SDG7

7.2.1

題目:Energy-efficient renovation and building.

Have a policy in place for ensuring all renovations or new builds are following energy efficiency standards.

NCUE has formulated comprehensive policies and regulations on the refurbishment and construction of new buildings and the installation and replacement of equipment within these buildings, as well as energy-saving and carbon-reduction practices to be followed by all users of the buildings, facilities, and equipment on campus. These are elaborated upon below.

1. The government's regulations on environmental protection and energy and water conservation must be fully complied with when refurbishing old buildings or constructing new buildings on campus. These include, but are not limited to, the following points:

1.1 We are committed to all new buildings on campus passing Item SDG-6-2-4 of the Green Building Label certification process.

- 1.2 Split-type air-conditioners are purchased in accordance with the latest environmental regulations and are inverter air-conditioners with Level 1 standard in terms of energy efficiency (CSPF efficiency > 5.1 kW/kWh).
- 1.3 LED energy-saving lamps (efficiency > 100l m/w) are installed when constructing new buildings and during the refurbishment of old buildings.
- 1.4 All installed power transformers are amorphous, environmentally friendly, and energy-saving (core loss reduced by 80% of traditional iron core).
- 1.5 The motors are rated as high efficiency (IE3 and above), having either a soft-starter or frequency converter installed for all high-power motors and motors that are frequently used.
- 1.6 The light switches in public areas have been replaced with motion sensor switches or timers.
- 1.7 It is expected that 3000kWp photovoltaic solar cells will be installed throughout the university by the end of 2022, to further commit to the government policy promoting clean, green energy and zero carbon emissions.
- 1.8 The construction of a high MWh energy storage system is intended with the aim of shifting the power grid consumption from peak hours to off-peak hours. The intention is to promote the stability of the national power grid and increase the efficiency and stability of our power supply.
- 2. NCUE have formulated a comprehensive set of policies that have been implemented on campus for many years. Their purpose is to save energy and improve the energy efficiency standards of old buildings, while mandating that all refurbished and new buildings meet the energy efficiency standards:

2.1 Key implementation points for promoting energy saving and carbon reduction of the National Changhua University of Education (NCUE):

This point stipulates that NCUE shall form an energy-saving group with the convener being of the vice-chancellor level or above. The functions of this group include holding annual meetings to review, plan, and formulate energy-saving plans and measures for each year; and arriving at a consensus on the utilisation and management measures for general electricity, lighting, air-conditioning, water resources, paper usage, and even daily environmental protection and carbon reduction that all university units have to comply with. These implement energy conservation on a daily basis.

2.2 Key implementation points for the management of power consumption on the NCUE campus

This point stipulates that the entire university shall, on a yearly basis, review the effectiveness of annual electricity savings achieved by the various units (using buildings as the main measurement unit). Units that have achieved significant results shall be duly rewarded, while those with excessive increases in electricity consumption shall be penalised. The purpose is to establish energy-saving as a habit.

Link for the reference materials: http://general2.ncue.edu.tw/files/11-1019-1133.php. One may also refer to Annex SDG7.2.1-A: Key Points of Energy Saving and Carbon Reduction Promoted by NCUE,

and Annex SDG7.2.1-B: Key Points of Power Consumption Management of NCUE

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The above table shows the list of the new Level 1 energy-saving inverter air conditioners installed in 2021 (the list is not exhaustive; for the complete list, please refer to Annex SDG7.2.1-C).



The new buildings on campus use new energy-saving and environmentally friendly transformers.

題目: Upgrade buildings to higher energy efficiency.

Have plans to upgrade existing buildings to higher energy efficiency.

1. NCUE holds an annual energy-saving and carbon-reduction meeting to evaluate plans for the replacement of existing equipment with energy-saving equivalents the following year. At least NT\$5 million is invested annually to replace energy-consuming equipment, which is forecasted to achieve the goal of increasing total energy efficiency by at least 1% per year (the goal is to save 150,000 kWh or more annually).

1.1 NCUE has implemented a range of major energy conservation and carbon reduction measures from 2019 to 2022.



1.2 In response to the national policy of promoting renewable energy, NCUE installed solar power cells on the roof of the Jinde campus gymnasium in 2017. The capacity of the generator is 467.28 kWp and it is expected to generate 625,945 kWh of power annually. The event was highlighted in the regional Changhua news (for details of the news report, please refer to http://epage.ncue.edu.tw/files/14-1000-13227,r9-1.php)



The above picture shows the gymnasium's roof with installed solar cells.

- 2. In response to the national policy, NCUE plans to complete the second installation of photovoltaic solar cells on the roofs of other school buildings by the end of 2022. The total capacity of the solar power system on the Jinde campus is expected to be 2,085.75 Kw, and that on the Baoshan campus is expected to be 571.5 kW. In addition to reducing the net energy load of the buildings, in certain scenarios (such as off-peak months), the buildings' energy needs can be entirely met by the solar power system. By reducing the amount of energy drawn from the main grid, local line loss can be reduced by approximately 3%, improving energy efficiency. Moreover, solar panels block direct sunlight that would otherwise be absorbed by the roof. According to research, direct sunlight on the roof can be reduced by 38% with the use of solar panels and roof temperature, consequently, can be reduced by 2.8 °C. Thus, the temperature inside the buildings can be lowered, use of air conditioners can be reduced, and energy efficiency can be improved.
- 3. The (partial) design and layout of the rooftop photovoltaic solar cells on each building in the Jinde and Baoshan campuses from 2021 to 2022 are as follows:

Sola	r Power System Installation	Plan for the	Jinde and	Baoshan Ca	mpuses in 2021-
Campus	Building	Estimated capacity (kWp)	(Total)	Estimated power generation (kwh/year)	(Total)
	Qiaosi Building	75.75		94,687	
	Baisha Building	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	2,607,183kWh
	No. 6 Dormitory	88.5	-	110,625	
Jinde	Hubin Building	123	2,085.75 kWp	153,750	
Campus	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 Jinping Activity Center	153.75	-	192,187	
	Wang Jinping Swimming Pool	242.25		302,812	
	Old Activity Center	103.5		129,375	
	No. 9 Dormitory	99.75		125,625	
_	First Educational Building	69.75		126,563	
Baoshan Campus	Engineering College Building	139.5	571.25 kWp	174,375	714,375 kWh
	Jingshi Building	114.375		142,969	
	Lixing Building	148.125		185,156	

4. For the complete layout of the solar power system on the roofs of each building, please refer to Annex 7.2.2A: Layout of Photovoltaic Solar Devices on the Roofs of the Buildings in the Jinde and Baoshan campuses.

5. NCUE is planning the installation of new rooftop and ground-based solar photovoltaic devices in 2023. It is estimated that between 2023 and 2024, an additional 510.04 kWp and 473.14 kWp of capacity will be added to the Jinde and Baoshan campuses, respectively (see the table below).

Campus New Location	Estimated (Total)	Estimated (Total)
	Capacity	Power

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

The schedule of the solar power plant project is as follows:

Campus	Year	Newly Added Capacity (kWp)	Accumulated Capacity (kWp)	Estimated Annual Power Generation (kWh)
Jinde	Before	467	467	583,750
Campus	2020			
	2021~2022	2085.75	2552.75	3,190,933
	2023~2024	510.04	3062.79	3,828,483
Baoshan Campus	Before 2020	0	0	0
	2021-2022	571.5	571.5	714,375
	2023-2024	473.14	1044.64	1,305,799

6. The complete design and layout of the 2023-2024 solar energy project can be found in the Annex 7.2.2-B: 2023-2024 Solar Energy Project of NCUE Jinde Campus and Baoshan Campus.

題目 Does your university as a body have a process for carbon management and reducing carbon dioxide emissions?

- 1. In accordance with the Ministry of Education's regulations, NCUE has achieved electricity saving of at least 1% annually, thereby effectively reducing the amount of carbon dioxide emissions.
- 2. NCUE have formulated the 'NCUE's key implementation points to promote energy conservation and carbon reduction', which focus on management measures for power and water conservation, energy saving for lighting and air conditioning, and environmental education. The purpose is to reduce our carbon footprint and carbon dioxide emissions (see Annex 7.2.1A).
- 3. The megawatt-size energy storage pilot system at Bao-Shan Campus of NCUE was officially launched on June 17, 2020 (see photo-1). The system can store electrical energy during off-peak hours (at night) and release it during peak hours (in the day) to achieve the load transfer effect (see photo-2). This reduces the peak output of coal-fired thermal units, thereby reducing the power plants' carbon emissions. In addition, using energy storage to lower the peak load and boost the off-peak load allows the load curve to be evened out for the entire day. This reduces the maximum line current and lowers power transmission losses by approximately 3%, thereby achieving energy saving and carbon reduction.
- 4. Additionally, tNCUE purchased a 100% electric-powered bus to replace the traditional internal combustion engine (photo 4) buses. This engages both the EV100 initiative while serving as an energy storage system when the bus is not being used, assisting the aforementioned energy-grid load reduction strategies.



photo 1) Megawatt Energy Storage System



(photo 2) 100,000-watt Energy Storage System



7.2.4

題目: Plan to reduce energy consumption.

Have an energy efficiency plan in place to reduce overall energy consumption.

NCUE has implemented the regular replacement of old, energy-consuming, and low energy-efficient equipment based on the requirements of each building, to achieve the goal of saving 1% total energy annually. From 2007 to 2020, NCUE has reduced its annual power consumption by more than 15%. The power saving plan for 2019-2022 is presented in the table below.
 Year

2022	(1) Install a peak offloading system for air-conditioning, prioritizing systems based on year and region, until the entire University is covered. It is expected that the system will reduce annual power consumption by 100 000 kWh
	(2) Replace the T5 lights of all buildings with LED lights, which involves at least 500 light replacements.
	This measure is expected to save more than 50,000 kWh of power annually.
	(3) Implement the routine replacement of all air-conditioning units with more energy-efficient units, which involves more than 70 replacements and is expected to save 100,000 kWh of
	power annually.
2021	(1) Replace the 300RT water-cooled chiller and ancillary equipment in the gymnasium of Jinde campus, which is expected to save 227,603 kWh of power annually.
	(2) Replace the T5 lights of all buildings with LED lights, which involves at least 500 replacements and is expected save more than 50,000 kWh of power annually.
	(3) Implement the routine replacement of air-conditioning units, which involves more than 50 replacements and is expected to save 75,000 kWh of power annually.
2020	(1) Replace the water-cooled chiller and ancillary equipment in the Library and Information Center Building of Jinde campus, which is expected to save 327,603 kWh of power
	annually.
	(2) Replace the T5 lights in the classrooms on the first floor of the gymnasium with LED lights, to save 25,028 kWh of power annually.
	(3) Replace 64 air-conditioning units, saving approximately 1,500 x 64 = 96,000 kWh of power annually.
2019	(1) Replace the T5 lights on the first and second floors of the library with LED lights to save 27,430 kWh of power annually.
	(2) Replace 64 air-conditioning units to save approximately 97,500 kWh of power annually.
	(3) Calibrate the equipment in the machine room of the swimming pool to sleep during closed periods to reduce annual power consumption by up to 40,000 kWh.

2. Timers or sensors are used to manage the automatic activation of electrical equipment, which ensures proper illumination while saving energy. 全校96-110用電度數趨勢圖





(above photo)All street lights on campus are controlled by timers and are set to turn off by region and time



(above photo)All the street lights on campus are equipped with light sensors to save on energy used for illumination

3. The Baoshan campus uses a large-scale energy storage system to shift power consumption from peak hours to off-peak hours. In 2021, the highest peak-hour power consumption reduction reached 43% (because of the COVID-19 pandemic, the power consumption in 2021 was lower than usual; hence, the reduction was higher than that of previous years). The measure helped reduce the loss of high-voltage lines and improve efficiency of energy transmission. In addition to complementing the power supply with a photovoltaic solar system during peak hours, NCUE also uses large-scale energy storage systems to reduce peak demand and improve energy efficiency.

7.2.5

題目: Energy wastage identification.

Undergo energy reviews to identify areas with high energy wastage.

1. NCUE regularly convenes meetings of the campus-wide energy-saving group at the end of each year to review the effectiveness of that year's energy-saving policies, and formulate measures for the following year. The meeting is presided over by the chancellor, with the respective buildings' management units appointed as team members. In addition, the respective energy management unit

monitors increases in electricity consumption for each building during the past year and implements reward and punishment measures to ensure that all unit members practice electricity-saving habits. The results of past reviews indicate that air-conditioning is currently our largest source of energy consumption, followed by the lighting system.

2. We have installed an energy management system (EMS) that monitors the hourly, daily, monthly, and annual electricity consumption of more than 33 buildings and related equipment on campus. The data are used to monitor the daily electricity consumption of the buildings, analyse NCUE's electricity consumption habits, and even verify the results of our annual energy-saving measures.

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(above photo)An excerpt from the NCUE's energy management and monitoring system

3. The specific functions of the EMS are as follows:

3.1 Measures the real-time voltage, current, power, demand, frequency, and other important parameters of each building.

3.2 Generates reports to display the cumulative energy consumption of all buildings in the entire campus on an hourly, daily, and monthly basis.

3.3 Please refer to Annex 7.2.5A for the related interfaces.

7.2.6

題目: Divestment policy.

Have a policy on divesting investments from carbon-intensive energy industries, notably coal and oil.

1. The investment monies for the 2021 university endowment fund are deposited mainly with private financial institutions in the form of fixed deposits. No investment has been made in carbonintensive energy industries.

六、投資規劃

為確保校務基金永續經營,加強本校財務規劃,提升校務發展之效益。 本校投資管理小組每三個月開會一次,在安全保本之投資目標前提下,儘可 能尋求活化校務資金、掌握投資契機與進行資金調度的最佳時機。基於本校 校務基金主要收入來源為政府撥付預算及學雜費收入,理財投資方式採審慎 評估方式進行。

109年資金存放於公民營金融機構為主,將資金以定存方式辦理。惟市 場游資過剩,目前往來公股銀行已不願再吸收本校新的一般定期存款。經投 資管理小組106年度第3次會議決議,於其他民營銀行開立存款新戶,並積 極爭取優惠條件辦理定期存款,寬能增加利息收入。

依據 109 年 10 月 13 日投資管理小組 109 年度第 4 次會議討論:110 年 度投資規劃如下:

考量現階段中美貿易爭戰期間,全球經濟景氣極不穩定,為安全起見, 資金仍以存放於公民營金融機構以定存方式為主辦理,又為避免大額定期存 款利息較低,故均依據銀行公告一般定存門檻分天期存入,且定存期間儘量 以一年以上為原則,以獲取較高利息。日後投資管理小組仍將持續關注市場 動態,以掌握購買投資型金融商品(如:外幣存款、共同基金及股票等…)最 佳時機,並於財務金融專業委員審慎評估且提出規劃後執行,以提高校務基 金收益。

本案於 109 年 11 月 20 日校務基金管理委員會審議通過後,列入本校 110 年度財務規劃報告書並據以施行。

(above figure)NCUE 2021 Investment Plan

2. For the complete report, please refer to Annex 7.2.6A-2021-NCUE's financial planning report.

Website: Public information on university affairs\Analysis of financial information\Financial planning report\2021 annual financial planning report (https://ncue-info.ncue.edu.tw/02%E8%B2%A1%E5%8B%99%E8%B3%87%E8%A8%8A%E5%88%86%E6%9E%90/%E8%B2%A1%E5%8B%99%E8%A6%8F%E5%8A%83%E5%A0%B1%E5%91%8A%E6%9B%B8)

7.3.1

題目:Total energy used.

Consumption in 2020 was approximately 13,541,300 kWh = 48,748.29 GJConsumption in 2021 was approximately 12,350,600 kWh = 44462.16 GJ

Definition: Total energy is expressed in terms of gigajoules (GJ)

University floor space : 241,300.547 m²

		經世態(技職大橋)	8027.66			972.19	974.79	939.76	793.16	772.65	736.04	867.14	829.41	412.42	412.42	19
		力行楼(機械大楼)	12422.48		406.38	2247.04	2203.02	222.37	2138.04	1341.45	1252.35	1245.07	1242.4			
	教學研究辨公	数學一個(含增達)	2697.23				715.92	596.96	619.88	624.83	96.34					
		数學二個	2419.97				667.03	592.22	625.24	338.43	65.87					96
		教學大橋	20931.35	2398.54	2549.24	1792.55	2258.54	2256.73	2249.31	2240.18	2168	1679.4	1111.3			
	小針		46498.69													
	職務宿舍	寶山2-1~2-11	1639.63				811.69	827.94								
	小針		1639.63													
	C 1 C 1	知止楼 (孥生九舍)	10122.87			676.04	1188.79	1142.16	1142.16	1142.16	1142.16	1142.16	1142.2	1142.16		121
	华生宿舍	(學生十合)	12572.76			1918.51	1623.61	1784.89	1807.03	1756.87	1756.87	1756.75				
-	小針		22695.63													
复山权匠	警衛室	甲医兽衔室	56.12				56.12									
	小針		56.12													
		甲医塑電站/刻育中心	1376			269.06	229.61	234.85	234.85	229.61	151.14					
		總塑電站(乙匠)	782.51			280.3	177.18	147.9	160.49							
		污水廠	332.62				84.64	116.14	131.84							
	其他	淨水廠	207.5			207.5										
		寶山倉庫(A棟)	130.9				130.9									
		寶山倉庫(B楝)	163.63				163.63									
		寶山大門(乙匠)	556.86				480.82	47.06								
	小針		3550.02													
	總計		74440.09													
彰化校医	總計		240723.567													
		五權西二街114卷5號	92.88				46.44	46.44								
		民具街6號	107.44				51	56.44								
	*****	民興街8號	107.44				51	56.44								
圣中校医	440.000 410 1251	柳川東路26號	90.36				45.18	45.18								
		柳川東路28號	90.36				45.18	45.18								
		柳川東路29號	88.5				44.25	44.25								
	總計		576.98													
圣中校医	總計		576.98													
	全校總	面積	241300.547													
nttp://gener Power Con	ral2.ncue.edu.t sumption/m2	w/files/11-1019-1465.p in 2020 = 48,748.29/24	<u>hp</u> 1,300.547 = 0	.202 (GJ/n	<u>n2)</u>											

Power Consumption/m2 in 2021 = 44,462.16/241,300.547 = 0.184 (GJ/m2)

The power consumption per unit from 2020 to 2021 is shown in the chart below.

全校2007-2021用電度數趨勢圖



7.4.1

題目: Local community outreach for energy efficiency.

Provide programs for local community to learn about the significance of energy efficiency and clean energy.

Through both government-funded and self-funded efforts, NCUE carries out sustained programmes to raise awareness of the importance of energy efficiency and clean energy among residents in the local community and students in neighbouring schools, and implements energy-saving and carbon-saving programmes.

1. In September 2021, NCUE organized "Green in Dayou Community," an event subsidized by the Environmental Protection Administration; 59 people participated in the event. Photos of the "Green in Dayou Community," September 2021.



The Biomass Energy DIY Course



A Student's Design from the Green Energy Teaching Plan and Design Course

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

2. On March 26 and 27, 2021, in response to the "In-Depth Cultivation of Fangyuan, Working Hand in Hand with Dacheng: Industrial and Environmental Sustainability Plan of the Two Townships of

Changhua County," a program promoted by the Ministry of Education, NCUE organized activities covering the learning and development of home appliance maintenance; 88 people participated in the activities.

Photo of "The Small Seed of Engineering for Appliances" activity held on March 26-27, 2021.



An instructor's demonstration during the Basic Home Appliance Maintenance and Repair Course



Students repair household appliances at the recycling site The Small Seed of Engineering for Appliances (https://www.facebook.com/media/set/?set=a.972446406825801&type=3)

3. NCUE actively promotes clean-energy-based activities. In 2021, because of the COVID-19 pandemic, the "Solar Photonics Teaching Plan Development Workshop" was conducted virtually; three sessions were held and 47 teachers participated. The teachers, after returning to the campus, held their corresponding lectures. The photos of the activities are presented below. Corresponding courses, such as "Distributed Power Supplies," "Smart Grids," and "Green Energy Technology," were offered at the College of Engineering and College of Technology.



2021 Solar Photonics Teaching Plan Workshop - Online Course.



Teachers returned to campus following the training.

7.4.2

題目: 100% renewable energy pledge Promote a pledge for 100% renewable energy.

NCUE is committed to increasing our renewable energy usage year by year. For example, the planning and installation of a megawatt-size energy storage pilot system in our Bao-Shan Campus not only helped significantly improve the campus' energy use efficiency; the system is also being used as the foundation for the development of more than 20 research projects related to the topic, including smart grids, microgrid, power electronics, and the strategic management of energy storage equipment. We are constructing an Internet of Things (IoT) smart grid demonstration project on that campus, which will use the energy storage system to adjust and optimise energy usage on campus. We will also install monitoring equipment in various buildings to collect power data with which to research and develop forecasting models on energy usage. By optimising efficiency, we aim to make NCUE an important centre for green energy research.

1. From 2021 to 2022, the roofs of all building on the Baoshan campus will be equipped with solar photovoltaic devices, with a total capacity of 571.5 kW. When supplemented with the megawatt energy storage system, the campus will be able to use 100% renewable energy during daytime in the winter (off-peak hours), as the estimated power consumption, based on past consumption trend, is usually less than 400 kW. The chart below is a simulation of the power consumption on the Baoshan campus following installation of the solar power system. According to the historical records of the electric load of February 23, 2021, in addition to ensuring the power supply of the entire campus during daytime, the additional power generated by the photovoltaic solar system can be stored in the megawatt energy storage system to be used at night.



2. It is planned that between 2023 and 2024, additional solar cells, with capacities of 510.04 kWp and 473.14 kWp will be installed at Jinde and Baoshan campuses, respectively. By 2024, the total power generation capacity will exceed the power consumption of NCUE during peak hours. Thus, 100% of the power requirement during normal daytime operating hours will be supplied by renewable energy.

	Year	Newly Added Capacity (kWp)	Accumulated Capacity (kWp)	Power Consumption (peak-hour)
Jinde Campus	Before 2020	467	467	About 2,800
· ·	2021-2022	2,085.75	2552.75	kWh
	2023-2024	510.04	3062.79	
Baoshan Campus	Before 2020	0	0	

2021-2022	21-2022 571.5 571.5	About 900
2023-2024	23-2024 473.14 1,044.64	kWh





3. Baoshan campus is planning a smart grid project, where a smart energy management system will be run through the main campus microgrids, utilizing the assistance of the #1 sub-microgrid

(Sewage Treatment Plant), #2 sub-microgrid (Educational Building), and #3 sub-microgrid (College of Technology) (Figure 1). Each sub-microgrid includes rooftop photovoltaic solar cells and a 100,000-watt energy storage system. The #3 sub-microgrid also includes an electric bus charging station for vehicle-to-grid/grid-to-vehicle (V2G/G2V) battery control applications. Together with smart meters and energy management systems (EMS), the energy storage system is expected to control the net load by partitioning the energy sector to achieve the goal of 100% renewable energy power supply (Figure 2).

NCUE has also considered power usage when weather is unpredictable and lack of sunlight results in a sudden drop in output from the solar power system. Under these temporary conditions, the total energy storage system of 1.3 million watts can be used as the main power supply to ensure a relatively stable power supply of 100% renewable energy (Figure 3).



4

100kW/ 100kWh 180個

(Figure 2) Planning of the Photovoltaic Solar Power System, Energy Storage System, and Charging Station of Sub-Microgrids



(Figure 3) Solar Photovoltaic Output Smoothing with Energy Storage System

4.On September 29, 2020, NCUE's chancellor signed the *NCUE Environmental Safety and Health Policy*, witnessed by members of NCUE's Occupational Safety and Health Committee. The policy contents are as follows: To build a sustainable green university, all NCUE faculty and staff shall actively abide by the relevant laws and regulations, implement education and publicity, maintain campus safety, prevent disasters from happening, cherish environmental resources, work towards energy conservation and carbon reduction, and strive for pollution prevention and continuous improvement, thereby creating a zero-disaster and pollution-free ecological campus and doing our part as members of the global village.



NCUE/Environmental Safety Centre/University-level laws and regulations/NCUE's Environmental Safety and Health Policy (signed by the chancellor): http://webadmin.ncue.edu.tw/el/ploy/UploadFiles/934/File/%E7%92%B0%E5%AE%89%E8%A1%9B%E6%94%BF%E7%AD%96%28%E6%96%B0%E7%89%88%29%5B1272%5D.pdf

5. The president of NCUE signed the carbon neutrality declaration in September 2022. The detailed content is as follows:

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.

💮 国立彭化師範大學

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.

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President Minj - flei Chen Stptember 2022

題目:Energy efficiency services for industry.

Provide direct services to local industry to improve energy efficiency and promote clean energy (energy efficiency assessments, workshops, research on renewable energy options, etc.)

With funding under the Ministry of Science and Technology, NCUE conducts seminars and lectures for the local community and industries on topics related to improving energy efficiency and clean energy.

In September 2021, NCUE organized the "Green in Dayou" Community, an event subsidized by the Environmental Protection Administration; 59 people participated in the event. Photos of the "Green in Dayou" Community, September 2021.

The Biomass Energy DIY Course





A Student's Design from the Green Energy Teaching Plan and Design Course

The Facebook page of "Green in Dayou" Community can be found here:

https://www.facebook.com/media/set/?set=a.1121310101939430&type=3

On March 26 and 27, 2021, in response to the "In-Depth Cultivation of Fangyuan, Working Hand in Hand with Dacheng: Industrial and Environmental Sustainability Plan of the Two Townships of Changhua County," a program promoted by the Ministry of Education, NCUE organized activities covering the learning and development of home appliance maintenance; 88 people participated in the activities.

Photo of "The Small Seed of Engineering for Appliances" activity held on March 26-27, 2021

An instructor's demonstration during the Basic Home Appliance Maintenance and Repair Course

Students repair household appliances at the recycling site The Small Seed of Engineering for Appliances https://www.facebook.com/media/set/?set=a.972446406825801&type=3

In 2021, NCUE conducted several energy storage and clean energy-related research projects, seven of which were sponsored by the Ministry of Science and Technology (total amount of \$NT 20.662 million) and nine were sponsored by other organizations (total amount of \$NT 9.41 million).



Projects Sponsored by the National Science and TechnologyCouncil (2021)

				2021年	皮國科會計畫 ————————————————————————————————————			
項次	執行機構	學院	系所	主持人	計畫名稱	開始日期	結束日期	總金額
1	國立彰化師範大學	工學院	電機工程學系	阮昱霖	108年度 【模組化設計之具主動平衡 智慧型電池儲能系統】	110/08/01	111/07/31	875,000
2	國立彰化師範大學	理學院	化學系	高琨哲	109年度 【利用組裝型表面電漿奈米 晶體發展太陽能光熱觸媒 】	110/11/01	111/07/31	924,000
3	國立彰化師範大學	科技學院	工業教育與技術學系工業教育與技術學系	黃維澤 姚凱超	109年度【整合電池儲能系統於校區微 電網最佳運轉研究(2/2)】	110/08/01	111/07/31	852,000
4	國立彰化師範大學	理學院	物理學系	劉嘉吉	110年度【以高效節能方法合成熱電 材料暨其微觀結構與熱電傳輸性質之 研究】	110/08/01	113/07/31	2,003,000
5	國立彰化師範大學	工學院	電子工程學系	林得裕	110年度【CVD成長大面積SnSe2和 SnSc薄膜及掺雜對其光電與熱電特性 影響之研究】	110/08/01	111/07/31	1,350,000
6	國立彰化師範大學	科技學院	工業教育與技術學系	黃維澤 姚凱超	110年度【應用電池儲能系統於太陽 光電高渗透微電網淨負載平滑化與轉 移】	110/08/01	111/07/31	742,000
7	國立彰化師範大學 國立清華大學 國立中與大學 國立中與大學 國立中與大學 國立彰化師範大學 建國科技大學	工學院	電機工程學系 電機工程學系 電機工程學系 環說管理學系 互素教育與技術學系 資訊與網路通訊系	陳朱賴莊許載 豪慶秉志維 許 訪 恭 慧 恭 志 維 宇	110年度【多重微電網於高佔比太陽 光電環境之實際場域研究與展示(1/2) 】	110/07/01	111/05/31	13,916,000
					•			20,662,000

Note: The projects in green font are energy storage related and those in red are clean energy related.

項次	學院	系所	主持人	計畫名稱	開始日期	結束日期	總金額
1	工學院	電機工程 學系	陳良瑞	110年國防科技學術合作研究計 畫(整合型)-輪型裝甲車新式 電池電源系統設計總計劃暨子計 畫一:輪型裝甲新式電池儲能系 統暨電力品質設計	110/01/20	110/12/15	2,570,000
2	工學院	電子工程 舉系	陳偉立	110年太陽光電教案研習活動規 劃與執行	110/04/16	110/11/15	190,000
3	工學院	電機工程 學系	陳良瑞	多重微電網於高佔比太陽光電環 境之實際場域研究與展示	110/09/01	112/05/31	1,000,00
4	工學院	電機工程 學系	陳良瑞	多重微電網於高佔比太陽光電環 境之實際場域研究與展示	110/09/01	112/05/31	1,000,00
5	工學院	電機工程 學系	陳良瑞	多重微電網於高佔比太陽光電環 境之實際場域研究與展示	110/09/01	112/05/31	500,000
6	工學院	電機工程 學系	陳良瑞	多重微電網於高佔比太陽光電環 境之實際場域研究	110/09/01	112/12/31	1,500,000
7	研究發展 處	創新育成 中心	陳明飛	110年度「產業園區產業輔導創 新計畫」-推動智慧綠能製造數 位轉型計畫-福興兼埠頭及田中 工業區	110/02/01	1 10/11/30	760,000
8	工學院	電機工程 學系	陳良瑞	緣能科技研究與教育計畫	110/09/01	111/07/31	1,500,000
9	研究發展 處	台灣綠色能源科技中心	阮昱霖	具雙向驅動之混合式智慧儲能系 統計畫	110/08/01	111/05/31	390,000

9,410,000

Note: Projects in green font are energy storage related and those in red are clean energy related.

4. The project conducted under the National Science and Technology Council to beimplemented by NCUE in 2021 is listed below. Multiple companies will collaborate in these plans to produce

research findings and technologies relevant to the local industries.

計畫名稱	參與廠商	計畫金額
多重微電網於高 佔比太陽光電環 境之實際場域研 究與展示	寰宇宏、沃旭能源、天泰 管理、睿禾控股、中佳電 力、聯齊科技、聚盛能 源、台電	13,916,000

7.4.4

題目: Policy development for clean energy technology.

Inform and support governments in clean energy and energy-efficient technology policy development.

1. NCUE actively engages with government regulation and standards on environmental protection, energy saving, and water conservation, and is committed to using clean energy and improving the efficiency of existing energy consumption. Specifically, the following measures have been adopted:

1.1 All new buildings have obtained the Green Building Certification by regulatory authorities.

1.2 The newly purchased split air-conditioners are in accordance with the latest environmental laws and regulations, that is, they are inverter air-conditioners (efficiency >5.1 kW/kWh) with a Level 1 cooling seasonal performance factor (CSPF) and auto-shutdown timers.

- 1.3 The light systems for new buildings and replacements for old buildings are all LED energy-saving (efficiency > 100lm/w).
- 1.4 All power transformers are amorphous metal type (core loss reduced by 80% compared to traditional iron core types).
- 1.5 All motors are high-efficiency (IE3 or above), and a soft-starter or frequency converter is installed on all motors that are either high-power or are used more frequently.
- 1.6 The light switches in all public areas have been changed to motion sensors or timers.
- 1.7 A 3000 kWp photovoltaic solar power system is expected to be installed on campus by end of 2022 in response to the government's policy on promoting clean and green energy and zero carbon emissions.
- 1.8 NCUE is constructing additional megawatt energy storage systems to shift power consumption from peak to off-peak hours, promote the stability of the national power system, and increase the efficiency and stability of the campus's power supply.
- . By building a megawatt-size energy storage pilot system and installing a photovoltaic system on the roof of each building, NCUE have effectively increased the development of our energy-saving technologies and clean energy use. NCUE have also become a model campus for green energy and provide the government with a successful experience that it can use as guidance when formulating policies related to clean energy and energy-saving technologies.
 - 2.1 NCUE has already installed a megawatt energy storage system, a 100,000-watt energy storage system, electric bus V2G/G2V charging stations, and rooftop solar cells, which collectively demonstrate the commitment to green energy systems.
 - 2.2 We have implemented the Ministry of Science and Technology's 'Field Research and Display of Multiple Microgrids in a High-concentration Photovoltaic Environment' project. The aim is to realise a microgrid demonstration system consisting of renewable energy, energy storage systems, V2G/G2V, and demand response. The demonstration field can provide information and support for the formulation of related technical policies.
 - 2.3 NCUE has also actively assisted the government in promoting energy policies, such as the implementation of the "Study on Optimizing the Long-term Operation Sequence of Feeder Switches" (2022, planned amount: \$NT 950,000) proposed by the Institute of Nuclear Energy Research of Atomic Energy Council, Executive Yuan; "Research on the Optimal Operation of Integrated Battery Energy Storage Systems in Campus Microgrids" (2021-2022, planned amount: \$NT 1.727 million) proposed by the Ministry of Science and Technology; and "Application for a Battery Energy Storage System for the Smoothing and Transfer of Net Load from a Photovoltaic Solar High-Penetration Microgrid" (2020-2022, planned amount: \$NT 742,000). Additionally, NCUE professors also serve as members of the Review Committee for Power Reliability, Ministry of Economic Affairs, and Review Committee of Green Factory Label-Cleaner Production Technology.



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台城美位「北港部電力可靠度審議會」委員 - 時期自105年2月27日起 至111年7月6日 五 -	
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经资部電力可靠度響識會委員。	1

7.4.5

題目: Assistance to low-carbon innovation.

Assist start-ups that foster and support a low-carbon economy or technology.

1. NCUE has implemented the "Research and Demonstration of Multiple Microgrids in a High-Proportion Photovoltaic Solar Environment" sub-project, launched by the Ministry of Science and Technology. Many enterprises have cooperated and participated in the project, and collectively, have been able to advance corresponding research results and technologies. Cooperative Enterprises (1/3)

合作企業	配合款	公司負介	
寰宇宏科技股份有限公 司	150 %	致力於智慧電動車、自駕車及線能應用相關專案整合與製造 供應,並提供電池、驅動馬達與控制模組、車用零配件、檔 能系統與電源管理、線能電力系統,站合台灣電動車及線能 產業關鍵零組件之生態鏈,提供全方但智慧電動車規劃	
沃旭能源股份有限公司	66 英	知名風力發電機廠商,為台灣鐮岸風場最大投資者。與影師 大合作成立"智慧線能應用中心",從事智慧機電網與儲能 系統之研究。	Cooperative Enterprises (2/3)
	150 美	與影師大合作"綠龍科技研究與教育計畫"共同推進影化成 為台灣線能教育重鎮	
天泰管理顧問股 份有限公司	100 복	 全台灣開發商轉超過2000WW 之太陽能電廠 自主開發以AI、機器學習之異常診斷系統幫助維運體系, 為台灣維運最多裝置容量電廠之維運廠商。 	
春禾拉股股份有限公司	100 🛪	 台灣第一批取得再生能源售電業特許執照。 取得再生能源發電業特許執照,可進行電能轉供。 完成台灣第一度綠電交易。 與台北101 合作,完成台灣第一案商辦線電供電。 	

合作企業			配合計畫
. 寰宇宏股份有限公司		子計畫一	A.電池信期技術、電池主動平衡技術・B.電池信期技術、E.電 施系統狀態預告・
沃旭能源股份有限公司	Z	子計畫二	C.素場發電資料,合作太陽能發電預測,D.用電資料,結合約 料,合作負款預測,E.提供太陽能發電資料,合作太陽能發 測,結合與最資料,合作負款預測,H.場供用電資料,結合)
天泰管理顧問股份有限公司		子計畫四	資料,合作負載預測 B.電光領能系統工作排程,D.電光領能系統工作排程,E.電光
春禾控股股份有限公司			系統工作排程。F.在能源管理系統導入「應用強化學習演算》 執行當電池及負獻設備的最佳化自動調整。H.提供 IQ21 鏡線 資料,探討效能改善。
中佳電力事業股份有限公司		子計畫五	A、四象限電力調節器、.V2G/G2V 建重研究探討・D.電動車 收費市場機制討論
聯齊科技股份有限公司	///	子計畫六	A: 營運模式創新實驗 B.營運模式創新實驗 C.營運模式創新費 錄電市場機制討論 E.輪助備轉容量服務 F.提供本案場在各種?
<u>察盛能源股份有限公司</u>	//`	Ĩ	環境條件變化下各種營運模式之能源管理系統最佳解決方案 協助本案場參與電力輔助服務市場最低門盤,通過台電通訊 期後十回時日期時末支援金額公司(第十六百十八回)
台灣電力公司(彰化區處)			- 発売ルあみで、街台や茶板が発音車公司・車力欠易中心」車 助市場・共創装査

Participation of Cooperative Enterprises (3/3)

合作企業	配合款	公司简介		
中佳電力事業股 份有限公司	50 萬	新進電力 IPP 公司,配合政府節能減碳、發展儲能、削峰填 谷政策,中住燃氣複循環電廠主要設備乃採取天然氣、太陽 能、儲能之三合一電廠,為全國首創。		
聯齊科技股份有限公司	60 篤	聯齊科技專業研發橫跨系統軟體、硬體、手機應用程式、網 路、通訊、機構設計、雲端服務及大數據分析、品質管理 等。聯齊擁有自主開發通用型物聯網開道器作業系統 (NextDrive OS),能管理各種感測與控制裝置並提供自動化 運作的能力,也可同時支援多種網路通訊標準如Wi-Fi、 BT/BLE、Wi-SUN、LTE、LoRa、PLC等,並能快速開發或整合 不同的週邊裝置。		
聚盛能源 50 萬		目前聚盛能源公司提供的需量反應平台服務,已可鏈結台電 輔助服務平台,並介接電網級通訊協定和達成 VPN 資訊安全 之要求。所提供之智慧電表設備及 gateway 也已達到台電公 司要求的精準度反資料傳輸可靠性		
台電公司 ()		台電「電力交易中心」於 2021 年7 月1 日揭牌啟用,即日 起電力交易平台正式開放註冊登記,經本計畫聚合商合作夥 伴協助書面申請、能力測試等程序,本案場即可參與電力輔 助服務實際交易。		

2. NCUE's Taiwan Green Energy Technology Center established an alliance of contactless power supply and charging technology producers, which currently hosts 30 participating manufacturers (including Buffalo Machinery, Auto Tech, Sunshine Kinetics Technology, Te Chang Construction, Air Cool Industrial, Join-Precision Technology, Raychuan Enterprise, Yong Xiang, Higher Way Electronic, Jeen Horng Trading, Won-link Industrial, Praise Machinery, Uniauto Technology, Pin Jeng Machinery, Shih Bang Technology, Yi Feng Construction, Avertronics, Taisun International, Solid Year, Inchung, Renyou International, Miao Cherng Corporation, Feiloli, Cheery Technology, Yi Jin Shiuan Beauty Style, Aspire Electric Automation, Ying Fang Hardware Manufacturing, Yu-Shen HS Electronics, and CUB Elecparts). The alliance also actively assists start-ups in the research and development of energy-saving technologies. The Center was also included in the 2021 Plan for Academia to Promote Value-Added Technological Innovation in the Real Estate Industry and has guided 15 manufacturers, such as Diann Bao, Jia Meng, Ray-Fabrics, and Green World Ecological Farm, to develop low-carbon energy solutions (Taiwan Green Energy Technology Center).



The above image (021) is from the 16th International Green Energy Technology and Management Symposium



The above imageis from the Industrial Application, Development, and Achievement of Contactless Power Transmission Technology: Exhibition and Manufacturer Exchange