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# 風光時刻

人物·專訪

Interview

提升風電技師環安衛

GWO證照守護職業安全



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環境 · 永續

## 光電啟發新世代能源認知 太陽能教案推廣

Environmental Education on Solar Power

### 環境教育課程進入校園 綠能知識向下扎根

#### Environmental Education Courses On Campus To Deepen Green Energy Knowledge

緊鄰台中大安風機旁的達德能源環境教育中心，不僅有全台首個位在生態公園內的風機，同時也催生了環境教育教材，透過巡迴校園，讓中部地區學校，更能了解綠能帶給現在生活的便利，也讓孩子們對於未來的世界，勾勒出新的藍圖。

wpd Environmental Education Center (wpdeec), located adjacent to the Da'an wind turbines in Taichung, not only hosts the first turbine within an ecological park in Taiwan but also fosters environmental education materials. Through campus tours, schools in the central region can better understand the convenience green energy brings to current living conditions. It also allows children to envision new blueprints for the future world.

環境教育中心的進駐，除了讓地方帶來新的契機、建立了綠能與當地居民的話題橋樑，同時也是推廣能源的重要節點，並且串連鄰近的其他環境教育，讓地方教育開始慢慢翻轉。

The establishment of an environmental education center not only brings new opportunities to the local area but also serves as a bridge for dialogue between green energy and local residents. It acts as a crucial hub for promoting energy awareness and connects with nearby environmental education initiatives, commencing a gradual transformation in local education.

### 生態公園內孕育出光電教材 讓環境教育從小學開始

#### Ecological Park Nurtures Solar Energy Teaching Materials, Initiating Environmental Education from Elementary School

位在龜殼生態公園內的 15 號風機，矗立在海岸邊，隨著海風的吹動下，是見證台灣綠能推動的重要歷史之一，更是全台首創的能源環境教育課程，催生了環境教育教材，除了風力發電外，現在太陽光電也融入課程，讓學員們可以一次了解兩種在台灣最主要的綠能來源。

The No. 15 wind turbine located in the Turtle Shell Ecological Park, standing tall by the coast, is one of the important historical landmarks witnessing Taiwan's green energy transition. It is also the pioneer of energy environmental education programs in Taiwan, giving rise to teaching materials. In addition to wind power generation, solar energy has now been incorporated into the curriculum, allowing children to understand both of Taiwan's main green energy sources in one go.

達德能源政府暨公共事務部總監李雅貞表示，根據國際能源總署 IEA 的預測，到 2028 年，再生能源將佔全球發電量的 42% 以上，其中風能和太陽能光電發電將佔比 25%。在台灣，風光兩大綠能也開始肩負國內的發電任務，這代表台灣對於氣候變遷越來越重視，當然環境教育課程就需要從頭開始講起，同時也要發展能「帶著走」的教材，才能深入到校園當中。



wpd Taiwan Energy's Director of Government and Public Affairs Department, Alison Lee, stated that according to forecasts from the International Energy Agency (IEA), renewable energy will account for over 42% of global electricity generation by 2028, with wind and solar energy accounting for 25%. In Taiwan, wind and solar energy are increasingly shouldering the domestic power generation tasks, reflecting an increasing emphasis on climate change issue. Consequently, environmental education programs need to start from the origin, and there is a need to develop portable teaching materials that can be brought directly into schools.

李雅貞說，現在環境教育課程隨著學校老師來申請合作，在中部地區已經打響名號，環教中心已經走過台中、南投、雲林、苗栗等縣市，越來越多的學校希望能入校教學，讓孩子們體驗有別於課本中的學習。

Alison mentioned that the environmental education program is now gaining recognition as schools and teachers in the central region apply for cooperation. wpdeec has already made their mark in counties and cities such as Taichung, Nantou, Yunlin, and Miaoli. More and more schools are hoping to incorporate these programs into their teaching



curriculum, providing students with hands-on learning experiences beyond textbooks.

「不過要讓小朋友了解再生能源，就必須要先知道地球其實正在暖化與氣候變遷等問題」，李雅貞指出，環境教育很重要的一點，是要讓小朋友意識到這件事情正在發生，並從太陽能發電的角度切入延緩暖化發生，同時也要讓孩子們知道，改變是可以從自身做起。

"However, to help students understand renewable energy, they must first know that the Earth is actually experiencing issues such as global warming and climate change," Alison pointed out. She emphasized

that a crucial aspect of environmental education is to raise children's awareness of the ongoing climate change and solar energy can help mitigate warming. At the same time, it is essential for students to understand that changes can be made by themselves.

**實際動手作 迸出新的創造力**  
**Hands-On Activities Unleash New Creativity**

在環境教育課程中，除了有獎徵答外，最重要的是會有實際操作的環節，一次教案的教學會以 2 小時為規劃，在第二小時會有簡單的教具操作，透過實

際用風來發電，或是利用太陽能來驅動小汽車，來加深小朋友對於再生能源的印象。

In environmental education programs, besides award-winning quizzes, the most crucial aspect is hands-on activities. Each teaching session is planned for 2 hours, with a simple teaching aid operation activity in the second hour. Through practical experiences such as generating electricity with wind or powering small cars using solar energy, children's understanding of renewable energy is deepened.

因為小朋友在校園內讓太陽能車奔馳，立即吸引了其他班級的目光，這也會讓其他班級的老師受影響，進而著手了解環境教育，是另一種帶動校園教學的模式，也以輕鬆的方式讓綠能教育深入每個孩子心中。

The sight of solar-powered cars racing around the campus immediately caught the attention of other classes, influencing other teachers to delve into environmental education. This serves as another way for promoting renewable teaching on campus, and it effortlessly embeds green energy education into every child's heart.

### 再生能源融入生活 太陽能板成為校園綠能教育先鋒

#### Renewable Energy Integrated into Daily Life: Solar Panels Leading the Way in Green Energy Education on Campuses

隨著政府政策推動下，越來越多學校設有太陽能發電設備。李雅貞說，在許多學校進行環教課程時，雖然已經能看到太陽能以各種形式出現在小朋友的生活當中，但是由於安裝太陽能板的屋頂因安全考量屬於「學生禁區」，因此學生對於發電過程能看到的相當有限，只有在校園內會有顯示器呈現發電狀態，但是對於理解綠能還需要有人幫忙推一把。

Following the government's policy, many schools are now equipped with solar energy generation facilities. Alison mentioned that although solar energy appears in various forms in students' daily lives, they have limited access to the power generation equipment due to safety considerations – the roof where solar panels are installed is designated as "restricted areas" for students. Students can read the number of power

generation displayed on bulletin boards, but it's far more than enough to really understand green energy.

當要建立起一套教學模式，前期教案開發要做很多努力資料蒐集。要建構出完整的教案，才可以傳遞出正確的資訊；同時也要有與環境互相結合的教具，自己動手組裝太陽能車，就是讓小朋友實踐的重要關鍵，讓孩子們理解綠能原來已經早就融入在生活中。

When establishing a teaching model, a lot of efforts and data collection are required in the early stages of lesson planning. Composing a comprehensive lesson plan is essential to deliver accurate information. Additionally, having teaching aids that integrate with the environment is crucial. The hands-on assembly of solar-powered mini cars is an important aspect of practical learning for students, allowing them to understand that green energy has long been integrated into our lives.

### 級任老師回饋 小朋友在快樂中體驗且學習

#### Students Gain Experiences in Joyous Environment, A Classroom Teacher's Feedback

環境教育課程透過財團法人電路板環境公益基金會平台（TPCA Environment Foundation），讓老師們可以依孩子的學習狀況，挑選適合的教學課程，並安排入校與孩子們互動。台中市石岡國小莊惠如老師表示，過去在上自然課時，本來就有設計課程讓小朋友可以親自動手、嘗試作一些科學小實驗，在電學上已有類似的教具，因此當環境教育中心的老師帶來太陽能車時，小朋友很快就能上手，迅速的組裝完成並且追著太陽，讓太陽能車在校園內奔馳。

The environmental education programs in wpdeec, facilitated by the TPCA Environment Foundation platform, allow teachers to select suitable teaching courses based on students' learning progress and then arrange interactive sessions at schools. Ms. Chuang Hui-Ru, a teacher at Shih Gang Elementary School in Taichung City, mentioned that they already had designed courses during natural science classes that allowed children to engage in hands-on activities and try out some scientific experiments. They also had similar teaching aids related to electricity. Therefore, when teachers from wpdeec brought

solar-powered cars, the children quickly grasped the concept and assembled the cars swiftly. They excitedly chased after the sun, seeing the solar-powered cars race around the campus.

莊老師說，由於小朋友對於太陽能車覺得非常的新鮮且有趣，上完課程後迫不及待的想要填寫意見、給予回饋，希望能爭取更多的環境教育課程到校當中。同時也因為上課程到校一次只有一個班，因此讓其他班的同學相當羨慕，也都表達想要上課的意願。

Teacher Chuang mentioned that the children found the solar-powered car very novel and interesting. After completing the course, they were eager to provide feedback, hoping to get more environmental education programs into the school. Additionally, because only one class can attend the course at a time, students from other classes also expressed desire to participate in the program.



莊老師認為，小朋友確實可以因為課程理解到生活周遭的能源議題，因為台中地區有全台最大的火力電廠，同時學校內也有設置太陽光電設備，因此課程中環教老師能夠透過生活化的議題帶出能源主題。莊老師說在兼顧小朋友學習狀況的同時，環教老師也能顧及能源發展的現況，非常厲害。

Teacher Chuang believes that children can indeed gain deeper understanding of energy issues in their surroundings through the program. Taichung has the largest thermal power plant in Taiwan, and there are also solar energy facilities at schools, so energy topics can be easily brought up during the course. Teacher Chuang said, while ensuring the children's learning progress, environmental education teachers can also address the current state of energy development, which is impressive.

因為太陽能車的手作實驗就跟太陽光電一樣，對於天候的變化有很直接的關係，此次環境教育課到校時，運氣很好有遇上太陽的時刻。莊老師也有聽聞其他學校因為陰天讓小朋友做好的太陽能車沒辦法跑起來，但環教老師也會藉由這樣的機會向小朋友們解釋太陽光電結合儲能後，可以讓能源供應可以不受天候限制。

The hand-made solar-powered cars is also highly related to weather conditions just like solar energy systems, so when the environmental education program comes to the school, it might be fortunate to encounter sunny weather, while Teacher Chuang also heard of other cases that children couldn't make their solar-powered cars run due to cloudy weather. However, environmental education teachers will also take the chance and explain to the students that solar energy systems combined

with energy storage will allow energy supply to be independent of weather conditions.

### 環境教育不只改變學校 社區也開始改觀 Not Only Schools, Environmental Education Also Starts to Transform Communities

教育的場域不侷限在校園內，受眾也不僅僅是小朋友，有時社區的大人同樣也會受影響。採訪過程中，環教中心的志工大哥就表示，社區民眾對於風機的運作也很關心，有時風機停機下來，鄰近的住戶比起公司更在意，甚至還會打電話向他通報，想瞭解風機沒有運轉的原因，知道是在定期維修後，就放心了。這些反應也展現出民眾已經開始習慣綠能出現在生活當中，同時也消弭彼此的鴻溝，進入

相互溝通與理解的階段。

The scope of education is not limited to school campuses, and the audience is not only children; sometimes adults in the community are also within the reach. During interviews, volunteers from the wpdeec mentioned that community residents also care about the operation of wind turbines. At times, when the turbines stop, nearby residents pay more attention than the company itself. They sometimes call the volunteers to inquire about the reasons for the turbine's shutdown. Once they learn that it's due to regular maintenance, they feel reassured. These reactions demonstrate that people have begun to adapt to the presence of green energy in their lives. Environmental education also bridges the gap, leading to mutual communication and understanding.

人物 · 專訪



## 提升風電技師環安衛 GWO 證照守護職業安全

Enhancing the Environment, Health, and Safety of  
Wind Turbine Technicians Through GWO Certification

### 陸域風場環安衛再升級 BST 課程增添工程師安全意識

#### Upgrading Onshore Wind Farm HSE with An Enhanced BST Courses

矗立在西海岸邊的風力發電機，隨著季風而轉動，吹響台灣綠能轉型的號角，也帶來豐沛的綠電，讓台灣能源轉型穩健發展中。為了讓風機可以時時刻刻穩定運轉，風機維護就是相當重要的一環，維修工程師在風機內上下移動，讓風機保持在健康的狀態。

Standing on the western coast, wind turbines rotate with the monsoon, heralding Taiwan's green energy development and bringing abundant green electricity for the steady growth of Taiwan's energy transition. To ensure the continuous operation of wind turbines, maintenance is crucial. Maintenance engineers move up and down inside the turbines to keep them in optimal condition.

當工程師在風機內移動，從塔架到機艙內，都需要仔細專注，才能在維護過程中，既確保風機正常運作也保持工作安全。在風機內的安全指引規範是依據勞動部職業安全衛生署在 2019 年公布的離岸風電海域作業安全指引，但在陸域風電上，只有採用高空安全作業等要求，因此工程師在進行維護時，更需要更多的安全指引。

As engineers move inside the wind turbines, from the tower to the nacelle, careful attention is essential. This ensures both the turbine's normal operation and workplace safety during maintenance. Safety

guidelines within the turbines are based on the Offshore Wind Farm Operation Safety Guidelines issued by the Occupational Safety and Health Administration of the Ministry of Labor in 2019. However, for onshore wind farms, only high-altitude safety operations are adopted. Therefore, engineers require even more safety guidelines when performing their tasks.

### BST 五大課程 以證照考試確保安全

#### 5 Major Modules of BST To Ensure Safety Through Certification Exams

目前國際風能組織 (Global Wind Organization, GWO) 為了保證風場在工作時，工作人員都需保有一致性的安全認知，因此要求基本安全訓練標準規範，並制定基礎安全訓練課程 (Basic Safety Training; 簡稱 BST)，課程包含高空作業、徒手搬運、緊急救護、海上求生、火場應變等五大課程，並且規定證書期限為 2 年，有效期限過期前需進行 BST 複訓，確保證書有效性。

The Global Wind Organization (GWO) currently requires standardized basic safety training to ensure consistent safety awareness among personnel working at wind farms. This initiative aims to establish a uniform safety training standard and develop a Basic Safety Training course (BST). The BST course includes five major modules: Working at Heights, Manual Handling, First Aid, Sea Survival, and Fire Awareness. Certificates issued upon completion

格偉旭風能營運長吳信賢

Cook Wu, Chief Operating Officer of Greenwish

of the training are valid for two years, after which BST retraining is required to ensure the continued validity of the certificates.

格偉旭風能營運長吳信賢說，雖然陸域風電用不到海上求生的相關模組，但部分風機設立在海岸上，車輛及人員進出並不是那麼方便，在發生事故時影響救災搶救人員靠近風機的時間，因此在風機內工作的人員，都需具備必要的安全意識，才能確保安全。

The Chief Operating Officer of Greenwish, Cook Wu, mentioned that while onshore wind farm operations may not directly involve modules related to sea survival, some wind turbines are

situated near coastlines. This proximity can pose challenges for vehicles and personnel accessing these sites. In the event of an accident, delays in reaching wind turbines can hinder rescue and relief efforts. Therefore, personnel working within the turbines must possess the necessary safety awareness to ensure their safety.

吳信賢表示，當風機遇上問題時，風機受侷限的空間內，人員的移動相當受限，且風機大多設立在人煙較為稀少的區域，因此消防車抵達的時間必將拉長，也很可能會因路況讓救援時間延後，因此保有自救的能力相當重要。



Cook stated that when wind turbines encounter issues, personnel mobility within the confined spaces of the turbines is significantly restricted. Moreover, wind turbines are often located in remote areas with sparse population, resulting in longer arrival times for fire trucks. Additionally, rescue times may also be prolonged due to road conditions. Therefore, maintaining the ability to seek self-rescue is crucial in such situations.

在 BST 的課程模組中，扣除海上求生的模組在陸域用不到之外，高空作業、徒手搬運、緊急救護、火場應變都是相當實用的課程，尤其是機艙的高度都相當高，遇到緊急狀況時，面對各種情境帶來的問題，不論是自救還是協助夥伴急救，都要在分秒之間爭取一線生機。

In the BST course modules, excluding the offshore survival module that is not applicable to onshore situations, Working at Heights, Manual Handling, First Aid, and Fire Awareness are all highly practical courses. Especially considering the height of the nacelles, it requires quick responses to various scenarios during emergencies. It's about not only self-rescue but also assisting colleagues in first aid, because every second counts in securing a lifeline.

### 避免高空作業意外 安全需求擺第一 Safety is the Priority When Working at Heights

由於高空作業距離地面高度動輒幾十公尺，甚至大型風機會破百公尺，人員在移動時就耗費相當多的時間，過程中還要經過多次轉換移動方式，從塔內電梯到爬梯，每一步都需要安全評估。

Due to the significant height of working environment, which can reach tens or even over a hundred meters above the ground, engineers spend a considerable amount of time moving. Throughout the process, they must undergo multiple transitions in their mode of transport, from taking tower elevators to climbing ladders, with each step requiring a safety assessment.

在 BST 的課程精神中，最核心的部分是事先排除可能發生的危害，操作前需先確認自身與夥伴的安全。達德能源工程部資深經理葉明奇說，經過課程的訓練合格後就會知道，在上工前或休息後重新回到工作崗位上之前，都需再確認身上的個人防護設





備 (PPE) 是否安全無虞，是否有鬆脫、磨損或是不能使用的狀況，才能確保接下來的過程中，人員可以確實有安全的輔助支持。

The most crucial aspect in the spirit of the BST course is to anticipate potential hazards beforehand and ensure personal and team safety before commencing operations. wpd Taiwan Energy's Senior Manager of Engineering, Construction and Operation Department, Dean Yeh, stated that after completing the training, all will learn that personnels must reassess the safety of their personal protective equipment (PPE) before starting work or returning to duty after breaks. They need to check for any looseness, damage, or unusable conditions to ensure that they have reliable safety support throughout the subsequent processes.

除了確認 PPE 安全外，個人安全認知也相當重要。吳信賢表示，不管是在風機內外工作，都是離地距離相當遠，若發生墜落就是重大公安意外事件，因此在 BST 的課程中，高空作業首要就是時時刻刻確保安全措施都有兩項以上，課程教師也是課程評估的考官，若學員無法將安全意識烙印在首位，將會無法通過高空訓練。

In addition to ensuring the safety of PPE, personal safety awareness is also paramount. According to Cook, regardless of whether one is working inside or outside the wind turbine, the distance from the ground is considerable, and any fall would become a major safety incident. Therefore, in the BST course, the primary focus of working at heights is to always ensure that there are two or more safety measures in place at all times. The course instructors also serve as assessors, and if trainees fail to prioritize safety awareness, they will not pass the high-altitude training.

吳信賢解釋，格緯旭的講師們與其餘業界不同的地方是，講師本身一定具有從事高空作業的經驗，並有曾經在多個風場工作的實績，對於風場中可能遇到的安全問題是相當熟稔，因此會把常見的問題融入課程當中，並且列為課程必要項目，以期學員們未來離開訓練中心後，都能避免憾事發生。

Cook explained that what sets Greenwish's instructors apart from others in the industry is that they themselves have extensive experience in working at heights and have a proven track record of working in multiple wind farms. They are familiar with the safety issues that may arise in wind farms and

incorporate common problems into the curriculum, making them essential components of the training. This ensures that trainees can avoid accidents after they leave the training center.

不過由於安全不能打折扣，因此過去就有部分學員在訓練中心上課時，考核未通過，需重新訓練。吳信賢表示，在爬梯過程常會用到雙鉤，這就有許多細節要逐一檢視，從每一次操作到最後考核，都需要面面俱到，而不是一味的求快速完成，穩定進行才是支撐安全的必要元素。

As safety is non-negotiable, some trainees in the past did not pass the assessment at the training center and had to undergo retraining. Cook stated that in the process of climbing ladders, double hooks are often used, which requires careful examination of every detail. From each operation to the final assessment, thoroughness is needed rather than seeking quick completion. Stability is the essential element that supports safety.

### 高空作業挑戰多 更容易因氣候影響判斷 Working at Heights Presents Many Challenges; Weather Conditions Can Affect Judgment

風機因為風的吹動讓葉片轉動，但同樣也會造成風機跟著擺動，因此在風機上工作其實跟在船上一樣，很少會有完全安定靜止的時間。吳信賢說，在風機上工作最重要的考量因素就是天氣，惡劣氣候情況下一定不會勉強讓工作人員上工，但在還未抵達停工標準前常常仍要進行作業，因此就相當考驗人員的體力以及做好事先預防作業。

The rotation of turbine's blades is caused by the blowing wind, and the wind also results in swaying of the wind turbines themselves. Therefore, working on a wind turbine is much like working on a ship, where there is rarely a completely stable and static environment. According to Cook, the most crucial factor to consider when working on wind turbines is the weather. In adverse weather conditions, workers will never be forced to work. However, operations often continue even before reaching the criteria to stop working, which puts significant strain on the

physical endurance of engineers and emphasizes the importance of preemptive safety measures.

吳信賢回應，過去就有講師團隊們去彰化線西工作，一早開工就遇到大雨讓塔架濕滑，中午過後更因強風造成風機晃動，在體力消耗上會更快，尤其是在葉片維護、機艙密封防水等繩索垂降，晃動程度是地面上很難想像的。

Cook responded by recounting an event where the instructor team went to work in Xian Si Township, Changhua. Heavy rain in the morning made the tower slippery right before starting to work, and by noon, strong winds caused the turbine to sway. This increased the rate of physical exertion, particularly during tasks like blade maintenance and nacelle sealing which rope descent skill is needed, and the level of swaying is difficult to imagine from the ground.

過去也有進行複訓的學員分享，之前因為在高空吊掛的途中，遭遇強風且一時沒注意到就被工具砸傷並造成頭骨骨裂，在臉上造成明顯的疤痕，且無法透過醫療進行修補，只能自然恢復，這就是現場會出現風速不可控的狀況，學員是以親身體驗來說明一切。

Some trainees who underwent retraining also shared their experiences. One of them recounted an event where they were suspended at height and encountered strong winds. Without noticing, they were hit by a tool, resulting in a fractured skull and visible scars on the face. Unfortunately, medical intervention couldn't fully repair the damage, and they had to rely on natural recovery. This serves as a stark reminder of the uncontrollable nature of wind speeds at the site, as experienced firsthand by the trainees.

### 火場逃生關鍵 1 分鐘 自救也救人 Critical One Minute in Fire Escape: Self-Rescue and Assisting Others

吳信賢分享過去也有外國學員在風機工作中遇上火災的情況，雖然平時遇到機艙失火的機率相當小，但無論是在海上或陸地上，每一秒都是關鍵時刻，因此對於滅火裝置在哪、怎麼使用都會影



響當下的判斷，因此 BST 課程中有規定每兩年就要重新複訓、反覆練習，就是要重新訓練各種安全逃生。

Cook shared that foreign students had encountered fires while working on wind turbines in the past. Although the likelihood of nacelle fires is quite low, every second is crucial whether at sea or on land. Hence, knowing the location and operation of firefighting equipment greatly affects immediate judgment. Consequently, the BST course mandates biennial retraining and repeated drills to ensure proficiency in various safety evacuation procedures.

假設機艙上面發生火災時，該如何逃生？尤其是在機艙內，由於動線可能較不順，且一失足就很容易墜落，但在火場內多待一分鐘就可能吸入過多的濃煙及有害物質，並且後續要如何在機艙尾巴使用緩降機逃生、或是等待直升機救援等，過程中有許多項目平常都不會用到，因此需要每隔一段時間就要進行複習，確保會使用操作。

In the event of a fire in the nacelle, escaping can be challenging, especially due to potentially obstructed pathways and the risk of falling. However, staying inside even for an extra minute could result in inhaling dangerous smoke and toxins. In such scenarios, it's crucial to know how to utilize emergency equipment like descent devices located at the rear of the nacelle or await helicopter rescue. Rehearsing these procedures periodically is essential because many of these actions are rarely used under normal circumstances. This ensures that individuals are familiar with the operations when faced with an emergency.

### 事先預防排除危險 最簡單的知識也最困難做到

#### **Danger Prevention and Mitigation: the Simplest Knowledge Yet the Hardest to Put into Practice**

專業的團隊在進行每一次行動前都會做好風險評估，尤其是高空作業更需充分準備，排除可能發生的問題。吳信賢說，「事先預防」就可以提前改善可能的問題，甚至在安排作業時就要開始聯想可能的高風險因子。

Professional teams conduct thorough risk assessments before every operation, particularly for high-altitude tasks where comprehensive preparation is paramount to mitigate potential issues. Cook emphasized that "prevention in advance" allows for the proactive improvement of potential problems, even prompting consideration of high-risk factors when planning operations.

其實風機的設計，就已經考量工作人員的各種狀況，儘量避免危險發生。在風機塔架當中，爬梯不會一口氣從地面直接到最頂，而是分階段、多平臺的規劃，讓人員移動到一定距離後，就有休息的空間，這是有考量每個人的體力負荷不同，並透過設計讓人不得不休息，從硬體上就有給予限制，確保每個人不會在超過負荷的情況下勉強行動。

In fact, wind turbine design already takes into account various conditions for the workers to minimize the occurrence of hazards. Within the turbine tower, the ladder doesn't ascend directly from the ground to the top in one go. Instead, it's segmented with multiple platforms, providing resting spaces at certain intervals. This planning considers the varying physical capabilities of individuals, incorporating design elements that enforce breaks. By structurally limiting continuous movement, the internal design of a wind turbine ensures that individuals do not push themselves beyond their capacity, thereby reducing the risk of accidents.

隨著科技的進步，風機會逐漸大型化，風機內的設計也有部分調整，因此所有的課程每隔一段時間，GWO 就會重新檢視內容，逐年提升課程的安全性，並與法規同步邁進。

With technological advancements leading to the gradual enlargement of wind turbines, there are corresponding adjustments in the internal design of wind turbines. Consequently, GWO periodically reviews all courses to enhance safety measures, ensuring that course contents remain up-to-date and in sync with evolving regulations.



風光 · 專題



## 淺談漁電共生

### A Discussion on Aquavoltaics

國立嘉義大學水生生物科學系暨研究所 陳哲俊副教授 / 撰稿  
National Chiayi University Associate Professor Chen Che-Chun

#### 國內綠色能源發展需求

#### Domestic Demand for Green Energy Development

我國能源供給 97% 以上仰賴進口（能源署 113 年能源署資源手冊），同時依據國際能源總署 IEA 報告：再生能源 2025 年將取代煤炭，躍居全球最大電力來源，各國政府都在積極推動再生能源。國內因應強化能源自主、減碳議題、綠能發展、RE100，發展綠能勢在必行。現階段國內發展許多綠能產業，其中又以風能及太陽能是最具實質績效的模式。2023 年再生能源發電種類占比，以光電為主（4.58%），其次為風力（2.20%）、慣常水力（1.40%）。在其他綠能產業發展還未成熟前，國內勢必持續推動光電及風電產業。

Over 97% of Taiwan's energy supply relies on imports (Energy Administration, Resource Handbook, 2024). According to the International Energy Agency's (IEA) report, renewable energy is projected to surpass coal as the world's largest source of electricity by 2025, prompting governments worldwide to actively promote renewable energy. Domestically, in response to the need to strengthen energy independence, address carbon reduction issues, and promote green energy development, as well as meet the RE100 target, the development of green energy is imperative. Currently, many green energy industries are being developed domestically, with wind and solar energy being the most effective models. In 2023, the

proportion of renewable energy generation in Taiwan was led by solar energy (4.58%), followed by wind energy (2.20%) and conventional hydroelectric energy (1.40%). Until other green energy industries mature, the promotion of solar and wind energy industries will undoubtedly continue in Taiwan.

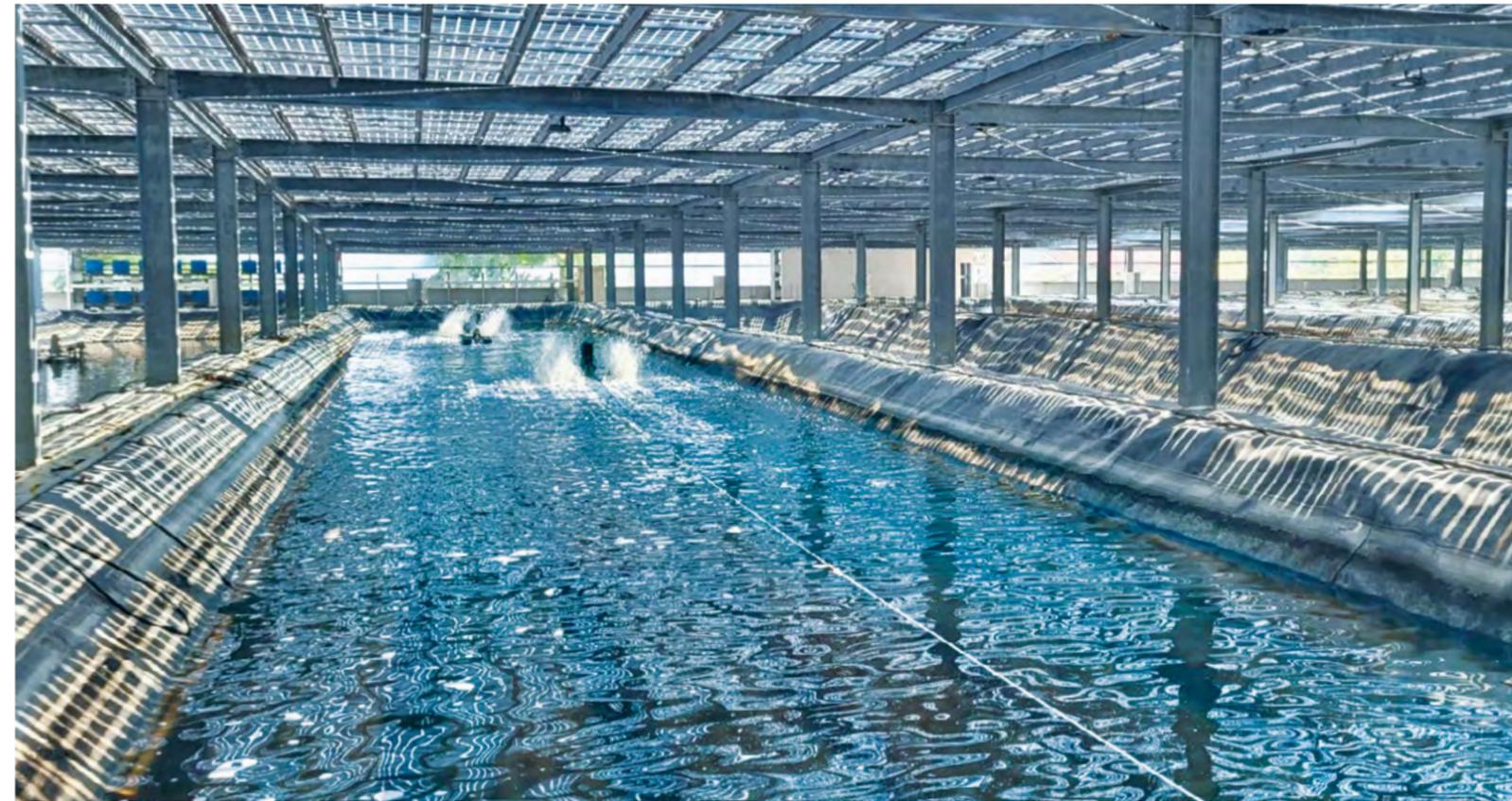
#### 太陽能發電

#### Solar Energy

太陽能板發電量，基本就是以日照面積 X 日照強度 X 能量轉換效益，因此如何取得較高日照面積便是建構電廠的基本要件，國際上能有大量太陽綠電區域，大都擁有廣大低度利用之土地，藉由大面積日照轉換出大量綠能，顯然這樣條件在台灣僅有 3 萬 6 千平方公里的小島，是處於弱勢狀態。

Solar panel power generation is all about the sunlight area multiplied by the intensity of sunlight and the energy conversion efficiency. Therefore, obtaining a larger sunlight area is essential for constructing solar power plants. Internationally, regions with abundant solar energy typically possess vast expanses of underutilized land, allowing for the conversion of sunlight into significant amounts of green energy. However, in Taiwan, with its limited land area of only 36,000 square kilometers, such conditions are relatively scarce, putting the island at a disadvantage in terms of solar power generation.

但台灣地區各行業蓬勃發展中，能源供應相對需求



也不斷提高，在預期 10-20 年內，其他綠色能源供應技術無法達到經濟產業規模，要增加綠能供應，透過提升太陽能產出是趨勢必然走向。

However, as various industries in Taiwan continue to thrive, the demand for energy supply also continues to rise. In 10 to 20 years, it's expected that other green energy technologies may not reach the economic scale, so increasing green energy supply through enhanced solar energy output is an inevitable trend.

台灣地區土地使用劃分中，非都市計畫土地約 78%，其中林業用地占非都市土地約 50%，另約三成作為農漁牧產業使用，這些農漁牧產業區域由於現有農業產業土地利用方式，大都屬於平坦無遮蔽之態樣，是利於建構太陽能發電設施。

In Taiwan, approximately 78% of land is designated as non-urban planning land, with forestry land accounting for about 50% of non-urban land and the remaining 30% allocated for agricultural, aquacultural,

and animal husbandry industries. These agricultural areas typically feature flat and unshaded terrain, making them conducive to the construction of solar power facilities.

如何在對於農業生產與太陽能發電間取得最好效益是個重要課題，農業一地二用是個相當良好方案，但如何順利達成有效之搭配，需要結合眾人智慧來推進。

Finding the optimal balance between agricultural production and solar power generation is an important challenge. Utilizing agricultural land for dual purposes could be a viable solution, but achieving effective integration requires the collective wisdom of all stakeholders.

國內外也有相當多農業區域開發綠能的案例，但由於日照是植物光合作用基礎，因此農作區開發太陽能利用上勢必以低覆蓋模式或利用不利耕作區塊進行鋪設。但在動物生產中畜牧及漁業，主要是以攝食飼料為主，對於日照遮蔽便比較不受此限制。因



此國內畜舍結合太陽能有過快速發展期，但也進入平緩狀態。

Both domestically and internationally, there are numerous cases of agricultural areas being developed for green energy. However, since sunlight is essential for photosynthesis, solar energy utilization in agricultural zones typically involves low coverage or utilizing non-arable areas for installation. In animal husbandry and fisheries, the key concern is more on feeding, and hence there is less restriction on shading caused by solar panels. The integration of solar energy with livestock facilities has experienced rapid development in Taiwan, but it has also entered a plateau phase.

### 漁電共生

#### Aquavoltaics

綜觀國際上對於漁電共生之研究，實際上也有相當資料，但大多集中於監測設備供電、提供產業自行使用為主，大都屬於研究範疇案例，並未涉及提供大眾能源供應概念。國內在養殖漁業與太陽能結合發展過程有相當曲折過程，台灣地區由於內陸養殖面積將近 3 萬多公頃，相對比率明顯高於其他國家地區。同時國內養殖區大都集中於西南沿海區域，具有強日照、長光照優勢，因此推動漁電略顯然與其他國家有相當大差異在。

Internationally, research on the symbiosis of fishery and electricity generation does exist, but it primarily focuses on providing power for monitoring equipment and industry self-use. These studies are mostly limited to research examples and have not delved into the concept of providing energy supply to the public. In Taiwan, the integration of aquaculture with solar energy has undergone a somewhat convoluted process. With an inland aquaculture area of nearly 30,000 hectares which is significantly higher than that of other countries and highly concentrated in the southwestern coastal regions, the advantages of strong sunlight and long daylight are prominent. Therefore, the promotion of aquavoltaics in Taiwan differs significantly from other countries.



由於電力基本上是難以儲存，國內整體產業分布密集，實務上與電力需求端距離較短，因此採取漁電共生規劃上是以匯入公共供電網為主，與國外有些地區在太陽能光電區域遠離使用端，部分採取儲能策略不同，國內推動漁電共生策略，必然是一個全新開創的模式。

Electricity is difficult to store and the industries are densely distributed in Taiwan. Therefore, the grid infrastructure in Taiwan is closer to demand side, which is different to some regions abroad where solar energy generation areas are far from the consumption end, and they adopt storage strategies. Aquavoltaics primarily connect to the public grid; thus, promoting fishery and solar energy symbiosis in Taiwan is inevitably a new and innovative approach.

### 因應不同法規 國內漁電共生有兩種 Two Kinds of Aquavoltaics According to Different Regulations

#### TYPE 1 \

**地面型漁電共生，沿用農業設施條例規範，相關設施不得超過申請土地之 40%**

**Ground-based Aquavoltaics: follows the regulations of agricultural facilities, stipulating that related facilities must not exceed 40% of the applied land.**

鑒於早年推動農電過程中，對於農電規範不夠完善，導致與電場共生的場域，農業生產大都不佳，大眾感覺有廢農的跡象，引起相當反對聲浪，因此在推動漁電中，政府也進行相關試驗，資料顯示對於漁電在 40% 遮蔽下，其產能均能達到農業設施要求之 70% 產能。

Given the imperfect regulations during the early promotion of agrivoltaics, which resulted in poor agricultural production in areas coexisting with solar panel installations, leading to a perception of wasted

farmland and significant opposition, the government has conducted relevant experiments in promoting fishery-solar energy symbiosis. Data shows that with a 40% shading in aquavoltaics, the power generation capacity can meet up to 70% of the requirements for agricultural facilities.

#### TYPE 2 \

**室內養殖場附屬綠能設施，室內養殖場面積不得申請超過土地面積 80%**

**Indoor aquaculture facilities with associated green energy installations: the indoor aquaculture area must not exceed 80% of the land area in the application.**

在室內養殖部分，各國尤其中緯度、高緯度區域，在氣候條件下，早早發展出室內養殖系統，尤其對於種苗、高經濟價值之物種以室內養殖作為主要生產模式，因此對於室內養殖場規劃附屬綠能模式，以提升生產效益是無庸置疑。國外室內養殖場發展中，實際上也會利用屋頂鋪設太陽能設施，同時供應養殖場電力需求。有些國外綠能養殖場案例可以達成 100% 使用綠能，以綠能養殖水產品在市場推廣。

Countries particularly those in the mid-latitudes and high latitudes, indoor aquaculture systems have been developed early on due to climatic conditions. Especially for breeding and species of high economic value, indoor aquaculture is the primary production model. Therefore, it makes sense to plan green energy systems for indoor aquaculture facilities to enhance production efficiency. In the development of indoor aquaculture facilities abroad, solar energy installations are often utilized on rooftops to supply power to the facilities. Some overseas green energy aquaculture facilities can achieve 100% use of green energy, promoting green energy aquaculture products in the market.

在近年發展漁電中還是有一些狀況，本文中將以養殖與光電整合議題為主。

In recent years, there have been some challenges in the development of fishery-solar energy integration, which will be the primary focus of this article.

室外場養殖因應操作習慣建構面積普遍較大，水產養殖場是一封閉水域，堤岸範圍較小，在架設太陽能設施時，如何能盡量降低對於養殖管理之干擾，這是漁電場成敗之基礎。養殖為本，綠能加值，前提便是養殖可以持續，因此在規劃漁電之光電設施中，必然要考量養殖作業之可行性。當然基本上漁電場架入硬體光電設備，不可能完全不改變養殖操作，在規劃中必須磨合互相諒解，尋求雙贏的方案。近期有些案場規劃，加大堤岸以利省工、省力、智慧化機械作業系統導入之規劃，同時因應水資源日益惡化下，建構蓄水、處理水區域，預期將在經營上可以有機會獲得較穩定之生產績效。

Outdoor aquaculture areas generally have larger construction areas due to operational habits. Aquaculture facilities are closed water bodies with limited embankment areas. When installing solar panel facilities, minimizing interference with aquaculture management is crucial for the success of fishery-solar energy integration. The premise of aquavoltaics is to enhance aquaculture sustainability while adding green energy value. Therefore, in planning solar panel facilities for aquavoltaics, the feasibility of aquaculture operations must be considered. While it's impractical for solar panel equipment to be installed without any changes to aquaculture operations, planning should involve compromises and seek win-win solutions. Some recent site plans have increased embankments to facilitate labor-saving and intelligent mechanical operation systems. Additionally, in response to worsening water resources, the construction of water storage and treatment areas is expected to improve operational stability and productivity.

在室內養殖部分，確實有部分種苗、中間育成、畜養作業及部分高經濟價值之物種之養殖場，導入循環水養殖系統，已具有相當成效。但隨著室內場大量建立，必然需要再導入其他類型養殖生物及養殖模式。實務上近年陸地上養殖發展兩個驅動力，一是隨著長期養殖下，北歐國家高度發展的海上箱網養殖疾病、逃逸、環境有機物累積，海上養殖優勢日益下降。二是接近市場區域養殖，由於長途運輸過程之碳排，日益被詬病，如何在消費市場周邊生產在地需求之產品。在上述狀況下，有些新的陸上養殖計畫被提出。

In indoor aquaculture, the introduction of recirculating aquaculture systems (RAS) has proven effective for cultivating certain species, including breeding, middle grow, husbandry, and some of the high-value species. However, with more and more indoor facilities, there is a need to introduce other types of aquaculture organisms and farming models. In recent years, there have been two driving forces behind the development of land-based aquaculture. Firstly, in Nordic countries, the decline in the advantages of offshore cage farming due to disease outbreaks, escape incidents, and the accumulation of organic matter in marine environments has led to a shift towards land-based aquaculture. Secondly, due to the increasing criticism of carbon emissions from long-distance transportation, aquaculture farming needs to be closer to the market and meet the demand on aquacultural products. In response, new land-based aquaculture projects have been proposed.

實際上台灣雖然是具有相當龐大養殖產業，但整體養殖水產品消費可能是一個貿易逆差之狀態，主要是台灣所生產之水產品，大部分屬於室外養殖產

品，整體價位大都屬於中低價位，消費者採購中，中高價位之養殖水產品大部分是進口。同時一般投入門檻較低，許多開發中國家也大力投入水產養殖，這些區域大部分擁有土地、水資源及人力資源優勢，對國內養殖產業形成相當大壓力。

While aquaculture industry is vast in Taiwan, the overall consumption of aquaculture products may be in a trade deficit situation. This is primarily because most of the aquaculture products are produced at outdoor environment in Taiwan with prices generally falling within the mid to low range. As a result, most of the mid to high-priced aquaculture products are imported for consumption. Additionally, the entry barrier of aquaculture is relatively low, prompting many developing countries to heavily invest in it. These regions typically possess advantages in terms of land, water resources, and labor, placing considerable pressure on the domestic aquaculture industry.

台灣地區養殖產業長期發展中，基本是由漁民自主資金開發為主，近年政府也投入一些公共設施之

建設及補助引導業者導入自動化、智能化之資金，但由於國家預算有限，實際上要引導產業更新換代不是很容易。近年來隨著大環境改變、氣候變遷、人口老化、水資源再分配狀況下，養殖產業是需要進行一些調適。在世人了解，養殖是未來重要動物蛋白供給前提下，台灣養殖產業是否有機會藉由與光電結合，進行升級蛻變。在規劃漁電共生場域時，有幾項可以立竿見影之思維導入，或許可以獲得雙贏局面。

In Taiwan, the aquaculture industry has mostly been developed by fishermen using their own funds over the long term. In recent years, the government has also invested in the construction of some public facilities and provided subsidies to guide operators in adopting automation and intelligence. However, due to limited national budget, it's not easy to facilitate industry upgrades and transformations in practice. With recent changes in the broader environment, climate change, aging population demographics, and water resource reallocations, adjustments

are necessary in the aquaculture industry. As generally recognized, aquaculture is a vital source of animal protein supply in the future, so there's speculation whether Taiwan's aquaculture industry has the opportunity to undergo a transformation by integrating with solar energy. When planning aquavoltaics sites, several forward-thinking strategies can be implemented to potentially achieve a win-win situation.

#### 1. 養殖供水、排水體系之優化

Optimize the aquaculture water supply and drainage system.

#### 2. 系統化規畫養殖作業之機械化、自動化作業場域

Systematically plan the mechanization and automation of aquaculture operations.

#### 3. 場域韌性規劃，協助降低氣候變遷中，異常氣候對養殖業的傷害

Implement resilient planning for sites to mitigate the impact of abnormal weather conditions caused by climate change on the aquaculture industry.

#### 4. 協助建構水產品安全衛生生產體系、提升養殖產品價值

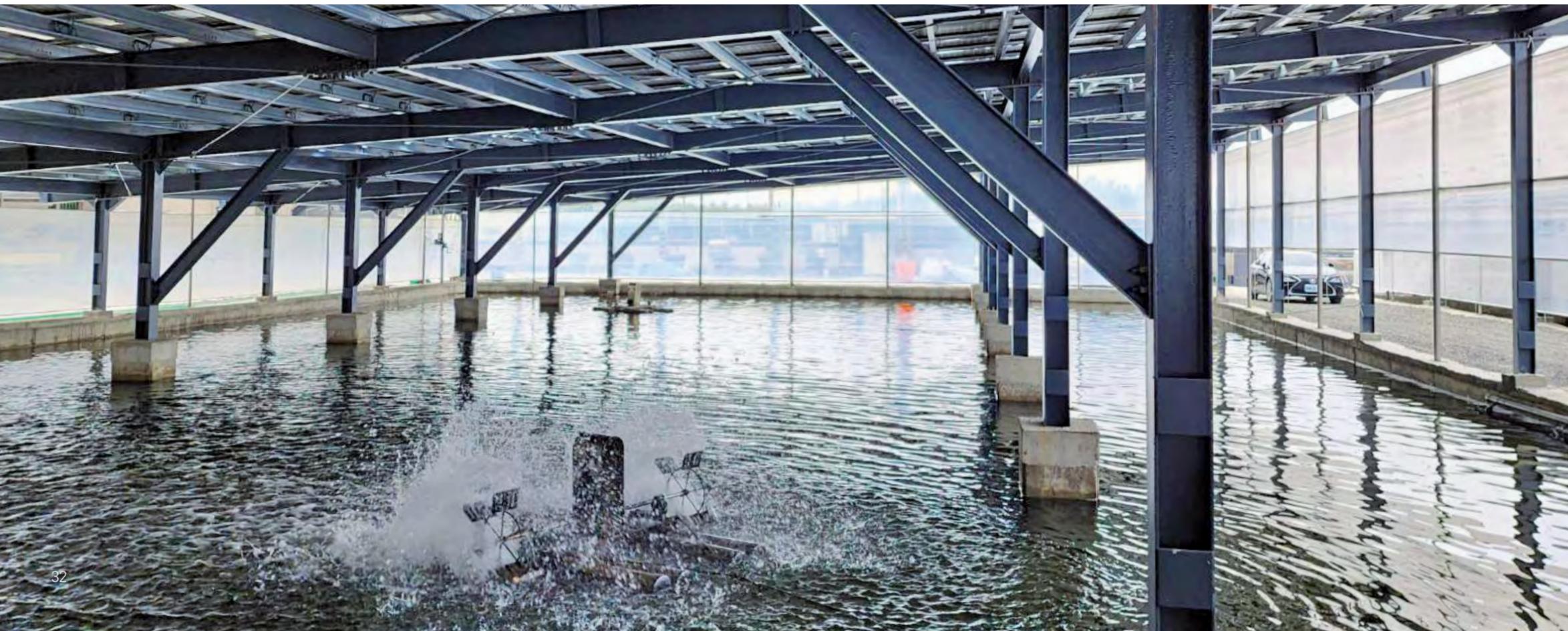
Assist in constructing a safe and hygienic production system for aquatic products to enhance the value of aquaculture products.

#### 5. 建構共同運銷體制，協助業者小量採購劣勢及小農產品銷售弱勢

Establish a cooperative marketing system to help overcome the disadvantages of small-scale procurement by operators and the weak sales of products from small-scale farmers.

最後期待漁電共生體系建立，透過太陽能建設引導資金，提升國內養殖產業升級、現代化，達成養殖永續發展。

Ultimately, we anticipate the establishment of a fishery-solar energy symbiotic system. Through the construction of solar energy facilities and the allocation of funds, we aim to enhance the upgrading and modernization of the domestic aquaculture industry, thereby achieving sustainable development in aquaculture.





點亮 · 在地

## 三月迓媽祖 太陽能手機充電站服務香燈腳

A Welcoming Fit for Mazu in March with  
Solar-Powered Mobile Charging Stations Serving Pilgrims

夏語天 / 撰稿  
Writer/ Xia Yutian

筆者為文字工作者，長期觀察地方文化與社群生態。  
The author is a writer who has long observed local cultures and community dynamics.

「三月迓媽祖」。媽祖信仰是台灣人共同信仰文化之一，3月23日媽祖生，整個農曆3月各地媽祖廟祝壽、出巡遶境與進香等各項慶典，全台信徒狂熱盛況有如「台灣嘉年華會」，展現台灣人對宗教的虔誠，及人與人之間熱情溫暖與純樸無私奉獻的最美風景。

"A Welcoming Fit for Mazu in March." The Mazu belief is a shared cultural faith among the people of Taiwan. Mazu's birthday is on March 23rd, and throughout the lunar month of March, Mazu temples across the island celebrate with various festivities such as celebrations, "tour of inspection", and pilgrimages. The fervent atmosphere among believers resembles a "Taiwanese carnival," showcasing the devoutness of Taiwanese people towards the folk deity. It also highlights the most beautiful scenery of warmth, passion, and selfless dedication between individuals.

今年達德能源有許多員工參與白沙屯媽祖進香、大甲媽祖遶境進香等活動，感受台灣「三月迓媽祖」豐富熱情宗教文化慶典，並出動太陽能手機充電站服務隨香信徒，讓追隨媽祖平安遶境的香燈腳們一路不斷電，也結合宗教文化與環境教育，一起追求淨零永續精神。

In 2024, many employees of wpd Taiwan Energy participated in events such as the Baishatun Mazu Pilgrimage and the Dajia Mazu Pilgrimage, experiencing the rich and passionate religious festivities of "A Welcoming Fit for Mazu in March" in Taiwan. The company provided solar-powered mobile charging stations to serve pilgrims, ensuring that the power supply of devotees following Mazu on her safe journey remained uninterrupted. This initiative not only supported the religious culture but also integrated environmental education, fostering a shared pursuit of cleanliness, sustainability, and perpetual spirit.

媽祖信仰文化，是台灣最重要的宗教文化之一，也是海洋文化的象徵。先民渡過危機四伏的黑水溝（台灣海峽）時媽祖就是他們心靈依靠，拓墾時期更成為庇佑百姓，救苦救難的守護神。媽祖慈悲為懷、庇佑眾生的精神也已內化成傳統台灣母親的形象。每年農曆三月媽祖誕辰之前，各地都會舉行各種慶典，男女老少熱情參與，已成台灣重要文化民俗。

The culture of Mazu faith stand as one of Taiwan's most significant religious and maritime symbols. It is said that when the ancestors braved the perilous



"Black Ditch" (Taiwan Strait), Mazu was their spiritual dependence. During the period of settlement, she became the guardian deity, blessing the people and aiding them in times of distress. The compassionate and protective spirit of Mazu has become ingrained in the image of traditional Taiwanese mothers. Before Mazu's birthday in the lunar month of March, various celebrations are held across the island, attracting enthusiastic participation from people of all ages and genders. These festivities have become an integral part of Taiwan's cultural heritage.

### 太陽能行動充電車 香燈腳一路不斷電 Solar-Power Mobile Charging Station Ensures Continuous Energy Supply for the Pilgrims

在眾多的慶典中，「白沙屯媽祖進香」、「大甲媽祖遶境進香」、「北港朝天宮迎媽祖」均已被文化部指定為「國家重要民俗文化資產」，每項慶典都吸引數十萬人參與，都是深具指標性的慶典活動。

The "Baishatun Mazu Pilgrimage," the "Dajia Mazu Pilgrimage," and the "Beigang Chao-Tian Temple Mazu Pilgrimage" have all been designated as "National Important Folklore Cultural Heritage" by the Ministry of Culture. Each of these celebrations attracts hundreds of thousands of participants and stands as a landmark folklore event.

達德能源每年都會參與各地方媽祖祝壽慶典，融入地方特有的人文風情，理解地方特有的民俗習慣，並以最直接的手機充電服務鄉親。活動過程中沿途民眾準備點心、飲料給香客補充體力，提供休息、沐浴地方給陌生人方便，也展現了人性善良、互信、互助的光明面。

Every year, wpd Taiwan Energy participates in various local Mazu birthday celebrations, not only to integrate into the unique cultural atmosphere of each region, but also to understand and respect the local customs and traditions, and the company provides direct mobile charging services to the locals. Along the way, people would prepare snacks and drinks to replenish the energy of pilgrims, offering rest areas and shower

facilities for strangers, showcasing the bright side of human kindness, trust, and mutual assistance.

這樣的慶典文化也正與達德能源深耕台灣的精神相符，期待透過信任、互助建立良善的溝通與理性的對談，發展乾淨能源，實現永續淨零的企業宗旨與目標。

The spirit of this festival aligns well with the company's commitment to the land of Taiwan, fostering goodwill communication and rational dialogue through trust and mutual assistance. They aspire to develop clean energy and achieve their corporate mission and goal of sustainability and net-zero emissions.

長期關心生態的螃蟹達人涂進興與大甲媽祖結緣近 40 年，每年遶境都擔任志工為媽祖服務，早期從事交通管制，近年來則是幫忙鐵馬隊檢修車輛，從去年起他又新增一項服務，架設行動充電站，用電與信眾結緣。

Ecology enthusiast and crab expert Tu Jin-Hsing has been acquainted and devoted to the Dajia Mazu Pilgrimage for nearly 40 years. Each year, he volunteers to serve Mazu, starting with traffic control in the early days and later assisting in the maintenance of the bike

team. Since last year, he has added another service by setting up mobile charging stations, forging bonds with worshippers through electricity.

達德能源政府暨公共事務部總監李雅貞表示，往年媽祖繞境的季節，公司都用點心攤表達心意。兩年前起開始思考如何讓這個心意兼具服務又更符合我們正在做的事，「所以我提議，達德是帶給大家能源的公司，繞境時一定會有手機充電的需求，我們可以幫大家充電嗎？」接著同仁想到涂大哥有一台專門介紹螃蟹生態的車，是用太陽能發電。接獲需求後涂大哥馬上巧手加裝充電設備。就這樣，螃蟹車變身太陽能手機充電車，在繞境的隊伍中，服務了許多信徒。

Alison Lee, Director of Government and Public Affairs Department at wpd Taiwan Energy, mentioned that in previous years during the Mazu pilgrimage season, the company expressed their goodwill through setting up snack booths. Two years ago, we began contemplating how to present this goodwill in a manner that not only served but also aligned with our ongoing initiatives. She proposed, "Since wpd is a



renewable energy developer, there must be a demand for mobile charging during the pilgrimage. Can we help with charging?" Colleagues then remembered Tu Jin-Hsing had a vehicle dedicated to promoting crab ecology powered by solar energy. Upon receiving the request, Tu Jin-Hsing promptly installed charging equipment onto his vehicle. Thus, the crab vehicle was transformed into a solar-powered mobile charging vehicle, serving many worshippers along the pilgrimage route.

涂進興說，他在達德能源環境教育中心擔任生態解說員，行動教育車內部有電視、電腦等電器，而電力來源就是 200 平方公分太陽能板。過去參加大甲媽祖遶境，發現許多隨香信徒常常找不到電源為手機充電，經過達德的建議，將行動教育車改為行動充電站，用電與信眾結緣，而從去年第一場 20 支手機，到今年大甲媽祖提供近 700 支手機充電，讓民眾不會因為手機電力下降，無法開導航跟隨媽祖，或是與親朋好失聯，獲得好評。

Tu Jin-Hsing said that he serves as an ecological guide at wpd's Environmental Education Center.

The mobile education vehicle is equipped with appliances such as a TV and computer, all powered by a 200-square-centimeter solar panel. During his past participations in the Dajia Mazu Pilgrimage, he noticed that many pilgrims often struggled to find power supplies to charge their phones. Upon wpd Taiwan Energy's suggestion, he transformed the mobile education vehicle into a mobile charging station to connect with worshippers through electricity. From the first event last year, serving 20 phones, to nearly 700 phones charged at this year's Dajia Mazu Pilgrimage, this initiative has received acclaim. It ensures that people won't lose navigation or contact with loved ones due to low phone battery while following Mazu.

涂進興指出，行動充電車的綠電來源是透過上方的太陽能板，經過儲能系統後輸出供使用，讓信徒和遊客在追隨信仰的同時，也能保持通訊連接，不因缺乏電力而中斷，而在手機充電約 30 分鐘的時間，涂進興與工作人員聆聽著信眾分享故事，涂進興也與工作人員分享綠能，並介紹台灣西海岸生態，希望在達德能源的陪伴下，與民眾一起共創永續新未來。

Tu Jin-Hsing pointed out that the source of green electricity for the mobile charging vehicle comes from the solar panels installed above. After passing through an energy storage system, it is outputted for use, allowing worshippers and tourists to maintain communication connections while following their faith. During the approximately 30 minutes when the phone is charging, Tu Jin-Hsing and the wpd Taiwan Energy staffs listen to the worshippers' stories and share information about green energy and the ecology of Taiwan's west coast. It's hoped that wpd Taiwan Energy can continuously accompany the locals to create a sustainable future.

### 首次參與媽祖繞境 以行動支持在地文化特色

#### First Time Participating in the Pilgrimage, Supporting Local Culture Through Practical Action

達德能源土地管理部副理楊子明今年第一次參加大甲媽遶境活動，深刻體會媽祖信仰共善共好的精神。而媽祖慈悲為懷、救苦救難，以及眾人齊心祈福精神與公司理念相同，都是為地球永續善盡一份心力的愛的表達。

Jimmy Yang, Deputy Manager of the Land Management Department at wpd Taiwan Energy, participated in the Dajia Mazu Pilgrimage for the first time this year, deeply experiencing the spirit of Mazu faith in mutual benefit and mutual assistance. The compassionate and benevolent nature of Mazu, along with the collective spirit of prayer and blessing, aligns with the company's ideology of contributing to the sustainability of the Earth, expressing love through dedicated efforts.

一同參與繞境慶典的達德能源安全衛生部經理劉得兆則說，以往他都是透過電視新聞獲得大甲媽遶境的資訊，只留下大甲媽鑿駕經過彰化縣民生地下道時壯觀的場面與搶轎相關訊息；但今年在公司邀請下實際參加繞境，才深刻體會這項慶典文化的魅力，他說「只要有機會，他一定還會參加這項活動。」

Techao Liu, Manager of the Health and Safety Department at wpd Taiwan Energy, who also participated in the pilgrimage, used to rely on television news for information about the Dajia Mazu Pilgrimage but only remembered the grandeur of Mazu's passage

through the Minsheng Underground Road in Changhua County and related information about the palanquin snatching. However, this year, upon the company's invitation, he participated in the procession and deeply appreciated the charm of this cultural celebration. He expressed, "Given the opportunity, he will definitely participate in this event again."

劉得兆說，他等待媽祖鑿轎期間，不停有善心人士分享結緣品，原本陌生的人因此結了善緣，但他也婉拒了許多結緣品，因為他認為資源應該要留給有需要且真正會使用的人，拿了卻沒有使用，不只浪費這份善緣美意，更加重了地球的負擔，所以，他婉拒了結緣品，卻把最美的風景烙印在心中。

During the wait for Mazu palanquin's coming, Techao continuously received sharings from kind-hearted individuals, fostering connections with strangers. However, he politely declined many of these sharings. He believed that resources should be reserved for those in genuine need who would truly utilize them. Accepting items without using them not only wasted the goodwill behind the offerings but also increased the burden of the Earth. Therefore, he declined these offerings, cherishing the most beautiful scenery in his heart.

「每個人都用自己方式，表達對媽祖的熱愛，與感謝媽祖庇佑，彼此都能體會與諒解，甚至主動加入互助行列，充滿感恩的氛圍。」劉先生說出參加繞境最大的收穫。

"Everyone expresses their love and gratitude to Mazu in their own way. They even actively join the ranks of mutual assistance, creating an atmosphere full of gratitude," Mr. Liu expressed as the greatest takeaway from participating in the pilgrimage.

有的民眾準備炮陣期盼媽祖鑿轎駐點，或者等著躡轎底祈福，也有人自備垃圾袋沿路資源回收，清掃沿路垃圾，而達德能源曾葳葳董事長也很榮幸地有機會參與媽祖扛轎的行列，首次扛轎的她感動地說，信眾們以不同形式表達對媽祖文化支持的共同信念，與達德能源以風力發電及太陽光電支持全球再生能源永續發展的精神相呼應。

Some people prepare firecrackers in anticipation of Mazu's palanquin, while others wait to crawl under the palanquin for blessings. There are also those who bring bags for resource recycling and clean up the garbage along the way. Wei Wei Tseng, Chairperson



of wpd Taiwan Energy, was also honored to have the opportunity to participate in carrying Mazu's palanquin. She was deeply moved by the believers expressing their support for Mazu culture in various forms, echoing the spirit of wpd in supporting global renewable energy sustainability through wind and solar power.

不僅如此，達德在沿海社區設立的陸域風機也與沿岸媽祖信仰息息相關，因此達德非常支持這樣的在地特色文化，也期盼能透過實際行動，讓陸域風機上的航障燈與媽祖精神相輔相成，指引沿海人家回家的路。

Moreover, wpd Taiwan Energy's onshore wind turbines in coastal communities are also closely related to coastal Mazu beliefs. Therefore, the company greatly supports such local cultural characteristics and hopes that through practical actions, the navigation lights on the onshore wind turbines can complement the spirit of Mazu, guiding coastal residents on their way home.

媽祖信仰在台灣獨特的自然、人文背景中發展出豐富多元的宗教文化。每年三月媽祖聖誕前，信徒透過繞境、進香、刈火、過爐等宗教儀式，為媽祖婆祝壽；而民眾也藉由各種宗教儀式，考驗毅力，祈求庇佑，達到撫慰心靈，凝聚族群的意義。

The Mazu belief has developed a rich and diverse religious culture from Taiwan's unique natural and cultural background. Before Mazu's birthday in March each year, believers participate in religious rituals such as "Rao-Jing" (Mazu touring the local area), "Jin-Xiang" (Mazu going on a pilgrimage to another temple), "Gua-Hui" (Mazu receiving incense from the main temple), and "Guo-Lu" (Circle a safety talisman around the incense burner for blessing, also means the transfer of ownership of a deity's incense furnace) to celebrate Mazu's birthday. People also use various religious rituals to test their perseverance, seek blessings, and find solace for their souls, thereby fostering a sense of unity within the community.

## 三大慶典特色

Characteristics of the Three Major Pilgrimages



### 大甲媽祖遶境進香

The Dajia Mazu Pilgrimage

「大甲媽祖遶境」是指大甲鎮瀾宮媽祖與信眾以徒步前往新港奉天宮的進香活動，全程約 340 多公里，跨越 4 縣市 21 鄉鎮市，去程駐駕廟宇依序為彰化南瑤宮、西螺福興宮；返程駐駕廟宇依序為西螺福興宮、北斗奠安宮、彰化天后宮、清水朝興宮，歷時 9 天 8 夜。每年參與的信徒約有數十萬人，被視為世界三大宗教活動之一。

The "Dajia Mazu Pilgrimage" refers to the pilgrimage of Mazu and worshippers from Dajia Jenn Lann Temple to Xingang Fengtian Temple. The journey spans approximately 340 kilometers, crossing 4 counties/ cities and 21 townships. During the outbound journey, the pilgrimage stops at Nanyao Temple in Changhua and Fuxing Temple in Xiluo. On the return journey, the pilgrimage stops at Fuxing Temple in Xiluo, Dian'an Temple in Beidou, Lukang Tianhou Temple in Changhua, and Chaohsing Temple in Qingshui, lasting for 9 days and 8 nights. Each year, tens of thousands of worshippers participate in this event, making it one of the world's three major religious activities.

### 北港迓媽祖

The Beigang Yà Mazu

「北港迓媽祖（迓 yà，即迎的意思）」為北港朝天宮的媽祖遶境活動，它是島內分靈最多的媽祖廟。遶境隊伍有陣頭、藝閣、花車，與眾多隨香隊伍，綿延 4、5 公里。其中由小朋友扮仙登上藝閣遊行，沿途灑平安糖，與「炸轎」（又名「吃炮」、「虎爺吃炮」）最為獨特，規模盛大，場面壯觀。

"Beigang Yà Mazu" ("Yà" means welcoming) is the Mazu pilgrimage event of the Chao-Tian Temple in Beigang, Yunlin. It is the temple with the most branch shrines across the Taiwan island. The pilgrimage includes various elements such as "Tín-Thâu" (religious troupes), "Gē- Koh"(performance troupes), "Flower carts" (also a type of performance troupes), and numerous groups of worshippers following Mazu's palanquin, spanning a distance of 4 to 5 kilometers. One unique aspect of the pilgrimage is the participation of children dressed as celestial beings riding on Gē- Koh, sprinkling peace candies along the way. Another distinctive feature is the "Zhà-Jiào" (also known as "eating firecrackers" or "Tiger God eating firecrackers"), which is grand in scale and spectacular in appearance.

### 白沙屯媽祖北港進香

The Baishatun Mazu Pilgrimage to Beigang

苗栗通霄白沙屯媽祖每年信眾以徒步前往北港朝天宮進香，全程約 400 公里，後龍鎮南港地區的「山邊媽祖」在出發前夕前來拱天宮會合，共乘神轎一起到北港進香。

白沙屯媽祖進香全憑媽祖的鑾轎旨意移動，媽祖想去哪就去哪，信徒們跟著媽祖走，有時來個大迴轉或臨時衝進巷弄民宅，一路上充滿驚喜。而由於進香路徑、速度都不是由轎夫決定，有時速度飛快，曾有在 36 小時內徒步走完近 200 公里的記錄，因此有「粉紅超跑」之稱號。

Every year, worshippers from Baishatun Mazu Temple in Tongxiao, Miaoli, embark on a pilgrimage to Beigang Chao-Tian Temple, covering approximately 400 kilometers on foot. Prior to departure, worshippers from the "Shanbian Mazu" in Nangang district from Houlong Township, also come to Gongtian Temple to join them. Together, they ride the divine palanquin to Beigang for the pilgrimage.

The Baishatun Mazu pilgrimage relies entirely on Mazu's divine guidance. Wherever Mazu wishes to go, the palanquin follows, and the worshippers follow Mazu. Sometimes, Mazu may make sudden turns or enter alleyways and residential homes, making the journey full of surprises. As the route and speed of the pilgrimage are not determined by the palanquin bearers, the pace can be quite fast. There have been records of covering nearly 200 kilometers on foot within 36 hours, earning the pilgrimage the nickname "Pink Sports Car."

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