

# 1-5 Achieving Net-Zero Sustainability

## • Management Approach

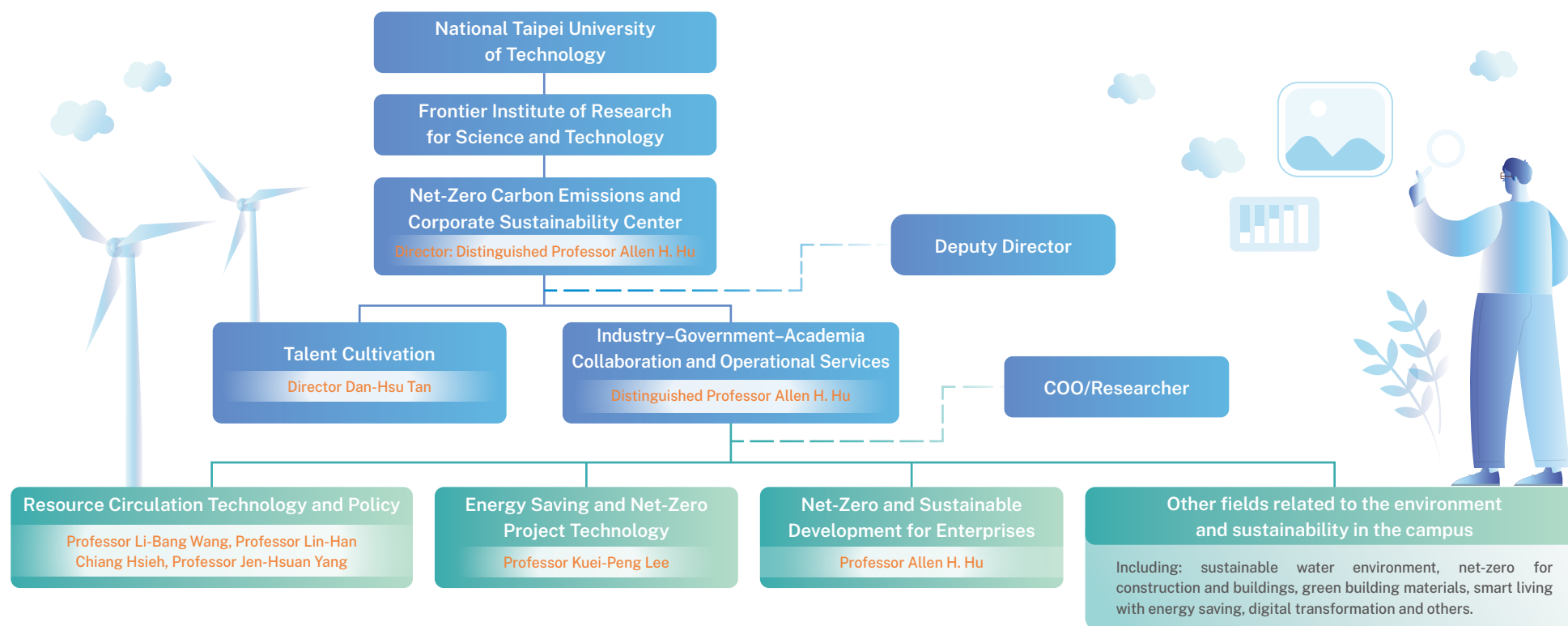
Climate change adaptation			
Policies/ Commitments	The university will reduce greenhouse gas emissions in accordance with international standards, promote carbon inventory and environmental education, and formulate carbon-reduction strategies. It is committed to achieving net-zero emissions by 2048, addressing climate change, enhancing environmental resilience, and encouraging participation from all faculty and students in sustainability initiatives.		
Responsible Unit	Campus Sustainability Center, R&D Division, Office of General Affairs, Military Training Office, Office of Personnel, Student Affairs Office, Environmental Safety and Health Center		
	Goals and Actions		Evaluation Mechanism
Short-term (2 years)	<ol style="list-style-type: none"> <li>1. Replace energy-efficient equipment, promote carbon-reduction awareness, and encourage green transportation.</li> <li>2. Promote carbon-reduction activities, establish a carbon inventory mechanism, and advocate low-carbon behaviors.</li> </ol>	<ol style="list-style-type: none"> <li>3. Regularly assess climate risks and propose response strategies.</li> <li>4. Set up recycling stations, organize environmental activities, and implement project-based training programs.</li> </ol>	<ul style="list-style-type: none"> <li>• Sustainability Quarterly Meetings</li> <li>• EUI Value Monitoring System</li> <li>• Waste and recycling volumes</li> </ul>
Mid-term (4 years)	<ol style="list-style-type: none"> <li>1. Expand carbon-reduction facilities, promote low-carbon transport, and evaluate installation of EV charging stations.</li> <li>2. Strengthen carbon emission data analysis, encourage participation of faculty and students in low-carbon lifestyles, and improve energy efficiency of facilities.</li> </ol>	<ol style="list-style-type: none"> <li>3. Launch sustainability courses and workshops to raise awareness of climate change among faculty and students.</li> <li>4. Deepen environmental initiatives and community service; promote green office practices.</li> </ol>	<ul style="list-style-type: none"> <li>• Greenhouse Gas Emissions</li> <li>• Surveys</li> <li>• Course/workshop frequency</li> <li>• Volume of paper purchased</li> </ul>
Long-term (8 years)	<ol style="list-style-type: none"> <li>1. Optimize carbon-reduction strategies, promote remote work and teaching, and adjust school holidays to reduce energy usage.</li> <li>2. Formulate a net-zero carbon action plan and collaborate with external units on carbon reduction and neutrality.</li> </ol>	<ol style="list-style-type: none"> <li>3. Strengthen industry-academia cooperation, integrate innovative technologies to enhance risk management in response to extreme climate events.</li> <li>4. Collaborate with communities to implement environmental initiatives and promote sustainable green actions.</li> </ol>	<ul style="list-style-type: none"> <li>• Research Strategy Meetings</li> <li>• Relevant meetings</li> <li>• Event frequency</li> </ul>
Corresponding Standards	GRI	GRI 201 Economic Performance	
	SDGs		
	STARS	<ul style="list-style-type: none"> <li>• OP-1 Emissions Inventory and Disclosure</li> <li>• OP-2 Greenhouse Gas Emissions</li> </ul>	<ul style="list-style-type: none"> <li>• OP-14 Office Paper Purchasing</li> <li>• OP-15 Campus Fleet</li> <li>• OP-16 Commute Modal Split</li> <li>• OP-17 Support for Sustainable Transportation</li> <li>• OP-18 Waste Minimization and Diversion</li> </ul>

• Established the Net-Zero Carbon Emission and Corporate Sustainability Center



In June 2024, National Taipei University of Technology (NTUT) established the “Net-Zero Carbon Emission and Corporate Sustainability Center” to strengthen collaboration among industry, government, and academia. The center assists government agencies and enterprises in net-zero transformation, ESG sustainable development promotion, implementation of circular economy practices, and net-zero energy-saving evaluations, aiming to cultivate professional talent in corporate sustainability and net-zero carbon management.

- The center serves as NTUT’s platform for net-zero sustainable industry–academia collaboration. It accumulates R&D capabilities, promotes research results externally, and maximizes overall benefits through the practical application of research outcomes.
- The center also fulfills the role of a “think tank,” supporting domestic government bodies and enterprises in advancing net-zero policies and conducting sustainability assessments.



### Center Features and Advantages

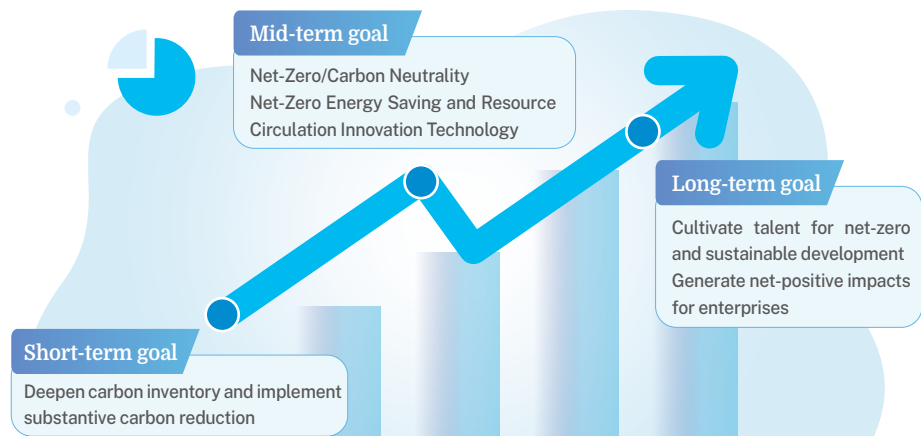
• Lab with Special Features: Provides technical solutions for corporate net-zero energy saving and resource recycling.

1. The only university in Taiwan with a full-scale integrated development and testing platform for smart cooling and heat pump systems.
2. Hydrothermal equipment for the removal of organic matter from sewage sludge and the synthesis of inorganic polymer materials for resource recovery.



• Low-Carbon Platform and Database: A suite of product life cycle assessment software and environmental data databases to assist enterprises in completing net-zero roadmaps and sustainability planning.

### Future Outlook of the Center



### • Climate Change Management

In 2022, NTUT introduced ISO 14064-1 to conduct self-assessments of greenhouse gas emissions, marking the University's first step toward achieving net-zero emissions. NTUT has actively incorporated sustainable development topics into the governance of campus sustainability. To address the operational risks posed by climate change, NTUT follows the Task Force on Climate-related Financial Disclosures (TCFD) framework, structuring its climate change response across four key dimensions: Governance, Strategy, Risk Management, and Metrics and Targets. By identifying climate-related risks and opportunities, the University aims to assess operational impacts and establish corresponding strategies and measures.

#### Research centers on climate change issues:

To integrate cross-disciplinary resources and enhance competitiveness in securing large-scale collaborative research projects, NTUT has enacted the "Regulations for the Establishment and Management of R&D Centers" and established a Management Committee. The committee holds annual meetings to evaluate the performance of each center, ensuring sustained operations and effective management.

<b>University-Level R&amp;D Centers</b>	Research Center of Energy Conservation (RCEC) for New Generation of Residential, Commercial, and Industrial Sectors, Water Environment Research Center.
<b>College-Level Research Centers</b>	Energy Conservation and Emission Reduction Research Center, Energy-Saving Technology R&D Center for Residential, Commercial, and Transportation Sectors, Sustainable Environment Control Center, Energy Monitoring Research Center, Circular Environment Research Center, Sustainable Innovation and Assessment Center, Disaster Prevention Engineering Technology Center, Innovative Green Building Materials R&D and Promotion Center, Twin Transition and Sustainable Governance Center.

#### Core elements of TCFD:

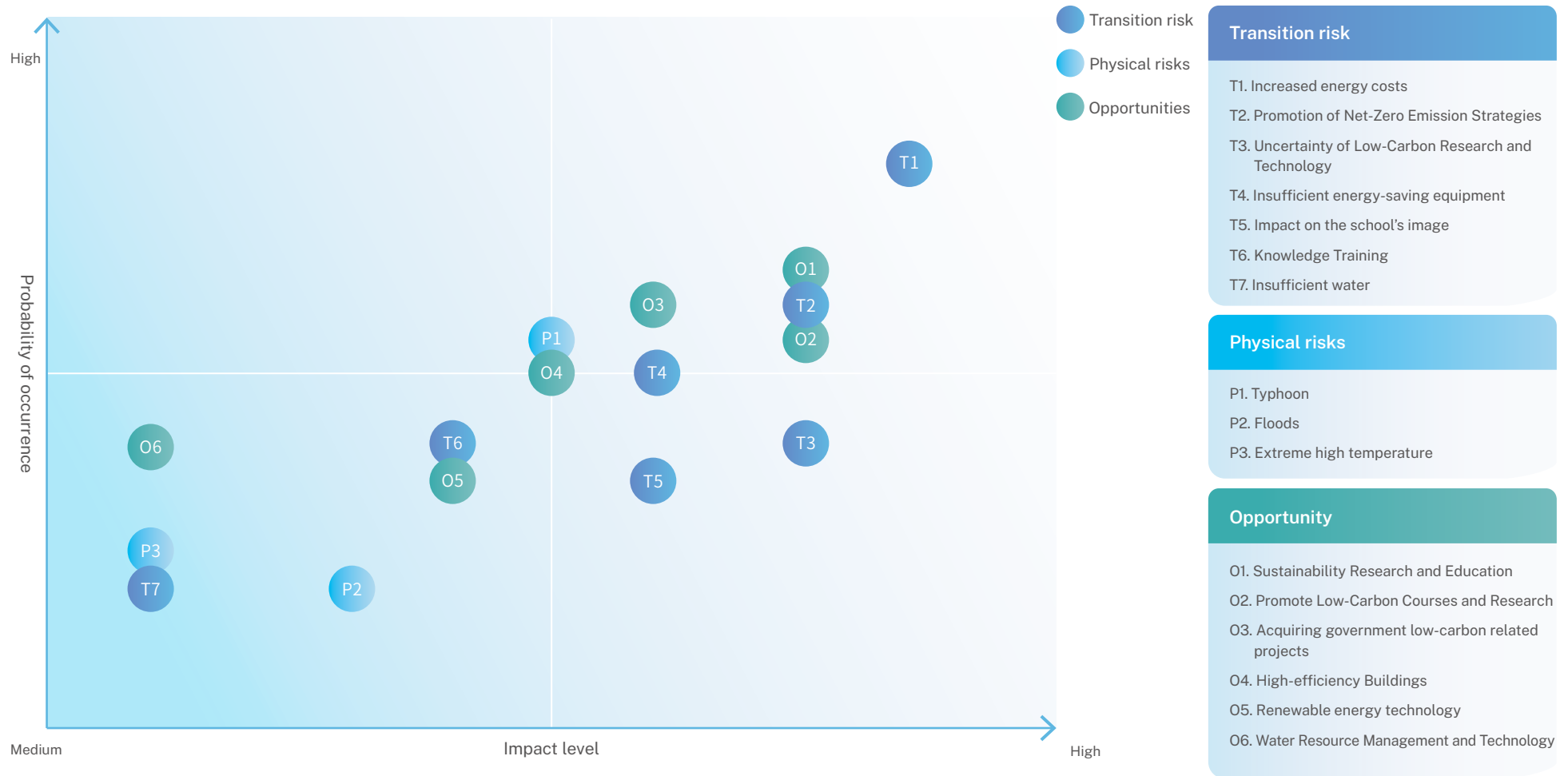
<b>Governance</b>	The School Affairs Research and Sustainable Development Center holds the "Sustainability Meeting" every year and includes climate risk identification and assessment. After corresponding to the Material topics of the school and related sustainability indicators, action plans are formulated to implement climate action and sustainability goals.
<b>Strategy</b>	In order to achieve the goal of net-zero emissions by 2048, we analyze the risks and opportunities based on current operating conditions and use them to promote greenhouse gas inventory, renewable energy development, energy saving and carbon reduction, as well as green procurement practices, to mitigate and adapt to the risks and impacts of climate change.
<b>Risk management</b>	<ul style="list-style-type: none"> <li>• Execute short-, medium-, and long-term climate-related risk and opportunity identification through cross-unit cooperation.</li> <li>• The survey questionnaire is used to assess the impact level and formulate response strategies.</li> </ul>
<b>Indicators and targets</b>	The action plan is designed to align with sustainability-related indicators such as GRI and STARS, and with reference to evaluation standards. Qualitative and quantitative targets are set to serve as the basis for evaluating the effectiveness of implementation.



## • Climate risk and opportunity management

Based on the Task Force on Climate-related Financial Disclosures (TCFD), the NTUT has identified seven major transition risks, three physical risks, and six climate-related opportunities through the disaster potential map of the Home Disaster Prevention and Protection Center, the climate change disaster risk adaptation platform, and the reference to the climate conditions of the education system. Then, the primary executives of the school further evaluated the likelihood and impact of the occurrence to identify the risks and opportunities of the financial impact of climate change and drew up a matrix of major climate change risks and opportunities.

Material climate change risk and opportunity matrix



## Transitional risk:

Climate risk	Financial Impact	Response strategy
Rising costs of energy	<ol style="list-style-type: none"> <li>1.High cost of green power</li> <li>2.Higher temperature, higher electricity cost</li> <li>3.High cost of renewable energy installation</li> </ol>	<ul style="list-style-type: none"> <li>• Promote energy conservation awareness and adopt energy conservation and carbon-reduction policies. Reduce total electricity consumption in the school through electricity consumption regulations and hold monthly meetings to investigate the school's electricity consumption.</li> <li>• Establish renewable energy such as solar panels to reduce energy expenditure from self-generated and self-use.</li> </ul>
Promotion of Net-Zero Emission Strategy	In response to the net-zero carbon emissions, carbon tax, and carbon trading impacts of the Climate Change Response Act, inventory, carbon-reduction strategy planning, and purchase of green power certificates, etc., are conducted to increase operating costs.	<ul style="list-style-type: none"> <li>• Promote campus carbon inventory and collect emission data for Scope 1, Scope 2, and Scope 3 (commuting) To set short-, medium-and long-term goals for net-zero carbon emissions.</li> <li>• Promote green procurement and use products with environmental protection and energy-saving labels.</li> <li>• New or modified buildings are subject to the Green Building Council (GBC) rating, such as EEWH Green Building Mark certification.</li> </ul>
Uncertainty of Low-Carbon Research and Technology	Emerging technologies that increase the cost of teacher research.	<ul style="list-style-type: none"> <li>• In response to the core expertise of the school in sustainable development and environmental climate, the school actively participates in government agencies and industry-academia collaboration in carbon-reduction-related projects and research to respond to the global net-zero carbon emission target.</li> </ul>
Insufficient energy-saving equipment	The campus is limited, and the establishment of renewable energy is insufficient.	<ul style="list-style-type: none"> <li>• Replace energy-intensive equipment (traditional lamps, inverter air conditioning, etc.), and purchase energy-saving and eco-friendly equipment.</li> <li>• Update smart meters and smart energy monitoring system equipment to implement campus energy management.</li> </ul>
School image impact	Poor sustainability performance.	<ul style="list-style-type: none"> <li>• Encourage academic research and social engagement in the field of sustainable development, and actively compete for external sustainable action awards to strengthen the competitiveness of school operations.</li> <li>• Participated in the "Smart and Climate-Friendly Campus Pilot Program" of the Ministry of Education to demonstrate the ecological campus's demonstration effect.</li> </ul>
Knowledge training	In order to build up the knowledge of sustainability for all teaching and staff members and increase the cost of education and training.	<ul style="list-style-type: none"> <li>• Increase the proportion of sustainability-oriented courses by promoting curriculum design centered on sustainability, along with expanding general education courses related to sustainable development. At the same time, relevant academic programs and micro-credentials are being developed to attract student participation.</li> <li>• Offer ESG and sustainability management-related advanced study courses to cultivate relevant talent in response to market demand.</li> </ul>
Lack of water supply	Imbalances in the supply and demand of water resources lead to water shortages.	<ul style="list-style-type: none"> <li>• Establish water consumption and water level monitoring systems to improve the water conservation plan for the entire campus.</li> <li>• Establish a rainwater harvesting system on the roof as a source of water for landscaping and gardening on the roof and flushing toilets.</li> <li>• Use of waterproof coating to achieve the goal of water retention.</li> </ul>



### Physical risks

Climate risk	Financial Impact	Response strategy
Typhoon	Because the sea temperature rises, the atmospheric water content increases significantly, resulting in an increase in the proportion of typhoons with stronger rainfall, resulting in higher damage.	<ul style="list-style-type: none"> <li>Implement disaster response plans and set up relevant disaster prevention facilities to ensure the safety of teaching and staff.</li> </ul>
Floods	Changes in rainfall patterns, increasing urban water stress.	<ul style="list-style-type: none"> <li>With the campus fully paved with a waterproof foundation, we will continue to improve the campus's drainage and flood prevention capabilities, increase resilience to deal with extreme weather, and reduce the losses caused by climate change.</li> </ul>
Extreme high temperature	Increased temperature and increased energy supply pressure.	<ul style="list-style-type: none"> <li>The school will strengthen the promotion of ecological campus, reduce the effect of thermal island effect of buildings through the increase in the percentage of ecological campus planning and planting, and improve the heat dissipation.</li> </ul>

### Opportunities:

Type of opportunity	Financial Impact	Response strategy
Sustainability Research and Education	Increase the competitiveness of campus sustainability performance, increase industry-academia collaboration, attract students to study, and increase operating revenue.	<ul style="list-style-type: none"> <li>The SDGs Thesis Award grants are provided to encourage the teaching and research staff of the school to publish high-quality international SDGs-related papers.</li> <li>Add corresponding sustainability indicators to the course teaching outline.</li> </ul>
Promote low-carbon courses and research	Research or R&D on low-carbon economy and green transformation.	
Acquiring government low-carbon related projects	Received government agency subsidies to implement energy conservation, environmental protection, or other low-carbon projects to realize a sustainable campus.	<ul style="list-style-type: none"> <li>Encourage teachers to apply for government-related research projects.</li> <li>Plan the 2048 net-zero emission measures.</li> </ul>
High-efficiency buildings	Low energy consumption, and reduce energy costs on campus.	<ul style="list-style-type: none"> <li>Replace the fluorescent lamps with LED lamps, and use smart streetlamps and other intelligent equipment to control energy consumption.</li> <li>Periodically investigate the electricity consumption of the school, and regularly or irregularly check the electricity consumption status, and monitor and guide the dormitory with large electricity consumption.</li> </ul>
Renewable energy technology	Lower energy costs, obtain government subsidies and tax incentives, and enhance school image and reputation.	<ul style="list-style-type: none"> <li>The new construction of the campus will plan the solar photovoltaic panels and other solar equipment.</li> <li>Renewable energy research creates maximum effect for green power.</li> </ul>
Water resource management and technology	Lower water consumption costs, lower drainage treatment costs, reduce environmental risks and responsibilities, and enhance school image and attractiveness.	<ul style="list-style-type: none"> <li>Establish a water resource monitoring system and optimize the rainwater harvesting system.</li> <li>Create rainwater gardens, green rooftops, and water-pervious paving.</li> </ul>

## • Climate Change Research and Action Outcomes

### Multipurpose smart rainwater garden:

The Water Environment Research Center supported the Climate Change Administration of the Ministry of Environment in establishing 16 multifunctional smart rainwater gardens across various counties and cities in Taiwan over the past four years. Through the implementation of an IoT-based real-time monitoring system, on-site data were collected and analyzed. During the monitoring period, these gardens demonstrated an average temperature reduction of 1.9°C and a total water retention volume of 31,752.61 m<sup>3</sup>. To further promote the rainwater garden initiative, the Center evaluated the feasibility of integrating such systems into building sites or infrastructure projects. This included a review of relevant domestic regulations and consultations with experts from industry, government, and academia in the construction sector. On-site inspections and interviews were conducted to provide recommendations for continuous improvement. Additionally, three community engagement forums were held in northern, central, and southern Taiwan, incorporating Nature-based Solutions (NbS) and community-based perspectives. To support the broader adoption of rainwater gardens, the Center also assisted in organizing a campus teaching materials competition and compiled a reference manual for the design of rainwater garden facilities. These efforts aimed to facilitate future applications, raise public and campus awareness on rainwater gardens, climate change adaptation, and environmental education, thereby enhancing Taiwan's overall capacity to adapt to climate change.



### Moisture-proof coating construction:

In addition to the ongoing long-term monitoring of the performance of permeable pavement at the Zhongxiao–Xinsheng intersection, the Water Environment Research Center collaborated with the New Construction Office of the Taipei City Public Works Department in 2024 on a sidewalk permeable pavement project along Zhongxiao East Road (from Jianguo to Fuxing section). Temperature monitoring equipment was installed at the Zhongxiao–Jianguo intersection to assess the effectiveness of permeable pavement in supporting urban climate change adaptation and mitigating the urban heat island effect.

