SDG13.2.1

題目:Low-carbon energy tracking .Measure the amount of low carbon energy used across NCUE whole university.

The amount of low-carbon energy used by NCUE in 2021 is 579,960 KWH = 2087.84 GJ, and all the low-carbon energy used was from solar energy.

SDG13.2.2

題目: Total energy used.

The total power consumption of Jinde Campus in 2021 was 8,711,600 kWh, that of Baoshan Campus was 3,639,000 kWh, and the total consumption of NCUE was 12,350,600kWh (= 44,462.16 GJ)
Remark: The total power consumption in 2021 was calculated with Gigajoule (GJ).
Total energy used in 2021 in Gigajoule (GJ)

Total energy used from low-carbon sources

1. In 2017, Jinde Campus installed a photovoltaic solar power system that generated 467kwp of power. As of July 2022, the cumulative power generated by solar energy has exceeded 2.9 million kWh (> 10,440 GJ), with an average annual power generation of 583,750 kWh (2,101.5GJ), accounting for 4.73% of the total power consumption of NCUE in 2021.
2. It is expected that in academic year 2021–2022, the annual solar power generation of Jinde Campus will increase to 3,190,933 kWh (11,487GJ), and that of Baoshan Campus will increase to 714,375 kWh (2,572GJ), which will account for more than 30% of NCUE's total power consumption for the academic year.
3. For academic year 2023–2024, there are plans to further increase the annual solar power generation capacities to 3,828,483 kWh (13,782GJ) and 1,305,799 kWh (4,700GJ), respectively, on Jinde and Baoshan Campuses.
4. It is estimated that by 2024, NCUE's total solar power generation will reach 5,134,282 kWh (18,483GJ), which would represent 40% of the total power consumption in 2021.
5. The table below summarizes NCUE's use of low carbon energy from 2021 to 2024.

Campus	Year	Newly Added Capacity (kWp)	Accumulated Capacity (kWp)	Expected Power Generation (kWh)	% of Total Power Consumption in 2021
Jinde	Before 2020	467	467	583,750	6.7%
	2021-2022	2085.75	2552.75	3,190,933	36.63%
	2023-2024	510.04	3062.79	3,828,483	43.95%
Baoshan	Before 2020	0	0	0	0%
	2021-2022	571.5	571.5	714,375	19.63%
	2023-2024	473.14	1044.64	1,305,799	35.88%
Total	Before 2020	467	467	583,750	4.73%
	2021-2022	2657.25	3124.25	3,905,308	31.62%

	2023-2024	983.18	4107.43	5,134,282	41.57%

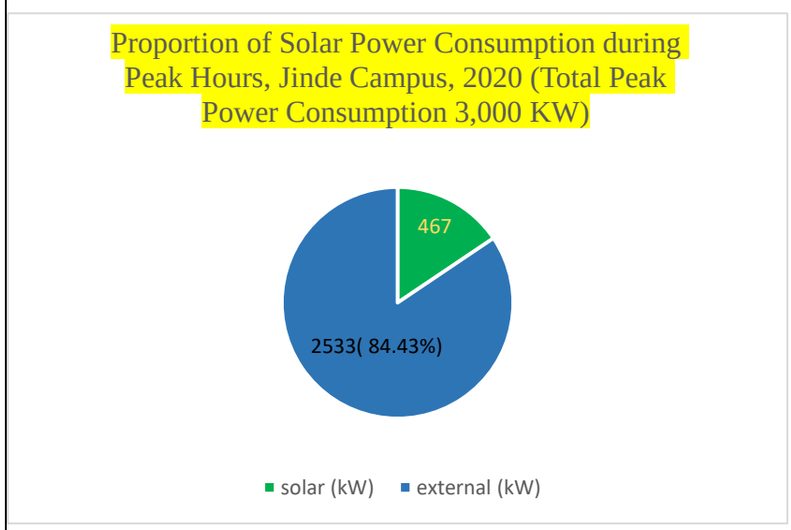
6. NCUE is striving for carbon neutrality. Prior to 2020, during peak hours, solar energy generated on Jinde campus was 467 kw, and low-carbon energy accounted for approximately 15.57% of total power consumption (3,000 kW), whereas Baoshan campus consumed 1,000 kw, which was not from low-carbon sources.
7. It is expected that in academic year 2021–2022, total solar energy generated on Jinde Campus will increase to 2,552.75 kw during peak hours, whereas power consumption will reduce to 2,600 kw, which will push low-carbon energy sources to 98.18% of the total energy consumed. On Baoshan Campus, solar power generation is expected to increase to 571.5 kw during peak hours, whereas power consumption is expected to reduce to 900 kw, increasing low-carbon energy sources to 63.5% of the total power consumed.
8. The target for academic year 2023–2024 is to increase solar power generation to 3,062.79 kw during peak hours and reduce power consumption to 2,400 kw on Jinde Campus, with low-carbon energy exceeding 100% of the total energy consumed. Similarly, for Baoshan Campus, it is expected that solar power generation will increase to 1,044.64 kw during peak hours and power consumption will reduce to 800 kw, with low-carbon energy exceeding 100% of the total energy consumed. The excess power generated will be supplied to neighboring power grids to increase the use of low-carbon energy in the region.
9. The table below summarizes the solar power generation capacity to be added between academic years 2021–2022 and 2023–2024.

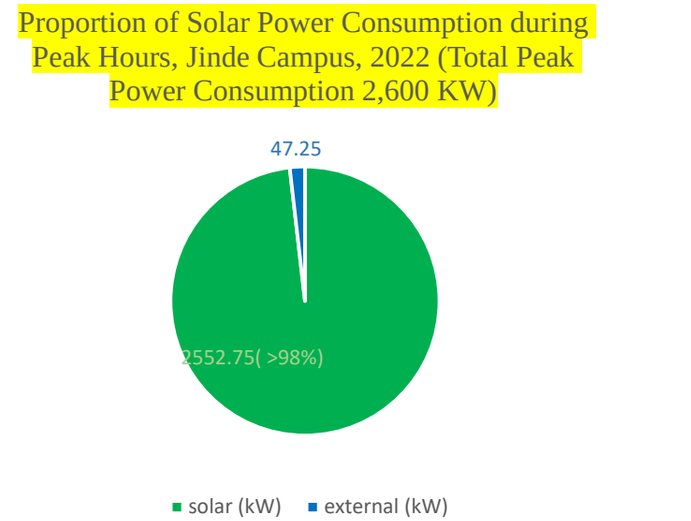
Campus	Year	Solar Energy Generated during Peak Hours (kW)	Power Consumption during Peak Hours (kW)	Proportion of Solar Power to Power Consumption
Jinde	Before 2020	467	3000	15.57%
	2021-2022	2552.75	2600	98.18%
	2023-2024	3062.79	2400	>100%
Baoshan	Before 2020	0	1000	0%
	2021-2022	571.5	900	63.5%
	2023-2024	1044.64	800	>100%

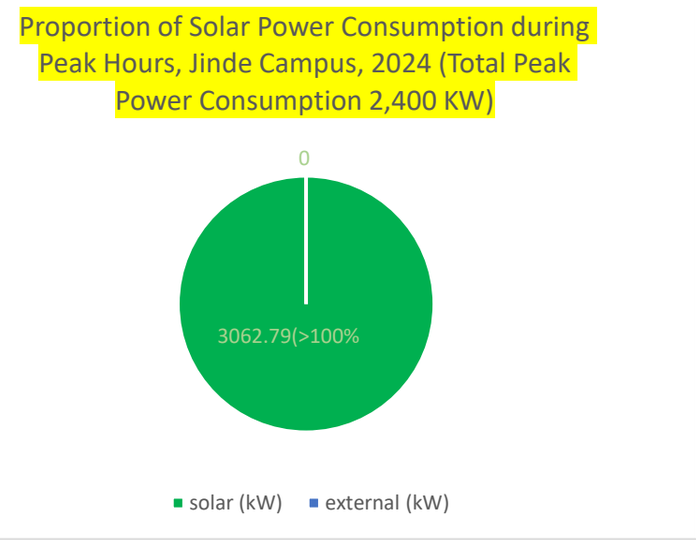
The following table presents the detailed distribution of solar power generation facility newly installed in academic year 2021–2022 (by building)

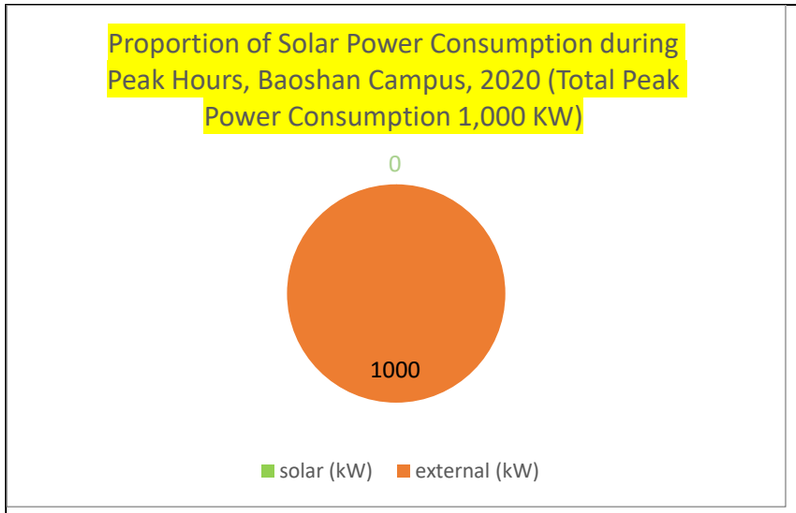
Campus	Building	Expected Capacity (kWp)	Total	Expected Power Generation (kwh/year)	Total
Jinde	Qiaosi Buiding	75.75	2085.75 kWp	94,687	2,607,183 kWh
	Baisha Buiding	191.625		239,531	
	Zhishan Building	48		60,000	
	Mingde Building	64.125		80,156	
	Educational Building	92.25		115,312	
	No. 8 Dormitory	189		236,250	
	No. 7 Dormitory	181.5		226,875	
	No. 6 Dormitory	88.5		110,625	

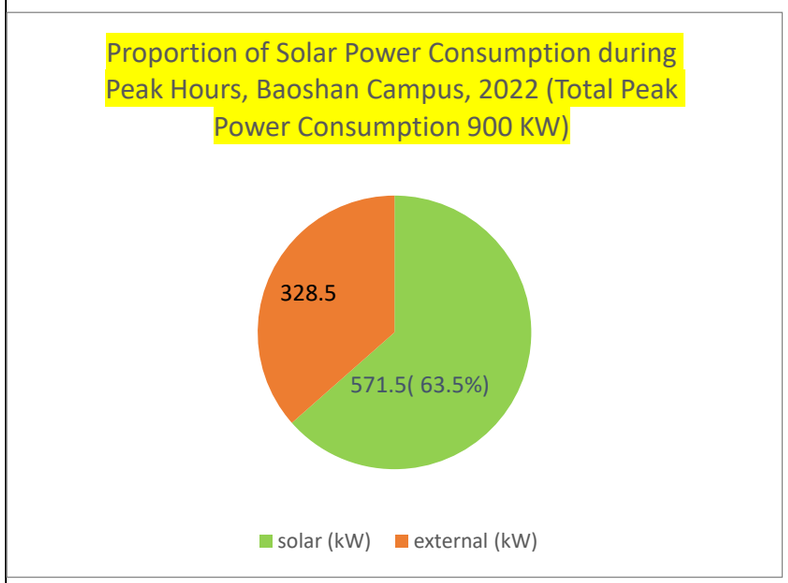
	Hubing Building	123		153,750	
	Library	146.625		183,281	
	Comprehensive Center	103.875		129,843	
	Student Canteen	146.625		183,281	
	Shengyang Building	99.375		124,218	
	Xuesi Building	36		45,000	
	Wang Jin-pyng Activity Center	153.75		192,187	
	Wang Jin-pyng Swimming Pool	242.25		302,812	
	Old Activity Center	103.5		129,375	
Baoshan	No. 9 Dormitory	99.75	571.25 kWp	125,625	714,375 kWh
	First Educational Building	69.75		126,563	
	School of Engineering Building	139.5		174,375	
	Jingshi Buidling	114.375		142,969	
	Lixing Building	148.125		185,156	

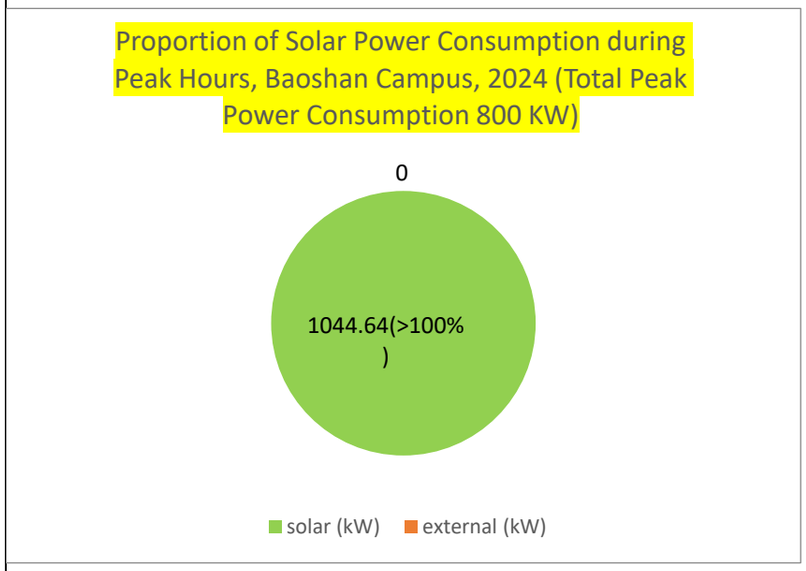



Proportion of Solar Power Consumption during Peak Hours, Jinde Campus, 2022 (Total Peak Power Consumption 2,600 KW)
47.25
2552.75(>98%)
solar (kW)
external (kW)


Proportion of Solar Power Consumption during Peak Hours, Jinde Campus, 2024 (Total Peak Power Consumption 2,400 KW)
0
3062.79(>100%
solar (kW)
external (kW)

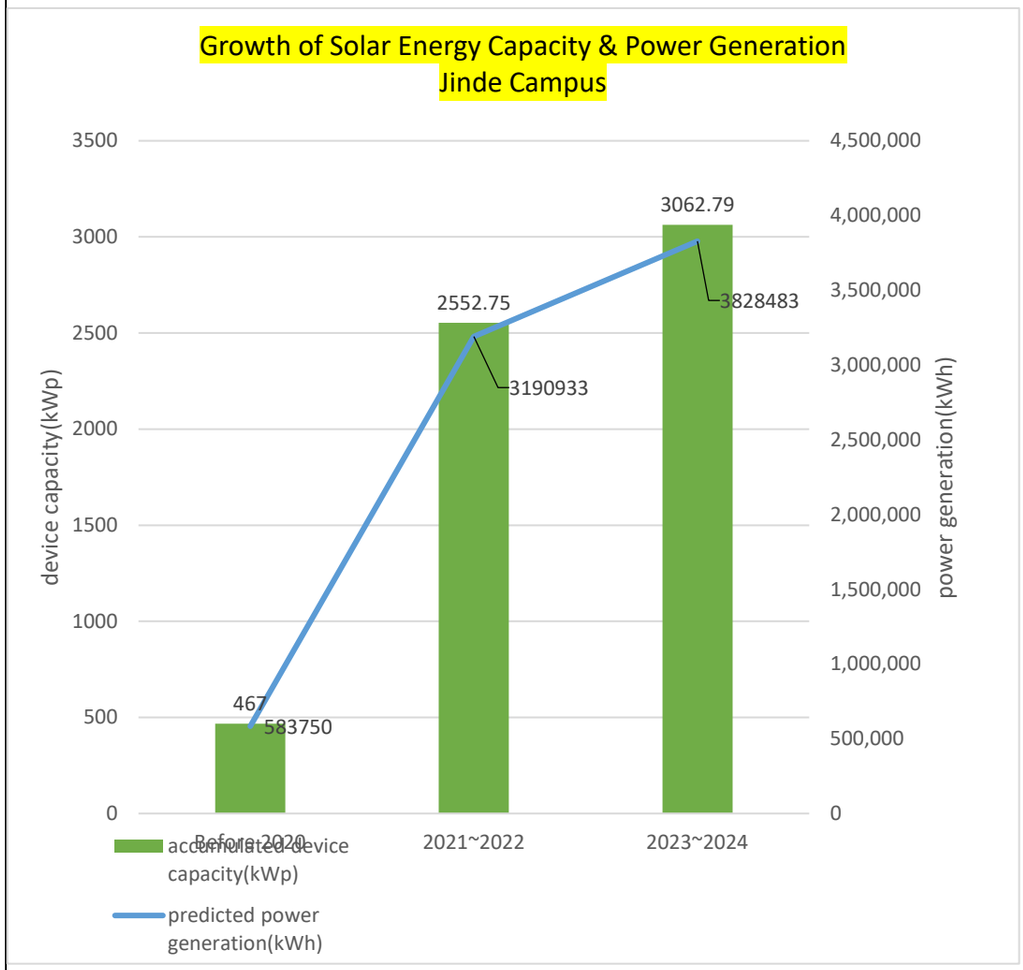

Proportion of Solar Power Consumption during Peak Hours, Baoshan Campus, 2020 (Total Peak Power Consumption 1,000 KW)
0
1000
solar (kW)
external (kW)

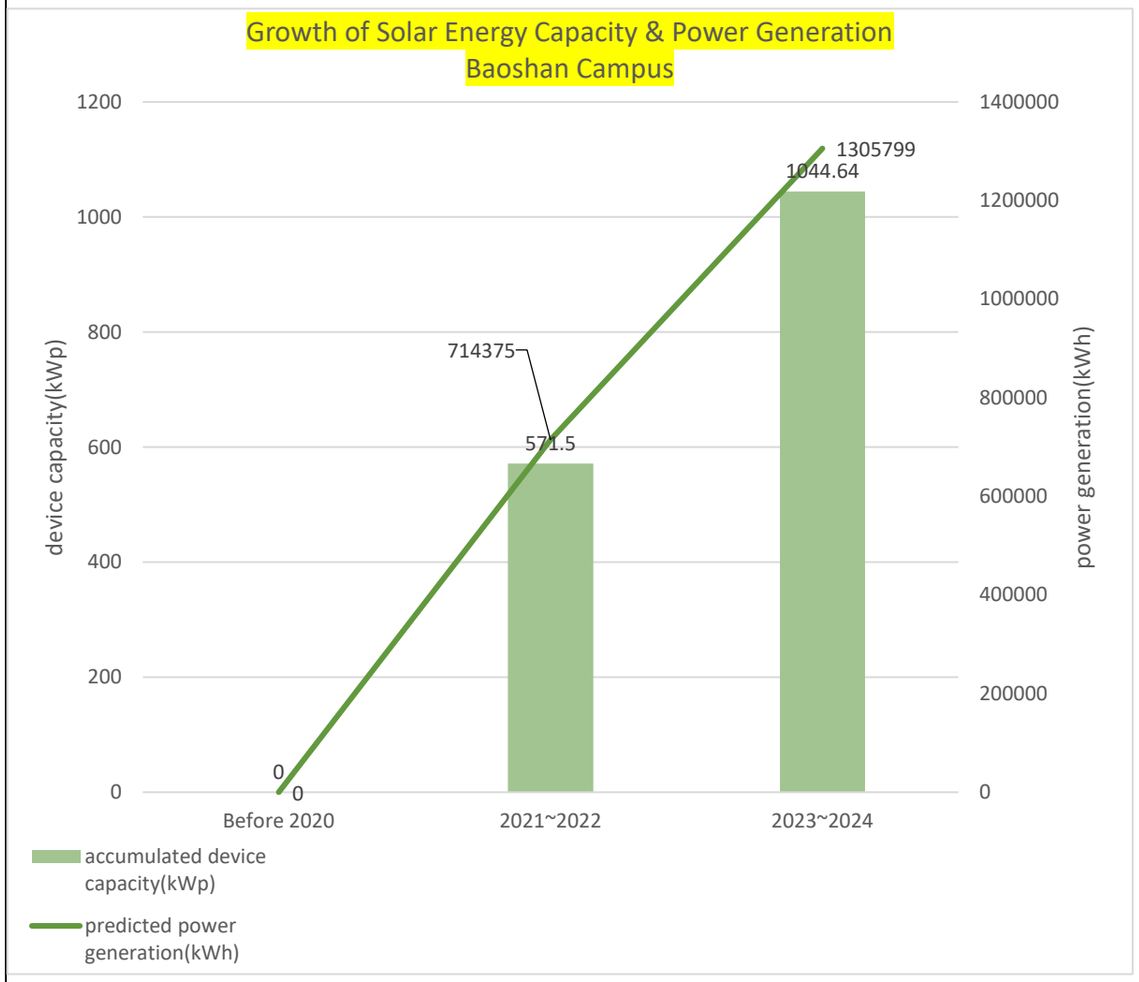

Proportion of Solar Power Consumption during Peak Hours, Baoshan Campus, 2022 (Total Peak Power Consumption 900 KW)
328.5
571.5(63.5%)
solar (kW)
external (kW)



The following table presents the detailed distribution of new solar power generation facilities to be installed during academic year 2023–2024 (for each building)

Campus	Building	Expected Capacity (kWp)	Total	Expected Power Generation (kWh/year)	Total
Jinde	No. 3 Dormitory	259.94	510 .04k Wp	324,925	637,550 kWh
	No. 5 Dormitory	69.7		87,125	
	Parking lot at the East Gate	102.5		128,125	
	Left and right sides of the Torch Tower	77.9		97,375	
Baoshan	Behind No. 9 Dormitory	138.99	473.14 kWp	173,737	591,424 kWh
	Parking lot of No. 9 Dormitory, next to Baoshan Road	123.41		154,262	
	Parking lot of the First Educational Building, next to Baoshan Road	113.98		142,475	
	Parking lot of the Second Educational Building	96.76		120,950	


Growth of Solar Energy Capacity & Power Generation
Jinde Campus
3500
3000
2500
2000
1500
1000
500
0
device capacity(kWp)
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
power generation(kWh)
467
583750
2552.75
3190933
3062.79
3828483
Before 2020
2021~2022
2023~2024
accumulated device capacity(kWp)
predicted power generation(kWh)


Growth of Solar Energy Capacity & Power Generation
Baoshan Campus
device capacity(kWp)
power generation(kWh)
1200
1000
800
600
400
200
0
1400000
1200000
1000000
800000
600000
400000
200000
0
714375
571.5
1305799
1044.64
0
0
Before 2020
2021~2022
2023~2024
accumulated device capacity(kWp)
predicted power generation(kWh)

SDG13.3.1

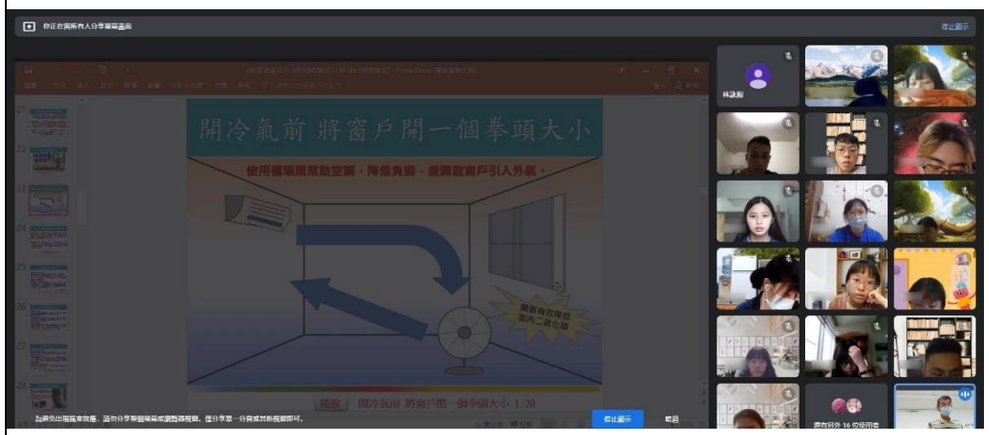
題目: Local education programs on climate.

Provide local education programs or campaigns on climate change risks, impacts, mitigation, adaptation, impact reduction, and early warning.

1. In 2021, NCUE ran two projects that organized local education programs and activities covering the risks and impacts of climate change, including ways to mitigate, adapt to, and reduce negative impacts as well as to develop early warning systems. The two projects were named “Green in Dayou Community” and “In-Depth Cultivation of Fangyuan, Working Hand in Hand with Dacheng: Industrial and Environmental Sustainability Plan of the Two Townships of Changhua County.”

Activity	Time	Participants
Green in Dayou Community	Sep 2021	59
The Small Seed of Engineering for Appliances	Mar 26 & 27, 2021	22
Environmental Educator Certification Workshop: Yuhua Elementary School Group	Sep 2021	36

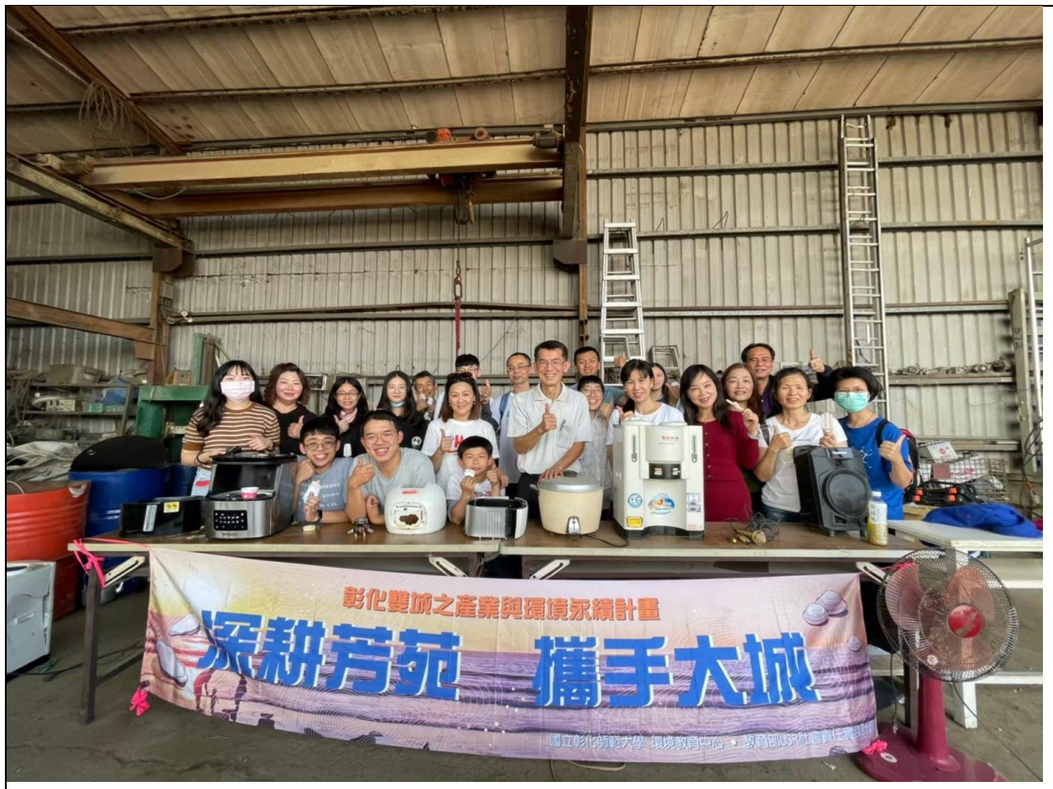
Below is a photo from the “Green in Dayou Community” activity held in Sep 2021.



The Facebook page of the “Green in Dayou Community” project is: https://www.facebook.com/media/set/?set=a.1121310101939430&type=3

2. NCUE supported the “In-Depth Cultivation of Fangyuan, Working Hand in Hand with Dacheng: Industrial and Environmental Sustainability Plan of the Two Townships of Changhua County” project launched by the Ministry of Education and organized home appliance maintenance knowledge and practice workshops on March 26 and 27, 2021, attended by 22 participants.

Below is a photo from “The Small Seed of Engineering for Appliances” activity held on March 26 and 27, 2021.



The Facebook page of “The Small Seed of Engineering for Appliances” is: https://www.facebook.com/media/set/?set=a.2685798888392832&type=3

3. NCUE supported the “In-Depth Cultivation of Fangyuan, Working Hand in Hand with Dacheng: Industrial and Environmental Sustainability Plan of the Two Townships of Changhua County” project launched by the Ministry of Education and organized Environmental Educator Certification Workshop: Yuhua Elementary School Group in September 2021.

Below is a photo from the Environmental Educator Certification Workshop: Yuhua Elementary School Group held in September 2021.

The Facebook page of the activity is: https://www.facebook.com/media/set/?set=a.2755875771385143&type=3

SDG13.3.2

題目: Climate Action Plan, shared.

Have a university climate action plan, shared with the local government and local community groups.

NCUE’ s Research Centre for GIS and Disaster Prevention has a project named ‘Impacts of Climate Changes on Lowland Ecology and Lowland Ant Problems Due to Community Changes: Discussion and Solutions’, supported by the Ministry of Science and Technology. The research team visited lowland villages, such as Liugui and Meinong, and assisted residents to control exotic ant species. The team also examined the relationship between invasive species and habitat spatial changes caused by climate changes. The action guidelines for biological disaster adaptation under climate change could inform the local government’ s decision-making process.

Climate change and warming caused the overgrowth of honey insects (Planococcus citri), worsening ant problems in lowland areas (above: Technomyrmex albipes and Planococcus citri).

The phenomena of natural landscape fragmentation, ecological loss, and habitat destruction caused by debris avalanches in Taiwan’ s lowland areas due to extreme rainfall (above: collapsed slope in lowland areas).

SDG13.3.3

題目: Co-operative planning for climate change disasters.

Participate in co-operative planning for climate change disasters, working with government.

Taiwan is located at the boundary of the ‘Eurasian Plate’ and the ‘Philippine Sea Plate’; therefore, earthquakes are very frequent. According to seismic data from the Seismic Information Centre (Central Weather Bureau) from 1991 to 2015, about 3,000 earthquakes occur in Taiwan every month on average, and 102 major earthquake disasters occurred from 1901 to 2016.

The director of the Seismic Information Center stated in March 2022 that it is highly likely that the “active seismic period” has begun in the Pacific Ring of Fire, which includes Taiwan.

Although an accurate earthquake prediction technology is not available yet, increasing seismic observation data are rather helpful in improving the efficiency of disaster relief and reducing the loss of life and property during earthquakes. In cooperation with the Central Weather Bureau, NCUE has installed strong motion observation apparatuses on the two campuses and in the Family Quarters as well as the Bai Sha weather station.

1. Below are some more details about the seismic observation apparatuses.

Strong motion observation station in Jin-De Campus. The observation station houses the strong motion observation apparatus. The time, location, and size of an earthquake can be calculated when many stations are connected to form a seismograph network.

Crustal deformation observation station in Bao-Shan Campus. The station continuously receives signals emitted from the global satellite positioning system and, with the signals received simultaneously by other stations, it can accurately calculate its location relative to other stations. Long-term observation data can reflect significant surface displacement due to major earthquakes. In addition, data on small crustal deformation during earthquakes are very helpful in understanding crustal movement and earthquake potential.

|Underground seismograph observation station in the Family Quarters. The seismograph installed at a depth of 300 metres in the well can significantly reduce interference from surface noise and obtain high quality ground motion signals, improving the accuracy of seismic locating and the ability to monitor small-scale, regional earthquakes.

2. The Central Weather Bureau works with academic institutions in Taiwan by installing weather facilities for teaching purposes. They can be used as practicing areas by students. The automatic meteorological observation station run by NCUE' s Department of Geography is one such facility. It is also the only such station in central Taiwan under the partnership. This automatic meteorological station was built in the attic of the Geography Department Building. It was commissioned in November 1997 and will have run for 24 years in 2021. The meteorological instruments and peripheral devices are used for real-time observation, and meteorological data are synchronised with the South District Weather Centre of the Central Weather Bureau. Real-time data are useful for disaster prevention units. The features of the observation station are shown in the photo below. In addition, sufficiently long observation time also means that the station could help researchers better understand regional climate characteristics and changes and allow them to conduct relevant studies.

NCUE’ s Bai Sha weather station.

SDG13.3.4

題目: Inform and support government.

Inform and support local or regional government regarding local climate change disaster or risk early warning and monitoring.

1. In 2021, our faculty members implemented Ministry of Science and Technology projects to provide advice and assistance to local and regional governments on the future planning of agricultural production systems, disaster prevention, and water resource allocation.

No.	Project leader	Project name
1	Professor Lin Chung-Chi	Impacts of Climate Change on Lowland Ecology and Lowland Ant Problems Due to Community Changes: Discussion and Solutions (Annex 13.3.4A-Report of Outcomes)
2	Professor Tu Jien-Yi	Interannual to Interdecadal Changes in Typhoon Frequency in the Northwest Pacific Ocean (Appendix 13.3.4B-Report of Outcomes)

Details of the project are provided below:

1.1. The Ministry of Science and Technology' s project was led by NCUE Professor Lin Chung-Chi. The project title is: 'Impacts of Climate Change on Lowland Ecology and Lowland Ant Problems Due to Community Changes: Discussion and Solutions' . Issues targeted by the project: given natural disasters due to climate change and development stress, lowland areas in Taiwan are ecologically fragile, with issues of landscape fragmentation, ecological barriers, and habitat loss. In recent years, the emerging problem of ant infestation has appeared in the lowland towns of central and southern Taiwan. Ants flood into houses like streams and flying ants invade houses like black fog. Such abnormal ecological phenomena are a warning of the gradual loss of health of Taiwan' s ecological system. The project covered multiple areas, delving into the causes behind the ant infestation affecting lowland residents and identifying the issues of landscape fragmentation, ecological loss, and development stress. Within the framework of slope ecosystem services, the research team investigated key biologic facies in the habitats, analysed landscape changes, established relevant indicators, and analysed environmental vulnerability and ecological potential. Given the mechanism of the impact of ant problems on village industries and tourism, a lowland agricultural production system with ecosystem service potential and human welfare benefits was proposed under the context of climate change.

1.2. The Ministry of Science and Technology' s project was led by NCUE Professor Tu Jien-Yi. The project title is: 'Interannual to Interdecadal Changes in Typhoon Frequency in the Northwest Pacific Ocean' . Issues addressed by the project: typhoons are the most severe weather phenomenon in tropical waters, and the typhoon climate is one of the most intensively studied subjects in the world. Because Taiwan is located in the northwestern Pacific and the South China Sea, a water area with the most frequent typhoon passage, 3–5 typhoons per year on average impact Taiwan, directly or indirectly. They constitute a major rainfall source for Taiwan; however, strong wind and heavy rain associated with typhoons could also cause life, property, and economic losses. The purpose of the project is to understand the characteristics of typhoons in the water area (including location of typhoon genesis and motion path), the characteristics of long-term changes over the past 50 years, and the impact of the changes on rainfall and water resources in Taiwan. Our results show that the frequency of typhoon passage over the waters near Taiwan (120–130 °E and up to 20 °N) in the early autumn months of September and October has increased since 1998. This result also coincides with the increase of rainfall in Taiwan in September and October. In summary, the research results not only enhance our understanding of the trend of long-term changes in typhoons but are also useful in evaluating the long-term impact of typhoons on regional rainfall. They could also inform the government' s future disaster prevention planning and water resource allocation.

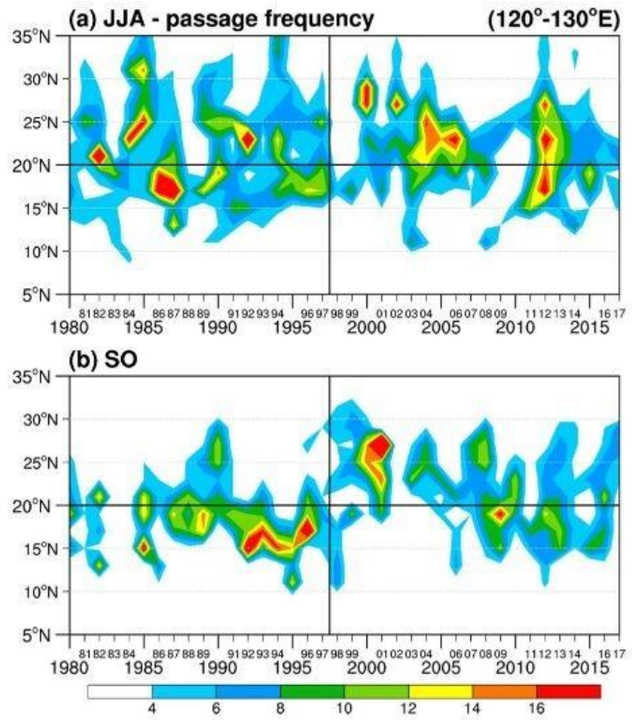


Figure 1. Latitudinal distributions of TC passage frequency averaged over the 120°-130°E for 1980-2017: (a) June-August (JJA), (b) September-October (SO).

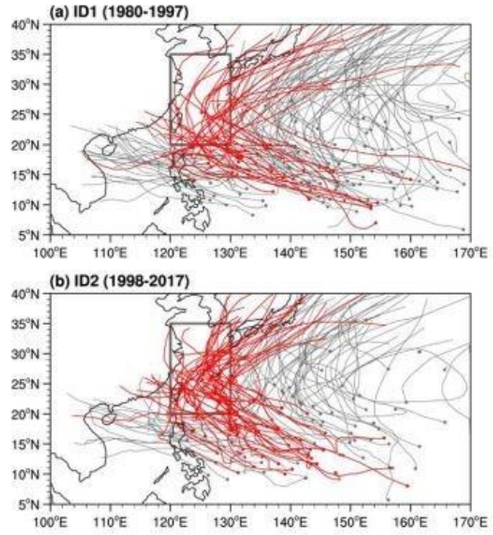


Figure 2. Tracks of all TCs during SO in (a) interdecadal period 1 (ID1; 1980-1997) and (b) interdecadal period 2 (ID2; 1998-2017). The northwestern North Pacific domain (120°-130°E, 20°-35°N) used for analyses of TC passage frequency is indicated by a rectangular box.

2. Taiwan is located at the boundary of the 'Eurasian Plate' and the 'Philippine Sea Plate', so earthquakes are very frequent. According to the seismic data of the Seismic Information Centre, Central Weather Bureau, from 1991 to 2015, about 3,000 earthquakes occurred in Taiwan every month on average, and 102 major earthquake disasters occurred from 1901 to 2016. Although an accurate earthquake prediction technology is not available yet, increasing seismic observation data are rather helpful in improving the efficiency of disaster relief and reducing the loss of life and property during earthquakes. In cooperation with the Central Weather Bureau, NCUE has installed strong motion observation apparatuses in the two campuses and in family quarters as well as the Bai Sha Weather station.

2.1 Below are some more details about the seismic observation apparatuses.

Strong motion observation station in Jin-De Campus The observation station houses the strong motion observation apparatus. The time, location, and size of an earthquake can be calculated when many stations are connected to form a seismograph network.

Crustal deformation observation station in Bao-Shan Campus The station continuously receives signals emitted from global satellite positioning system, and with the received signals at the same time by other stations, it can accurately calculate the station’ s lo-

cation relative to other stations. Long-term observation data could reflect significant surface displacement due to major earthquakes. Also, the data on small crustal deformation occurs during earthquake are very helpful in understanding crustal movement and earthquake potential.

Underground seismograph observation station in family quarters. The seismograph installed at a depth of 300 meters in the well can significantly reduce the interference from surface noise and obtain high quality ground motion signals, improving the accuracy of seismic locating and the ability to monitor regional small-scale earthquakes.

2.2 The Central Weather Bureau works with academic institutions in Taiwan by installing weather facilities for teaching purposes. They can be used as practicing areas by students. The automatic meteorological observation station run by NCUE' s Department of Geography is one of such facilities. It is also the only one stations in central Taiwan under the partnership. The automatic meteorological station was built on the attic of the Geography Department Building. It was commissioned in November 1997 and has run for 24 years by 2021. The meteorological instruments and peripheral devices are used for real-time observation, and meteorological data are synchronised with the South District Weather Centre of the Central Weather Bureau. The real-time data are useful for disaster prevention units. The features of the observation station are shown in the photo below. In addition, sufficiently long observation time also means that the station could help people better understand the regional climate characteristics and changes and researchers conduct relevant studies.

NCUE’ s Bai Sha Weather Station

SDG13.3.5

題目: Environmental education collaborate with NGOs.

Collaborate with NGOs on climate adaptation.

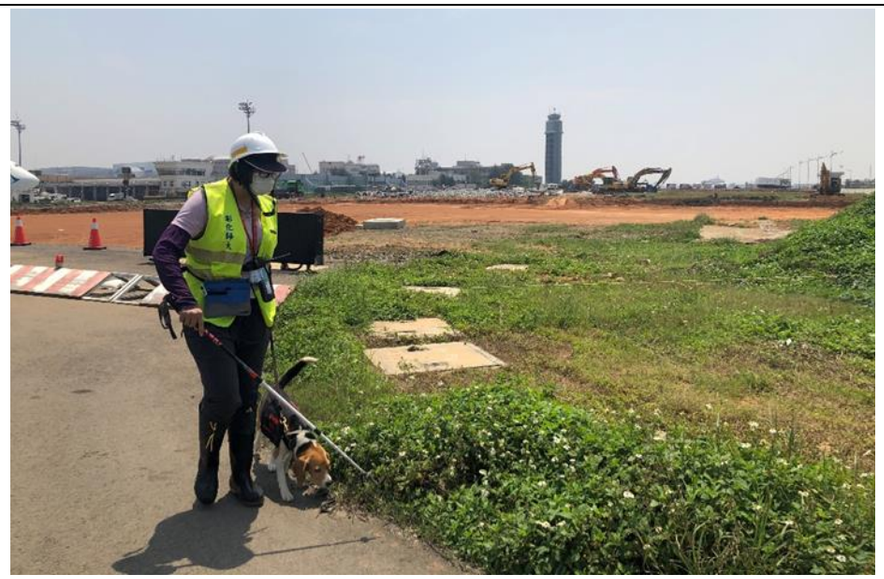
2023年英文內容

There are seven environmental education programmes at NCUE in collaboration with NGOs in 2021. Each is described in detail, below.

No.	Programme
1	Fangyuan Reengineering USR Seed Programme and Sprouting Programme for Engaging Fangyuan and Dacheng: Industrial and Environmental Sustainability for Changhua’ s Twin Towns
2	Taoyuan International Airport Corporation Programme/entrusted to plan, design, and implement control measures against fire ants
3	The Ministry of Science and Technology’ s project/Impacts of Climate Change on Lowland Ecology and Lowland Ant Problems Due to Community Changes: Discussion and Solutions
4	The Ministry of Science and Technology’ s project/Reshaping Global Control Efforts for Invasive Species: Positioning Taiwan as the Hub of Control, Prediction, and Education of Asiatic Red Fire Ants
5	The Ministry of Science and Technology’ s project/Development of Microbiological Control Technologies for Harmful Ants in Farmland
6	The project of the Bureau of Animal and Plant Health Inspection and Quarantine, Council of Agriculture/Development of Core Technologies and Construction of a Safety Assessment Model for Industrial Chain Agricultural Spraying based on Unmanned Aerial Vehicles (UAV): Field Experiment of UAVs Used against Invasive Red Fire Ants and System Management of UAV Pesticide Spraying
7	Programme for Kenting National Park/Investigation on the Invasion and Control Strategy of Yellow Termites in Kenting National Park

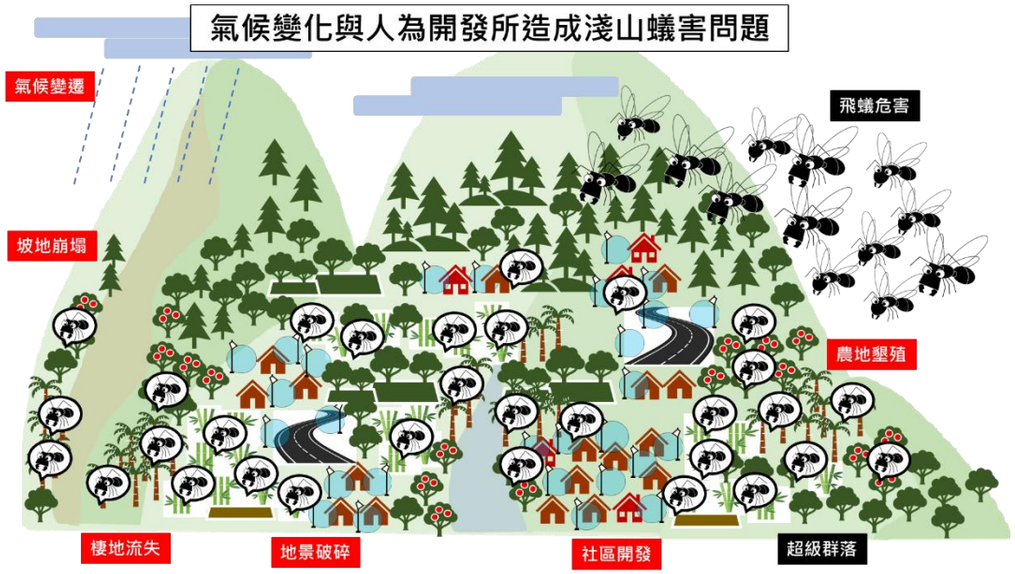
1. Fangyuan Reengineering USR Seed Programme and Sprouting Programme for Engaging Fangyuan and Dacheng: Industrial and Environmental Sustainability for Changhua’ s Twin Towns in 2020–2022: included in the research project: cooperation with the Changhua Aquaculture Association to explore adaptive measures to climate change.

2. Taoyuan International Airport Corporation Programme/entrusted to plan, design, and implement control measures against fire ants.



The NCUE-Taoyuan International Airport fire ant control team searches for imported red fire ants at Taoyuan Airport with the assistance of a fire ant detection dog.

3. The Ministry of Science and Technology’ s project/Impact of Climate Change on Lowland Ecology and Lowland Ant Problems Due to Community Changes: Discussion and Solutions.

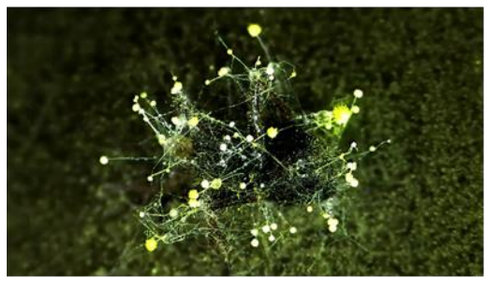


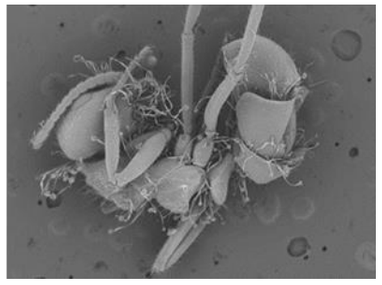
The project delved into the causes behind the ant infestation affecting lowland Zhongxing New Village residents in central and southern Taiwan and identified the issues of landscape fragmentation, ecological loss, and development stress. Within the framework of slope ecosystem services (supply, adapt, culture, and support), the research team investigated key biologic facies in the habitats affected by ant damage, and analysed environmental vulnerability and ecological potential. A lowland agricultural production system with ecosystem service potential and human welfare benefits was proposed under the context of climate change.

4. The Ministry of Science and Technology’ s project/Reshaping Global Control Efforts for Invasive Species: Positioning Taiwan as the Hub of Control, Prediction, and Education of the Asiatic Red Fire Ants

Data model analysis and establishment of an innovative platform for invasive red fire ants. The project made significant contributions to the ongoing scientific debate on the causes of global invasive imported red fire ants as well as control measures for the fire ants, the impact on agriculture and economy, and the scientific development of Taiwan.

5. The Ministry of Science and Technology’ s project/Development of Microbiological Control Technologies for Harmful Ants in Farmland





Development and application of microbial control for the growing problem of harmful ants in the agricultural environment. Especially in the development of sustainable agriculture and organic agriculture, this research focuses on the design, development, and application of microbial agents on crops to control harmful ants as well as the valuable development of its practical value and commercial potential.

6. **Project of the Bureau of Animal and Plant Health Inspection and Quarantine, Council of Agriculture/Development of Core Technologies and Construction of Safety Assessment Model for Industrial Chain Agricultural Spraying based on Unmanned Aerial Vehicles (UAV): Field Experiment of UAVs Used against Invasive Red Fire Ants and System Management of UAV Pesticide Spraying**

Assist in establishing a standard practice for pesticide application against invasive imported red fire ants on large areas or special terrains using agricultural drones.

Assist in establishing a standard practice for pesticide application against invasive imported red fire ants on large areas or special terrains using agricultural drones.

7. **Programme for Kenting National Park/Investigation on the Invasion and Control Strategy of Yellow Termites in Kenting National Park.** Assisted Kenting National Park to investigate the invasion status of Anoplolepis gracilipes, one of the most harmful invasive species in the world, in the land crab distribution concentration areas. This study is the first time that Anoplolepis gracilipes has been found to threaten land crab populations in East Asia. In addition to ant damage, land crabs also face threats from road killing, habitat destruction, and human harvesting.

Anoplolepis gracilipes attack young crabs.

SDG13.4.1

題目: Commitment to carbon neutral university.

Have a target date by which it will become carbon neutral according to the Greenhouse Gas Protocols?

2023年英文內容
Our commitment to becoming a carbon neutral university is outlined as follows: The National Changhua University of Education will adhere to the Greenhouse Gas Protocol and implement various carbon emissions regulations to achieve carbon neutrality by 2029. In response to this commitment, our institution has formulated the “National Changhua University of Education—Energy Conservation and Carbon Reduction Bulletin” service that aims to conserve water and energy used for lighting and air-conditioning, promote environmental awareness, and reduce carbon footprint and carbon-dioxide emissions. The annual budget allocated for the replacement and maintenance of high-energy-consuming equipment will amount to at least NT$5 million. Furthermore, a minimum of 1% year-on-year increase in overall energy efficiency is anticipated. Compared to 2021, it is projected that the total annual power consumption of existing equipment will be reduced by at least 1.3 million kWh by 2029. Additionally, our institution has already installed a megawatt-level power storage system and plans to accelerate the installation process of solar generators on Jinde and Baoshan campuses. An additional three sets of 100,000-watt power storage systems have also been proposed to assist in the operation of the campus microgrid. Such systems are intended to shift loads by saving excess electrical power during off-peak hours and at night for later usage during peak hours, which, in turn, alleviates the need for coal-power-driven loads during peak hours. Simultaneously, the maximum line current will be lowered, thereby reducing power transfer loss by approximately 3%, resulting in decreased carbon emissions from the power plants during transportation. Through continued education from relevant university courses, as well as our efforts to drive sustainability, we will continue to advocate energy conservation and carbon reduction measures in the future. We anticipate that our institution will become not only a sustainable campus with motivated and environmentally conscious faculty and students, but also a key facilitator of Taiwan’s sustainable development programs.

國立彰化師範大學
National Changhua University of Education

Carbon Neutrality Declaration –

National Changhua University of Education

National Changhua University of Education will adhere to the Greenhouse Gas Protocol and implement various carbon emission regulations in order to achieve carbon neutrality by 2029.

Our institution has formulated the "National Changhua University of Education - Energy Conservation and Carbon Reduction Bulletin" which intends to conserve electricity, water, and energy used for lighting and air conditioning. It also aims to promote environmental awareness in order to reduce the carbon footprint and carbon dioxide emissions. The annual budget allocated for the replacement and maintenance of energy-consuming equipment will amount to least NT$5 million. Furthermore, a minimum 1% yearly gain in overall energy efficiency is anticipated. Compared to 2021, it is projected that the total annual power consumption of existing equipment will be reduced by at least 1.3 million kWh by 2029.

In addition, our institution has already installed a megawatt-level power storage system and plans to accelerate the installation process of solar generators on the campuses in Jinde and Baoshan. An additional three sets of 100,000-watt-level power storage systems are proposed to assist in the operation of the campus microgrid. Such systems are intended to shift load by saving excess electrical power during off-peak hours at night for later usage during peak hours, which in turn alleviates the load on coal power units during peak hours. Simultaneously, the maximum line current will be lowered, thereby reducing power transfer loss by approximately 3%, resulting in decreased carbon emissions from power plants.

Through our continued education in relevant university courses, as well as our efforts towards sustainability, we will continue to advocate for energy conservation and carbon reduction measures in the future. We anticipate that our institution will become not only a sustainable campus with motivated, environmentally conscious faculty and students, but also a key facilitator of Taiwan's sustainable development.

President Ming-Fei Chen

Stptember 2022

SDG13.4.2

題目: Achieve by

1. In addition to the existing 467 kWp solar power generation system, NCUE expects to install an additional photovoltaic solar power system with a total capacity of 4,107.43 kWp by the end of 2024 (3,062.79 kWp for Jinde Campus and 1,044.64 kWp for Baoshan Campus), so that the total annual solar power generation reaches over 5,134,282 kWh.
2. Continuing our past power-saving achievements (saving approximately 18% of power consumption in the past 15 years), NCUE plans to invest more than NT$ 5 million per year over the next 10 years into reducing the total power consumption of existing facilities, with a goal of achieving a 1% reduction in total power consumption each year (that is, more than 150,000 kWh per year). It is expected that, by 2029, the total annual power consumption of existing equipment will be reduced by at least 1.3 million kWh, compared to 2021.
3. For Baoshan Campus, the total capacity of the solar energy system will reach 1,044.64 kWp by the end of 2024, and power consumption during peak hours will reduce to 800 kwh, thus attaining carbon neutrality during peak hours.
4. For Jinde Campus, the total capacity of the solar energy system will reach 3,062.79 kWp by the end of 2024, and power consumption during peak hours will reduce to 2,400 kwh, attaining carbon neutrality during peak hours.
5. With the implementation of energy-saving and carbon-reduction policies and construction of a school-wide energy storage system, NCUE will be able to store the excess solar energy generated during daytime for nighttime use, thereby achieving year-long carbon neutrality. For academic year 2021–2022, solar power generation during peak hours was 571 kW. Statistical analysis has revealed that during academic year 2021–2022, on 233 days, total power consumption during peak hours was lower than total power generated by the photovoltaic solar power system. With 1,410 kWh of total energy storage capacity, excess solar energy can be stored for nighttime use. Thus, NCUE not only uses renewable energy to achieve carbon neutrality during daytime, but also does so by applying a large-scale energy storage system that increases carbon neutrality at night, enhancing renewable energy utilization.

Campus	Year	Solar Energy Generation during Peak Hours (kW)	Power Consumption during Peak Hours (kW)	Proportion of Solar Power to Total Power Consumption
Jinde	Before 2020	467	3000	15.57%
	2021-2022	2552.75	2600	98.18%
	2023-2024	3062.79	2400	>100%
Baoshan	Before 2020	0	1000	0%
	2021-2022	571.5	900	63.5%
	2023-2024	1044.64	800	>100%

6. Based on the above information, NCUE expects to achieve preliminary carbon neutrality by 2029.