



R&D Policies and Circular Economy

Development of new products and new technologies

CPC implements management activities to maintain customer rights and interests and ensure product safety based on the concepts "full participation, quality improvement, and customer satisfaction," in order to provide products and services of the best quality. In addition to continuous understanding of customer needs, we constantly improve and reduce the defect rate and prevent the occurrence of problems to improve product quality and safety, protect customer rights and interests and enhance customer satisfaction.

Smart & Innovative CPC Projects

"CPC has been conducting R&D in environmental protection, energy saving, circular economy, promoting the commercialization of patents, and presenting the results of research and development in the form of user-friendly products in the hope of integrating with people's lives."

Highlights - Solar Power Technology Development

In 2021, CPC invested NT\$71,240,000 in R&D of solar power technology. By the end of 2022, CPC had more than 230 PV sites throughout Taiwan and the outlying islands. The installation includes gas station rooftops, oil supply centers, refinery and petrochemical plants, and office building rooftops. It is estimated that the installed capacity will reach 15.497 MW by the end of 2021. In addition, in order to comply with the "High Energy User Clause" of the Renewable Energy Development Act, CPC is actively evaluating potential sites for the installation of PV systems, with a total installed capacity of 19.56 MW by 2023. In 2021, CPC generated 10.849 million kWh of renewable energy from solar power stations, mainly for sale to TPC. CPC has obtained 19 renewable energy site certifications and 2,394 renewable energy certificates.

Highlights - Smart & Green e-Stations

In response to the development of electric transportation vehicles and green energy policies, CPC has actively sought to transform its gas station business and promote various carbon reduction initiatives to inject new growth momentum. In 2021, we leased the parking lot of Fulin Station in Taipei City and cooperated with manufacturers to build the first electric vehicle composite charging station of CPC. In 2013, CPC began planning "green building gas stations", using carbon reduction or ecological methods. By 2021, 67 gas stations received the green building label. In addition, since 2019, traditional gas stations had been upgraded and transformed into smart green energy gas stations, which integrated energy creation, storage, and use, and provide electric vehicle charging and switching facilities. By 2021, we completed the installation of four demonstration sites of smart green energy gas stations, each with its own characteristics, fully demonstrating CPC's R&D momentum, and regulating the overall power consumption of gas stations through the energy management system. So far, the equipment of each demonstration site has reached the installation target. Currently, we plan to complete the construction of a smart green energy demonstration site at the Hsinchu Guangming Station by the end of 2022 and continue to promote green energy transformation.

Highlights - High-value Materials

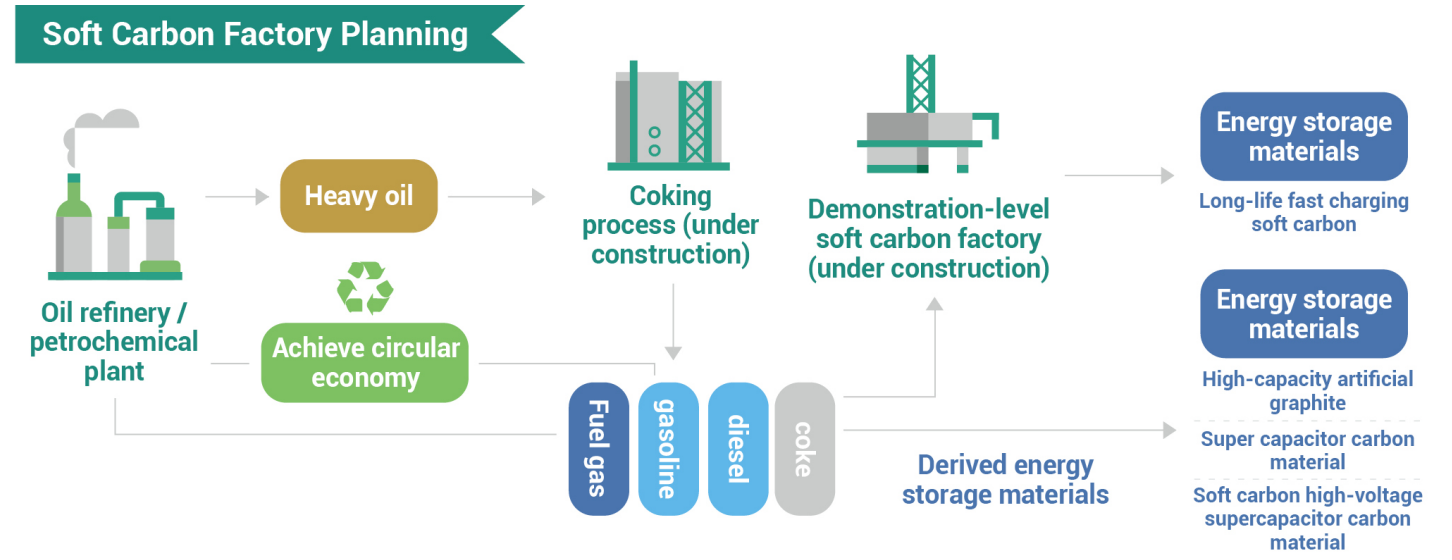
In response to the demand for high frequency, high speed or high-power efficiency in 5G generation, CPC is committed to develop dicyclopentadiene derivatives for application and use the by-products of ethylene production to develop materials with high value and technicality. Currently, CPC has successfully developed two types of high-frequency substrate resin materials and the substrates made in cooperation with manufacturers can be applied to the future high-frequency circuit board material field. The risk of supply chain fluctuation can be avoided if the materials developed by CPC are introduced. This type of research and development is attractive for the sustainable development of the panel industry in Taiwan. Another future star product developed by CPC is the water coating product for vehicles. After four different stages of R&D, such as testing and improvement, the product with good hydrophobicity, high gloss and high weather resistance was successfully developed. The product was tested in real vehicles with good results, and each performance was obviously better than other competitive products. Currently, the product has been actively promoted and sold at gas stations across the country.

Circular CPC

CPC considers waste as resources, which is why the company re-examines existing waste and tries to find new values through Reduce, Reuse, Recycle and Renew strategies. By pursuing a zero-waste goal and ensuring reasonable and effective use of resources, CPC hopes to address the dilemma between economic development and environmental impact.



- High-value Heavy Oil products

In order to actively plan for the commercial production of energy storage materials, CPC applied to the Ministry of Economic Affairs for the establishment of a factory in 2020 and received approval for its establishment. In 2021, CPC actively deployed the basic design and procurement of the leading-edge material precursor and the soft carbon processing plant. The demonstration soft carbon process plant is scheduled to be completed in 2024 and is expected to be in production in 2025.



- Use of LNG Cold Energy


Taiwan lacks natural resources and relies on imported natural gas supply. The international transportation of natural gas across the sea is first compressed into LNG at -162 degrees Celsius to facilitate storage and reduce transportation costs. After being transported to Taiwan by special ships, the LNG is exchanged with seawater for temperature exchange and then provided to the public. The large amount of cold energy released in the process of LNG gasification is a rare energy source that can be utilized. Therefore, CPC has secured this precious resource and utilized it properly in its related business.

Economic benefits 	Cost savings or value creation Total (Unit: NT\$) RDCE 02
Environmental benefits	Reduction in CO ₂ emissions Total (Unit: ton)  RDCE03

<div>Social benefits</div>	<ul style="list-style-type: none">• Reduce the risk of ground subsidence by avoiding groundwater extraction by farmers• Development of a rural area with one characteristic, brighten up the town and rural areas• Assist in government and academic research promotion• Improve the chaotic scene of dense coastal pipelines, beautify the seascape and enhance the quality of tourism
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• Energy and Resource Integration

As the leader of Taiwan's petrochemical energy industries, CPC has regarded the promotion of efficient use of energy resources as its responsibility. CPC has also actively formed energy resource integration links with enterprises in industrial areas, so that raw materials such as steam, hydrogen and other industrial gases can be obtained from other enterprises without the need to purchase or invest in energy resources for production. Thus, it reduces the overall cost and environmental burden of the entire industrial area. At the same time, CPC also further improves and refines the efficiency of energy use in the manufacturing process.



Internal energy and resource sharing

Fuel gas utilization: The emissions from the Dalin Refinery are used as fuel gas for the Linyuan Petrochemical Plant to improve energy efficiency rate.

Process equipment refinement: Renewed pure water treatment equipment, established MBR/RO wastewater purification recovery treatment equipment and condensate recovery and purification plant equipment, etc. The wastewater from Linyuan Petrochemical Plant is recycled to reuse through the wastewater treatment plant.

External energy and resource sharing

Nitrogen integration: Nitrogen is used in the plant for equipment pressurization, sealing, blowing out and other procedures. Other companies provide assistance to achieve the de-commissioning principle, and CPC does not need to purchase or invest in energy resources for production.

Caustic soda integration: Caustic soda is mainly used in refinery processes and acid-alkali neutralization. In the past, it was transported by tanker truck, but it has been partially converted to pipeline transportation, which can reduce the fuel, transportation cost and transportation management risks of tanker truck transportation.

Steam integration: The medium-pressure steam required for the process is integrated with the energy resources of the industrial area, and the steam generated from waste heat is used for mutual benefit and to reduce CO₂ emissions.

Hydrogen integration: The hydrogen by-products of the process can be used by other companies to improve the efficiency of the process.

Power integration: Instead of wasting energy, selling electricity back to TPC through demand bidding when electricity is in shortage.

Highlights - Established Advanced Catalysis Center to Lead the Upgrading and Transformation of Domestic Industries and Create a Circular Economy



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With the global energy-saving and carbon-reduction policies, the production of gasoline and diesel fuel will be reduced in the future. CPC is actively developing in the direction of refining structure upgrade, chemical value addition, and carbon capture and reuse. The “Advanced Catalysis Center” established in 2021 and CPC planned three stages of technological development milestones, including the establishment of basic research and development energy, the establishment of catalyst development and evaluation technology, the verification and mass production of its own catalyst performance, and the completion of the equipment construction plan of catalyst performance evaluation aiming to develop low-temperature denitrification catalysts. CPC invites important domestic and foreign companies to establish clusters in Taiwan in an attempt to reinforce the overall development of the circular industry and achieve the goal of catalyst nationalization. In addition, the Advanced Catalysis Center is positioned as a demonstration base for new generation of smart production, introducing digitalization and AI technology, and build a smart plant environment to realize the goal of "Industry 4.0" in petrochemical industry. The establishment of the Advanced Catalysis Center is a key step in the transformation of CPC. In the future, CPC will play a leading role in the domestic industry to create a circular economy and drive technological innovation and industrial upgrading.

SDGs



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