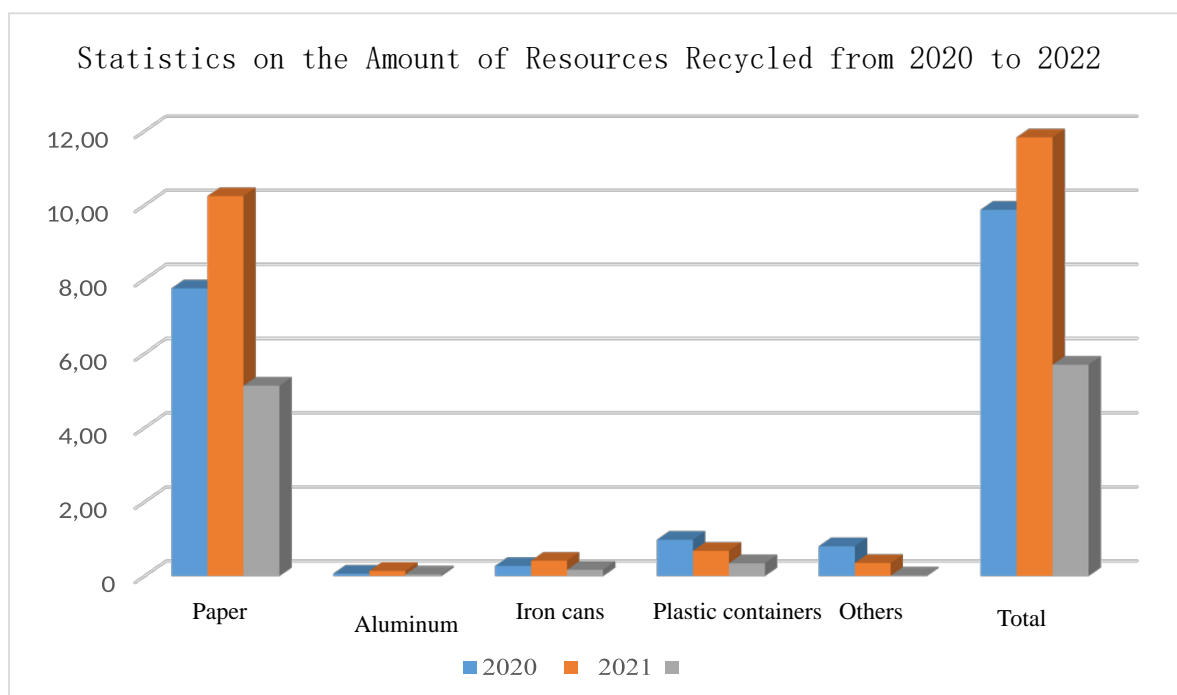
- A. In 2022, the amount of green procurement for designated projects implemented by the university was NT\$12,229,758. The total purchase amount was NT\$12,721,913, achieving 96.13% of the target.
- B. Promote the implementation of a paperless working environment in offices: Paper consumption was reduced by 2,620 kilograms in 2022 compared with 2020, a reduction of approximately 51%.
  - i. Encourage drinking more water and reduce the purchase of disposable beverages: usage of plastic containers reduced by



635 kilograms in 2022 compared with that in 2020, a reduction of approximately 64%.

- ii. Environmentally friendly tableware was used in the university's executive meetings: 252 meetings using environmentally friendly tableware were held in 2022, reducing the use of 459 pieces of disposable tableware and 4,062 pieces of various disposable packaged drinking water.

109~111年資源回收量統計表						
年度	紙類	鋁罐	鐵罐	塑膠容器	其他	總計
109	7,756	63.8	274	979.8	803.8	9,877.40
110	10,247	138.2	413	681	353.4	11,832.60
111	5,136	42.2	170	344	12.2	5,704.40



111年免洗餐具及包裝飲用水減量執行成果			
	場次	免洗餐具	包裝飲用水或各類材質一次用飲料杯
111.5.1~7.15	57	231	1588
111.11	174	149	2094
111.12	21	79	380
減少總數量	252	459	4062

Implementation Results of Reduction of Disposable Tableware and Packaged Drinking Water in 2022

## **(8) Transportation Policy**

### **1) Purpose**

- A. To comply with the government's environmental protection policy and take into account the limited parking spaces on campus, the University Parking Management Measures have been formulated to effectively control the vehicles entering the campus and maintain parking order.
- B. To ensure the safety of activities for faculty and students on campus. Motorcycles are prohibited from riding on campus to reduce negative impacts.

### **2) Strategy**

- A. In 2019, the main campus installed a license plate recognition system. Furthermore, in 2022, a campus parking management system was developed. Through complete digitization, the number of parking lots has been controlled, and temporary parking charges have been handled comprehensively and effectively.

In 2019, a license plate recognition system for automobiles was installed at the entrance lanes



- B. The main campus adopted a method for separating pedestrians and vehicles. After motorcycles enter the campus, they turn right and park in exclusive parking lots. Riding on campus is prohibited for non-official reasons to ensure the



safety of people and vehicles.

Entrance and exit lanes for motorcycles, pedestrians, and bicycle passages



- C. In 2018, the main campus set up approximately 500 uncovered motorcycle parking spaces in addition to the original 48 covered ones. They can effectively manage the number of motorcycles parked on campus.

500 uncovered motorcycle parking spaces were completed at the end of 2018



48 covered motorcycle parking spaces on the main campus



- D. The temporary parking fee on the main campus is NT\$40/hour, which is higher than the NT\$30/hour parking fee along Mingde Road outside the university. The parking space counter light at the university gate is adjusted to reduce the number of open temporary parking spaces on working days, and moderately reduce the chance of outside vehicles entering the campus.
- E. On the sidewalk outside the university, the Taipei City Government has widely set up motorcycle parking areas and U-Bike shared bicycle stations, which can effectively relieve the parking demand on campus.

U-Bike shared bicycle station near the campus





## Free motorcycle parking areas on the sidewalks around the campus



- F. Transportation around the campus is convenient, which indirectly encourages faculty, staff, students, or businesspeople to use public transportation.

### 3) Effects

- A. The number of automobiles on campus has been effectively reduced to ensure the safety of teachers and students.



- B. If there are too many vehicles on campus on a certain day, the security guards and staff will take the initiative to actively assist and guide parking, effectively relieving the parking of vehicles on campus and ensuring the safety of pedestrians on campus.
- C. Temporary parking fees have been implemented to effectively shorten the time that vehicles stay on campus and eliminate unnecessary temporary parking on campus in the past.

- D. Implement the principle of users paying for what they use.  
The fees collected can contribute to the university's administrative fund.