07 AFFORDABLE AND CLEAN ENERGY

2018-2022 Publications **1,243**

Course Units **89**

Student Engagements with Units on SDG 7 **3,438**

2018-2022 Percentage of all Taiwan Publications **9.7%**

Research

Solar Battery Developed by a Multinational Team

Professor Chien-Lung Wang' s team from NYCU's Department of Applied Chemistry collaborated with the Solar Center of the King Abdullah University of Science and Technology (KAUST), Saudi Arabia, to jointly develop stable perovskite solar cells with enhanced efficiency and stability, maintaining 95% of initial efficiency even after high humidity, high temperature, and accelerated aging tests. This has great significance in the development of sustainable energy and represents a major breakthrough in the field of solar power. The research results have brought the next-generation solar cells forward into commercialization, and have been published in the top international journal *Science*.

Emerging Solar Optoelectronic Technology

Semi-transparent organic photovoltaics (OPVs) is a type of emerging solar optoelectronic technology with dual functions that can generate electricity and facilitate photosynthesis for plants underneath. It can be used on the roof of greenhouses to supply energy. A joint research between Professor Kung-Hwa Wei of NYCU's Department of Materials Science and Engineering and UCLA found that translucent OPVs roofs boost the survival and growth of crops, confirming the high application value of this technology and its importance in addressing food and energy challenges. This research not only elevated NYCU's technology level, but also demonstrated the strength of the University's independent research and development. The findings have been published in the top international journal *Nature Sustainability*.

Social Impact

Solving Carbon Emission Problems Through Industry-Academia Collaboration

Professor Chuen-Jinn Tsai of NYCU' s Institute of Environmental Engineering attended the "Taichung City Air Quality Improvement and Net-Zero Emission Forum" in 2022, discussing ways to conserve energy and reduce carbon emissions with other industry, government, and academic figures, as well as the path towards net-zero emissions by 2050. Professor Tsai highlighted Taiwan's current carbon reduction technology faces numerous difficulties. In the past, some institutions were evaluating the feasibility of underground CO2 storage, but these efforts were met with local protests. Moreover, the reduction effect of carbon reuse is minimal. In the end, achieving net-zero emissions must rely on carbon storage technology. Therefore, Professor Tsai proposed that industry and academia cooperate to gradually address the carbon issue.

AIoT Tiny House

The "AIoT Tiny House" designed by Professor Sheng-Kai Tseng of NYCU' s Design and Innovative Technology Program is designed based on Taiwan' s countryside, with considerations made so that it would fit the typical subtropical climate as well as the climate in mid-to-high altitudes. The user-centric design includes a variety of modules along with solar power, a power storage system, and smart controls to achieve energy autonomy and create a highly adaptable environment. The AIoT Tiny House is currently being tested in an open area on campus, using the IoTtalk platform to achieve real-time monitoring and control. The performance and low-latency status of the AIoT Tiny House has also been tested in large-scale experimental sites with good results, showing that the house is economical and this technology is highly feasible.

Education & Cultivation

Joint R&D Center for AI and Green Energy

NYCU collaborated with Wistron to establish the Joint Industrial Innovation Center for AI and Green Energy (JCAG), which focuses on research, development, and talent cultivation mechanisms, using forward-looking industry-academia collaboration to promote interdisciplinary research collaboration and invite scholars and experts to collaborate with the industry. The JCAG is Taiwan' s first world-class R&D center and talent training base established through industry-academia collaboration in the fields of smart manufacturing and smart green energy. NYCU will also set up the "Smart IoT Industry Master's Degree Program" to promote interdisciplinary research on innovative smart services, smart technology, and smart industrial IoT in smart manufacturing and green energy electronics.

Improve Knowledge on Sustainable Energy through Overseas Internships

NYCU plans to send outstanding students on an overseas internship program at Delta Electronics' EMEA headquarters in Hoofddorp, the Netherlands, signing the "Delta EMEA Headquarters Overseas Internship Program" MOU with Delta. This internship program aims to allow students to learn automation and energy-related technologies and have the opportunity to help Delta provide green energy-saving solutions to customers, such as electric vehicles, energy infrastructure, information and communication infrastructure, and industrial automation, among other fields. In addition to learning professional knowledge, life overseas and interactions with global talents will help students broaden their horizons and improve their English communication skills. In 2023, 3 students were chosen for the internship program at Delta's EMEA headquarters, where they will train to become more competitive international talents. The close industry-academia collaboration will hopefully also continue to promote the development of Taiwanese international enterprises.

Stewardship

Implementing Energy-Saving and Carbon Reduction Strategies

In line with the Executive Yuan’ s "Energy Efficiency of Governments and Schools Program," NYCU established an "Energy Management Committee" to formulate energy-saving plans that conserve energy and reduce carbon emissions, continuously reduce power usage, and improve green competitiveness, with concrete methods such as:

- **Introducing Smart Meters**
  Smart meters record power consumption information throughout the day, providing information on power usage at any time, which allows NYCU to effectively manage power usage, accelerate the transition to low carbon energy, and establish sustainable electricity. In 2022, the Yangming Campus reduced its power usage by 410 thousand kWh. Considering every kWh is approximately 0.495kg of carbon emissions, this is equivalent to reducing carbon emissions by 205 thousand kg.
- **Solar Energy Generation**
  NYCU installed solar photovoltaic equipment with a total power output of 1194.14kWp at the Hsinchu's Boai Campus and Tainan Campus, and solar photovoltaic equipment with a power output of 300 kWp in Hsinchu's Guangfu Campus. The total power output of the equipment across the three campuses is 1494.14kWp. By using the solar photovoltaic equipment system in parallel with Taipower's transmission and distribution system, and providing electricity for sale, it is estimated that a total of 1.875 million kWh of electricity can be saved each year, which is equivalent to reducing carbon emissions by about 3,385 metric tons.
- **Replacing Old, Energy-Intensive Equipment**
  New or replaced air conditioners and lighting equipment across NYCU buildings are energy-saving models. For example, the conventional T8 and T5 fluorescent lights and the conventional mercury-vapor, metal-halide, and sodium-vapor street lights have been replaced with LED lights. Old air conditioners have been replaced with ones equipped with frequency changers with high COP (EER) values, IT server rooms have been designed with separate hot and cold aisles, and energy-intensive equipment like elevators have been replaced with energy-saving models with power feedback that are controlled from a central location. Existing equipment are also replaced based on each year’ s budget, gradually making buildings more energy efficient and reducing energy consumption.