chapter 2

Carbon Reduction

Clock of Hope

Its hands point to 2050, the pivotal milestone for the world's carbon-neutrality pledge. The Clock of Hope reminds us that, if we act, we can change the future. Every turning-back of its hands marks a change TCC makes for the planet, all to preserve the next generation's right to choose.

Alignment with SDGs

6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

2.1 Low-Carbon Construction Materials

The UNEP "Global Status Report for Buildings and Construction 2025–2026" highlights reducing embodied carbon in materials as key to global net zero. Achieving Paris Agreement goals requires low-carbon innovation, circular resource use, and life cycle management. Fortune Business Insights projects the global green cement market will grow from USD 43.37 billion in 2025 to USD 100.55 billion by 2034 (9.9% CAGR), proving low-carbon materials are a rigid demand in the carbon pricing era. Initiating its transition in 2018, TCC aligned with the SBT, introducing carbon management, developing low-carbon products, and establishing industry standards to deliver eco-economic solutions for urban development and climate resilience.

2018

First cement company to obtain BS 8001 circular economy certification

First batch of low-carbon product certifications in Mailand China

2019

Established carbon footprint label methodology for Taiwan's cement industry and developed Product Category Rules (PCR) for the cement sector

2020

Obtained Taiwan's first product carbon footprint label for cement products

First cement company to adopt Life Cycle Assessment (LCA)

2021

Established AI carbon reduction management platform

Obtained Taiwan's first carbon reduction label for bagged cement

Developed Ultra-High Performance Concrete (UHPC)

2022

Obtained carbon labels for main concrete products

Developed 3D printing cement construction materials

2023

Established UHPC Production Center

2024

Launched Total Climate Portfolio

Developed UHPC construction materials (UHPC KT Board, grass pavers, etc.)

2025

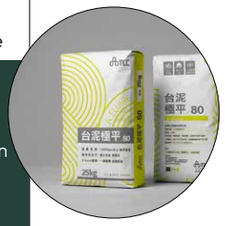
Developed pervious concrete

Portland Limestone (IL) cement obtained Environmental Product Declaration (EPD) verification

TÜRKİYE EPD INTERNATIONAL EPD SYSTEM

2026

Launched "A-Fluire" Mortar



CIMPOR
The Ivory Coast plant launched low-carbon calcined clay cement products

OYAK Cement — Launched low-carbon series

ALFACEM
Türkiye's first CEM VI low-carbon cement; carbon emissions below 350 kg CO_2e/t cement

NOVOCEM
Introduced calcined clay blending, with alternative materials reaching 36–50%; KarBeyaz Low-Carbon White Cement

CIMPOR
New generation composite cement

CIMPOR
Developing Flash Calcination technology for calcined clay

OYAK Cement
SuperWhite+
SuperWhite ProWhite
Duracem

CIMPOR
Cameroon deOHclay integrated cement plant completed

CIMPOR
Launched deOHclay

Ghana plant calcined clay vertical factory commissioned

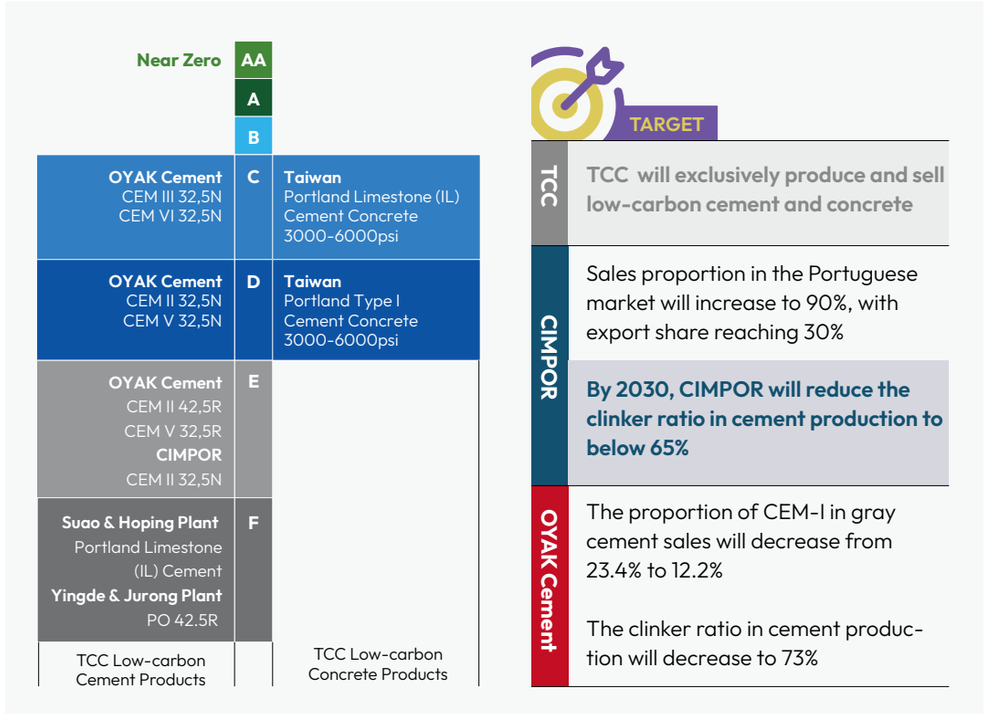
Nearing EPD verification for Portugal plant's RMC & aggregates

Alignment with SDGs

TCC Global Cement Products Enter International GCCA Low-Carbon Rating

In April 2025, the Global Cement and Concrete Association (GCCA) published the world's first Low Carbon Rating (LCR) for cement and concrete. The Company is the only building materials operator in Taiwan whose cement and concrete products both meet GCCA low-carbon standards. The Company's low-carbon products manufactured in Mainland China, Türkiye, Portugal, and West Africa also fully comply with these standards. However, compared to Europe's diverse and flexible low-carbon cement standards—which allow a significant reduction in clinker ratio and the use of up to 80% alternative additives—Taiwan's cement standards mainly inherit traditional American specifications with strict composition limits, forcing clinker ratios to remain high and severely restricting the proportion of supplementary cementitious materials. Under an environment so heavily constrained by outdated regulations, even though the cement produced by the Company in Taiwan is the only domestic product to meet the GCCA Low Carbon Rating, it can only achieve the most basic F level of this international standard.

Global Cement and Concrete Association LCR standards



ACTION SPOTLIGHT

Taiwan's First Dual EPD Certification for Cement & Concrete: Environmental Information Transparency on Par with Europe

In December 2025, the Portland Limestone (IL) cement produced by the Hoping Plant and Suao Plant, and the Portland Limestone (IL) cement concrete produced by the Taipei Plant, officially obtained Environmental Product Declaration (EPD) certification. This provides clients with the most complete and credible environmental data, serving as a reliable basis for green building calculations.

In the past, the industry mostly focused on ISO 14067 carbon footprint verification under government regulations. However, as international supply chain requirements become increasingly stringent, carbon data is no longer sufficient to reflect the true ecological impact of products. In operational management, the Company consistently insists on self-regulation with uniform high standards for cement produced globally. Our overseas subsidiaries, CIMPOR and OYAK Cement, have been progressively obtaining EPD certifications for their Cement and Environmental Protection Business products since 2023, the Taiwan plants also quickly completed the certification, covering multiple environmental indicators such as water resource usage and waste treatment. The main cement products in Mainland China are also currently introducing this, localizing Europe's leading environmental data governance experience. For more information, please refer to the TCC Sustainable E-Newsletter.

Environmental Product Declaration(EPD)

The EPD (Environmental Product Declaration) is the environmental ID card of a product, emphasizing multi- dimensional disclosure. Different industries have different lists of topics of concern. It conducts scientifically rigorous quantification based on the ISO 14025 standard, must pass the Life Cycle Assessment (LCA), and be verified by a third party to honestly disclose the energy consumption and carbon emissions of the product from raw materials and manufacturing to transportation.

Companies can also select suitable items for quantification based on their own stakeholder engagement purposes. The wave of data transparency has long become a common international language. The iMasons Climate Accord, formed by global tech giants such as Google, Microsoft, and Amazon, strongly requires its data center supply chain to provide EPDs.

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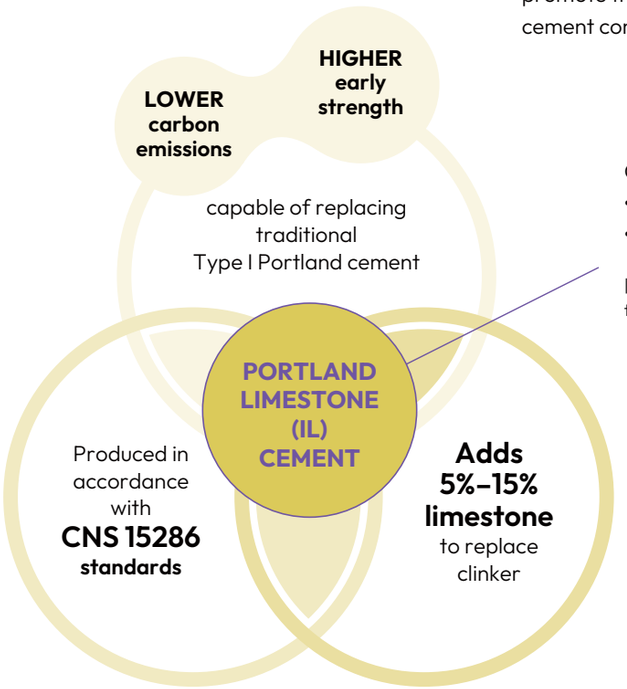
Climate Resilience Products: Total Climate Portfolio

Total Climate Portfolio

The Company is firmly committed to the strength and safety of its low-carbon products. In 2023, it developed an innovative lower-carbon green formula and launched the Total Climate Portfolio. The inaugural release, Portland Limestone (IL) Cement, targets corporate facilities and leading construction and development companies with carbon reduction concepts, partnering with clients to embrace the carbon pricing era and guiding the construction market to establish sustainability awareness.

Given initial concerns from Taiwanese ready-mixed concrete operators during the introduction phase, the Company, the Taiwan Construction Research Institute, and the Taiwan Concrete Institute jointly compiled the Portland Limestone Cement Concrete User Manual. This manual provides specific guidelines for project authorities, design and construction units, the construction industry, and ready-mixed concrete operators. It covers limestone cement characteristics, application benefits, mix design, construction precautions, and quality management to ensure engineering quality and promote the correct use of Portland Limestone cement concrete.



Compared to traditional cement
- **Cement Carbon Reduction: 24.6%**
- **Concrete Carbon Reduction: >50%**

| Baseline: Low Carbon Assessment Standard of the Ministry of the Interior, Taiwan

Ultra-High Performance Concrete (UHPC)
UHPC is a novel concrete developed in recent decades. Its discontinuous pore structure effectively inhibits harmful substances like chlorides, offering higher mechanical properties and durability than traditional concrete. With a century-long life cycle and lower material consumption, replacing traditional reinforced concrete with UHPC reduces component thickness, material usage, and carbon emissions.

Its high plasticity breaks through traditional designs, making it irreplaceable in high-specification scenarios like the Louvre Abu Dhabi. TCC targets heavy industrial fields, launching UHPC KT Board (Precast K-Truss Floor Slab), grass pavers, and paving bricks. Unrestrict-ed by precast methods, the Company developed formulas for cast-in-place engineering and integrated 3D printing technology to expand market applications.

Reduces building wall thickness
-75%

Extends building life cycle
~120 years

Carbon reduction of
60%
compared to conventional concrete

Cast-in-place type:
Overcomes pumping distance limits, suitable for the on-site construction phase of new structures

Spray/trowel type:
Thin-layer reinforcement increases the compressive strength of existing structures by over 30%, extending building service life

Precast type:
Replaces traditional cast-in-place construction with the precast method, reducing construction time by 50% while maintaining structural strength

3D printing type:
Responds to construction labor shortages and is applied to the EnergyArk® energy storage cabinet casing process, **reducing carbon by 50%** compared to metal energy storage cabinets (Please refer to CH 3.1)

ACTION SPOTLIGHT

Next-Generation Innovative Construction Materials

X-Clinker
CIMPOR collaborated with Instituto Superior Técnico (IST) in Lisbon to develop a new hydraulic material, X-Clinker, which has been patented in the US, Europe, and Bra-zil. Through a fully electrified process, industrial by-products and C&D waste can be completely melted and used as raw materials, practicing the circular economy. Coupled with renewable energy, the process reduces carbon emissions, achieving a carbon footprint of only 350 kgCO_2e/metric tons, significantly lower than traditional clinker, making it a highly potential low-carbon alternative. CIMPOR will continue to expand production, targeting an industrial scale of 300-400 metric tons/day. Furthermore, CIMPOR initiated a three-year collaboration with the CSIC/Eduardo Torroja Institute for Construction Science (IETcc) in 2024 to promote X-Clinker in obtaining the European Technical Assessment (ETA) to enter the EU market.

Biochar
TCC develops biochar, combining its carbon sequestration potential to complete the last mile of the net zero pathway. Trials by the Company show that replacing 10%-20% of cement with biochar can increase the compressive strength of concrete. When the replacement ratio reaches 20%, carbon emissions can be reduced by 63.2% without compromising strength. Increasing the replacement rate to 35% can even achieve a carbon-negative effect. TCC will continue to develop biochar applications, such as 3D printing building materials and coral restoration bricks.

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Development of Low-Carbon Technology and Methods

Alternative Clinkers

Natural Pozzolan

Cape Verde in Africa has abundant pozzolan resources. Using pozzolan in CEM II 42.5 cement can approach zero carbon emissions per metric tons of pozzolan, directly replacing traditional clinker, which emits 750-800 kg of carbon per metric tons.

Steel Mill Slag Reuse

The Aslan Plant in Türkiye operates a slag grinding facility with an annual capacity of 360,000 metric tons. Through grinding, separation, and filtration technologies, granulated blast furnace slag generated during steel production is processed into Supple-mentary Cementitious Materials (SCM), replacing up to 95% of traditional clinker.

Recycled Concrete Waste

CIMPOR uses high-efficiency separation technology to reprocess recycled concrete waste into recycled concrete powder. The new cement formulas CEM II/A-F and CEM II/B-F can use up to 35% recycled concrete powder to replace clinker, recycling concrete waste. For more information, please refer to Pillar III.

Controlled Carbonation

CIMPOR's Central Laboratory is researching controlled carbonation (recarbonation) technology and expects to develop proprietary equipment for recycled concrete. Through this technology, carbon dioxide from cement kiln exhaust gas can be directly reused in the future without a pre-carbon capture process, producing sup-plementary cementitious materials (SCM) that can permanently sequester carbon. It is estimated that each metric ton of SCM can sequester over 100 kg of carbon dioxide, further reducing the product carbon footprint.

ACTION SPOTLIGHT

Global Innovation Base

CIMPOR Central Laboratory and future R&D center — Portugal

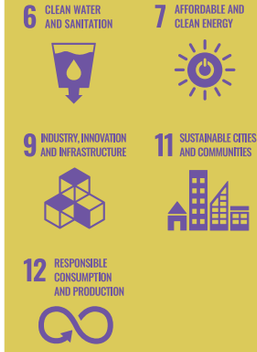
The CIMPOR Central Laboratory and R&D Center, located at Alhandra cement plant, handles product analysis, new material development, and technical optimization, holding NP EN ISO/IEC 17025 and NP EN ISO 9001 certifications with over 200 testing capabilities.

In 2025, it was decided to expand its research capacity by investing €155 million in a new R&D center. Scheduled to open in 2027 as a "Living Lab," the center will focus on decarbonization technologies for the cement industry like novel low-clinker cement, novel SCM, carbon capture, alternative fuels and raw materials, recycling of construction and demolition materials, circular concrete, AI-driven digital manufacturing, 3D mortars and concrete printing, and much other research streams, while supporting pilot-scale trials to accelerate green innovation. It is expected to create over 100 professional jobs alongside training programs, hosting workshops, seminars, and tours to unite em-ployees, academia, and startups as an open platform for sustainable construction technology.

Low-Carbon Construction Materials R&D Center — Taiwan

Equipped with a TAF-certified cement, civil, and public engineering materials laboratory, it is the only R&D center in Taiwan to obtain dual certifications for the cement and concrete TAF certification. It is responsible for analyzing the properties of constituent materials in cement and con-crete, controlling product quality, and expanding product verification capacity, such as "CNS 15286 hydraulic blended cement" testing. Meanwhile, the Low-Carbon Con-struction Materials R&D Center also continuously invests in developing new low-carbon materials, technologies, and products, such as 3D printing materials.

Alignment with SDGs



Product Performance AI Prediction

CIMPOR has deployed the Alcemy Predictive AI system across its Portuguese cement and concrete plants, combining machine learning with sensor data to transform traditional post-production testing into proactive quality control. Please refer to Pillar IV R&D Integration.

Alcemy Cement Module

Alhandra and Aslan plants

The Company integrates existing analyzers and automatic sampling systems to upgrade quality control and processes through AI prediction.

This accelerates the introduction of supplementary cementitious materials (SCM), such as calcined clay and granulated blast furnace slag, to promote the development and production of low-carbon products.

- **AI-Driven Prediction of Early and 28-Day Strength**: By integrating multidimensional physicochemical data analysis—including X-ray Diffraction (XRD), X-ray Fluorescence (XRF), Particle Size Analysis (PSA), Loss on Ignition (LOI), and fineness—the system introduces AI predictive models to calculate early and 28-day compressive strength in real time. This breaks through the limitations of traditional 28-day lagged testing, enabling plants to adjust proportions ahead of schedule and shifting from passive inspection to proactive control.
- **Reducing Quality Fluctuations, Enhancing Energy Efficiency, and Reducing Carbon Emissions**: Through a closed-loop quality optimization system, AI dynamically ad-justs grinding parameters in real time without manual settings. This improves product consistency and performance, reduces quality fluctuations, and enhances process stability, thereby increasing energy efficiency and lowering the clinker incorporation factor in cement.
- **Future Development Direction**: Track and quantify clinker blending effective-ness to achieve fully automated AI-driven proportioning.

Pilot Results:
Evaluated the performance difference between "applying AI recommen-dations" and "traditional operator settings." Results show that adopting AI recom-mendations significantly improves cement quality and processes.

Testing Alcemy Concrete Module

Kurtköy, İzmit, Alhandra, and Loulé plants

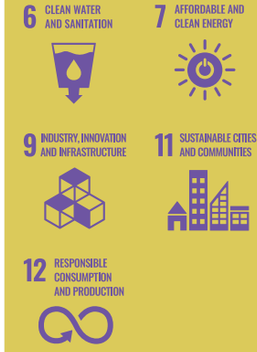
Extending digital quality control from plant to jobsite via AI-predicted fresh concrete properties. Deployed across multiple sites to enhance model adaptability under varying production and field conditions.

- **Predicting Fresh Concrete Properties**: Integrates plant data (mixer power curves, temperature, moisture, density) and transit mixer telemetry (drum hydraulic pressure, speed, water additions) with jobsite perfor-mance. This creates a data pipeline (Plant & Transit Data-> AI Prediction -> Jobsite Performance) to forecast slump, early strength, and overall performance.
- **Information Sharing**: Streams real-time concrete status during transit to plant operators and enables jobsite personnel to view data via QR codes, boosting collaborative QC efficiency.
- **Future Development Directions**: Improve the early quality warning sys-tem to proactively identify potential quality gaps, enhance slump predic-tion accuracy, and add strength prediction functions, expanding the appli-cation scope to hardened concrete.

Driving Low-Carbon Product Development and Strengthening Sustainable Design Theory and Practice

The Company trained R&D and technological innovation units on low-carbon design theories and technological developments. In March 2026, experts from the Industrial Technology Research Institute (ITRI), Environmental Technology, UL, and Bureau Veritas (BV) held in-person training on "Environmental Product Declaration (EPD) Trends and Applications," analyzing ISO 14040/14025, EU EN 15804 standards, Digital Product Passport (DPP), and product development trends. Through Life Cycle As-sessment (LCA) practices, the R&D team was guided to introduce sustainable design principles from the source, quantify product environmental impacts, and strength-en sustainable R&D of low-carbon construction materials and green energy products, with 72 participants.

Alignment with SDGs



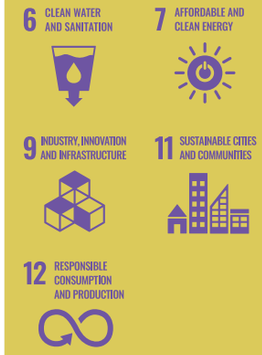
Industry-Government-Academia Engagement and Communication

TCC formulates its “Climate-related Public Participation and Management Policy”, actively engaging with authorities, academia, and professional institutions. The Company joins discussions on net-zero transition and industrial technology to help build a comprehensive, feasible regulatory system. TCC also drives global industrial and academic advancement through paper publications, technical forums, and transnational exchanges. By linking industry practices with policy goals, TCC expects to promote knowledge sharing, thereby driving construction carbon reduction and accelerating the cement industry's green transition.

2025 Industry-Government-Academia Engagement Status

Engaged Units	Industry-Government-Academia Engagement Focuses
Ministry of Environment, Climate Change Administration (Ministry of Environment), Office of Trade Negotiations of the Executive Yuan, and scholars in relevant fields	Discussed planning the product carbon emissions pilot reporting system for the Taiwan Carbon Border Adjustment Mechanism (Taiwan CBAM). Topics included categories of imported cement products to be reported, providing data for the MOE to set default values, and evaluating the planned control principles and screening methods. The discussions also emphasized that carbon emission calculation boundaries for imported and domestic cement products must be consistent. Through this engagement, the promotion of Taiwan CBAM was formally announced at the presidential level during the 4th National Climate Change Committee meeting.
Ministry of Finance	The anti-dumping duties and provisional anti-dumping duties imposed on imported Portland cement and its clinker produced in Vietnam have been implemented since July 2025.
Ministry of Economic Affairs, Ministry of Environment	Discussed the draft of the Manufacturing Sector Decarbonization Flagship Action Plan, proposing to include policies that create market demand for low-carbon construction materials, including the procurement of low-carbon construction materials for public works, revision of public works construction outline specifications, and linking the commodity tax system with climate policies.
Bureau of Standards, Metrology and Inspection, MOEA	Conducted seminars on low-carbon cement and CCU measurement and verification technologies; deliberated on chloride ion concentration in cement to align with international standards, facilitating the Bureau of Standards, Metrology and Inspection (BSMI) to announce the latest CNS61 standard on 2025/12/19, which revised the chloride ion limit for Type I Portland cement and Type IA cement from 240 ppm to 350 ppm.
Ministry of Environment	Discussed the draft amendment to air pollutant emission standards for the cement industry; reviewed and amended the specifications and standards for cement environmental protection labels; formulated Product Category Rules (PCR) for fiber cement, fiber concrete, and gypsum building material products for the industry to calculate carbon footprints; participated in the design of Taiwan's cap-and-trade emission trading system (ETS).
ATIC — Associação Técnica da Indústria de Cimento, University of Évora, European Cement Research Academy (ECRA), and VDZ	CIMPOR launched, within ATIC, the PT Carbon Link aiming at doing research, discussing carbon reduction measures and technologies in the cement industry with the government, academia, and research institutions, and promoting the establishment of relevant regulations and laws for deploying CCUS technologies and supporting the cement industry in achieving the 2045/2050 climate neutrality targets.
Ordem dos Engenheiros — Região Sul and Startup Lisboa, Quadrante	CIMPOR supported the creation of the Engineers Hub in Lisbon, Portugal, connecting engineers, industries, and academic research institutions to promote the exchange and development of low-carbon construction materials, AI, 3D printing, and circular economy technologies, strengthening innovation and sustainable development in the engineering and construction industries in Portugal.
Taiwan Carbon Solution Exchange (TCX)	Participated in the "Parallel Net Zero and Growth: Strengthening Market Mechanisms in Carbon Pricing" seminar, calling for the dual transformation of industry and systems; urged the government to propose policies to create market demand for low-carbon construction materials, including the procurement of low-carbon construction materials for public works, transitioning public works construction outline specifications from formulation-oriented to performance-oriented, and linking the commodity tax system with climate policies.
Taiwan Green Productivity Foundation	Discussed refinement strategies for the net zero emissions pathway of the cement industry.

Alignment with SDGs



2025 Academic Publications

Journals	Publication Highlights
GCCA 2025 Net Zero Progress Report	**Aligning with GCCA Net Zero Initiative: TCC and CIMPOR Dual-Track Drive for the Cement Industry's Net Zero Future** In response to the GCCA's stance on carbon pricing and preventing carbon leakage, the Company assisted in drafting the Taiwan CBAM, facilitating mandatory carbon emissions reporting for imported cement by 2026. The Company also co-planned the pilot carbon trading market (ETS) for 2026 and advocated for including low-carbon procurement in public construction projects within the National Greenhouse Gas Reduction Action Plan. Furthermore, the Company established the Low-Carbon Construction Pioneers Alliance to drive green transition in the construction industry. CIMPOR responded to GCCA's decarbonization pathway by actively developing calcined clay technology and launching low-carbon products. In addition to the successful operation of the Côte d'Ivoire Plant, large-scale production lines were expanded in Cameroon, Ghana, and Portugal.
Concrete Technology Journal Vol. 19 No. 1	**Prospects and Challenges of Limestone Calcined Clay Cement (LC3)** CIMPOR leads the world in developing limestone calcined clay cement (limestone calcined clay cement, LC3) technology, reducing the clinker ratio to 50% and integrating local resources. While ensuring product mechanical performance, it achieves a carbon reduction benefit of 40%, becoming a benchmark solution for low-carbon construction materials to address climate change.
2025 Taiwan Concrete Institute Annual Meeting and Concrete Engineering Conference	**Durability of Portland Limestone Cement (IL) in Sulfate Environments: A Study on the Effect of Fine Ground Limestone Powder Content** Research confirms that the Company's Type IL cement, while reducing the product carbon footprint, maintains building structural safety and durability in extreme environments, overcoming concerns about the application of low-carbon construction materials.
	Multi-Source Waste Glass Recycling for Highly Reactive Pozzolanic Materials The Company successfully converted multi-source waste glass into highly reactive pozzolanic materials, implementing resource recycling and addressing decarbonization challenges in cement production lines.
Concrete Technology	**Renewable Resource Recycling Center (RRRC): UHPC Creates Low-Carbon Buildings** UHPC building application example: TCC used self-developed UHPC to construct the exterior curtain wall of the RRRC, providing wind and water resistance. Leveraging the properties of UHPC, the exterior wall thickness is reduced to only 2.5–3.5 cm, significantly lowering the steel structure weight required and extending the service life of the UHPC concrete to 120 years.

Alignment with SDGs

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2.2 Resource Recycling—City Mining

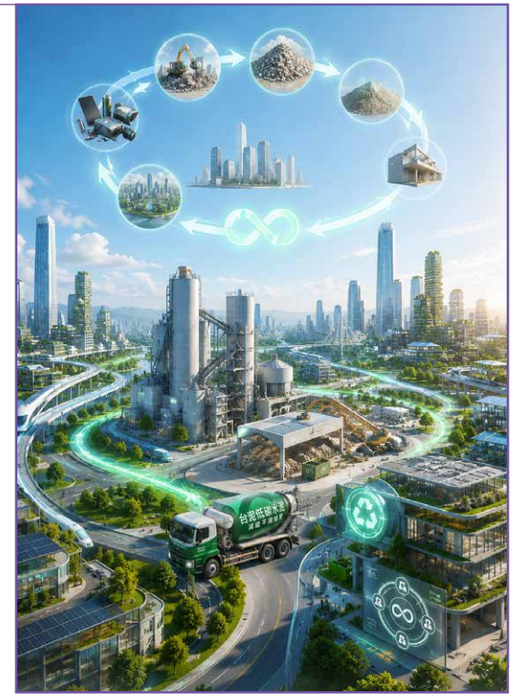
"There is no absolute waste, only misplaced resources." Domestic waste, construction and demolition waste, and industrial waste become new resources through high- temperature cement kiln co-processing. Thus, the cement industry is known as an "urban purifier."

The cement kiln's 1,450°C core renders waste harmless without generating any waste requiring secondary treatment. A World Business Council for Sustainable Development (WBCSD) report indicates that cement kilns' high temperatures decompose dioxins that incinerators cannot process. Thus, cement kiln co-processing is a circular economy venous industry, rendering waste harmless and recycling it as resources. After high-temperature decomposition, waste converts into alternative raw materials or alternative fuels for cement, reducing reliance on natural resources and fossil fuels.

TCC and enterprises, local governments jointly create a circular symbiosis sphere, continuously assisting in processing difficult-to-dispose industrial waste and domestic waste; TCC also collaborates with construction companies to return demolished construction and demolition waste (C&D waste) to TCC for screening and reuse as alternative raw materials and fuels, remanufacturing them into low-carbon cement or concrete. This is not just a method for processing waste, but also a way towards future resource sustainability; in an era of increasingly scarce resources, the cement kiln is no longer just a production facility, but a key to resource circular regeneration.

What Is City Mining

Future cities will no longer be viewed merely as resource consumption sites but as important "urban mines." Metals and raw materials are extracted by recycling waste, demolished construction materials, waste batteries, and electronics. Compared to traditional natural resource extraction, City Mining re-extracts metals, minerals, and materials through recycling, reuse, and circular technologies. This not only reduces primary resource consumption but also reduces carbon emissions and waste generation, serving as a key resource for the circular economy and low-carbon transition.



Cement Kiln Co-processing Technology 5 Characteristics of Circular Economy

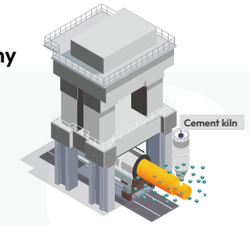
1 **Resource Reuse**

The high-temperature process of cement kilns is utilized to convert thermal energy, minerals, and usable components in waste into alternative fuels and raw materials.

2

Diverse Waste Treatment

TCC co-processes city wastes, sludge, scrap tires, waste oil, waste solvents, and waste generated by high-tech and semiconductor industries, among others.



3 **High-Temperature Complete Decomposition**

The 3T (high temperature, high turbulence, and long retention time) characteristics of cement kilns are utilized to completely decompose organic matter and harmful components in a high-temperature environment of approximately 1,450°C.

4 **Zero Secondary Pollution**

Heavy metals and inorganic substances are solidified within the clinker structure, reducing the risk of secondary pollution.

5

Composite System Application

Existing cement industry facilities are utilized without requiring significant new investments or land use.

TCC Circular Economy Model

RESOURCE CIRCULATION

Alternative Raw Materials

Industrial Waste

⊕ Semiconductor Industry | Electronic Packaging Industry
⊕ Power Plants | Incineration Plants
⊕ Water Purification Plants | Optoelectronics Plants
Steel Mills | Paper Mills

Construction Waste

Recycling and Crushing of Concrete Construction Waste

⊕ Public Works Construction
⊕ Green Buildings
⊕ Urban Renewal

Waste Heat Power Generation

Cement Production

Building Materials Production

Construction Public Works Building

ENERGY CIRCULATION

Alternative Fuels

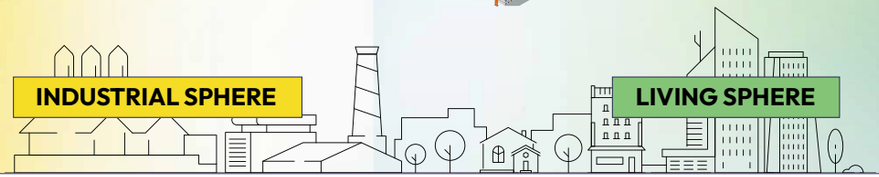
Agricultural and Forestry Surplus Materials / Biomass Fuels

⊕ Leucaena (White Leadtree)
⊕ Rice Husks / Rice Straw / Stalks
⊕ Waste Wood / Roadside Tree Pruned Branches
⊕ Waste Albizia
⊕ Waste Cooking Oil

Solid Recovered Fuel from Urban Waste (SRF)

Household Waste

⊕ Old Clothes / Waste Textiles
⊕ Tetra Pak / Bento Boxes (Meal Boxes)
⊕ Waste Paper / Waste Plastics
⊕ Tires / Rubber Sheets



Urban Mining Sustainability Benefit Dashboard

ECONOMIC	Reduce raw material and fuel procurement costs, and lower the risk of carbon fees.
ENVIRONMENTAL	Reduce the use of natural resources and lower greenhouse gas emissions.
SOCIAL	Improve the quality of the living environment and create job opportunities.

Alignment with SDGs

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Alternative Raw Materials and Fuels

Key Carbon Reduction Strategies

The GCCA points out that using alternative raw materials and fuels is a cornerstone for the cement industry's transition and the most effective carbon reduction method in the cement manufacturing process.

TCC's Cement and Environmental Protection Business actively invests in the development and application of various alternative materials. Considering the geographical characteristics, industrial, and regulatory structures of plant locations, TCC collaborates with local governments and enterprises to obtain stable material sources for testing.

To align with international carbon reduction trends, TCC continuously participates in government policy and industry seminars. In Taiwan, production must comply with CNS 61 Standard, where the chloride ion concentration standard is the threshold for using alternative materials. Following long-term engagement, in 2025, the Bureau of Standards, Metrology and Inspection (BSMI), Ministry of Economic Affairs updated the standard to adjust this limit from 240 ppm to 350 ppm, though a wide gap remains compared to EU regulations.

Scope 1

Carbon Reduction Strategy — Alternative Raw Materials and Fuels

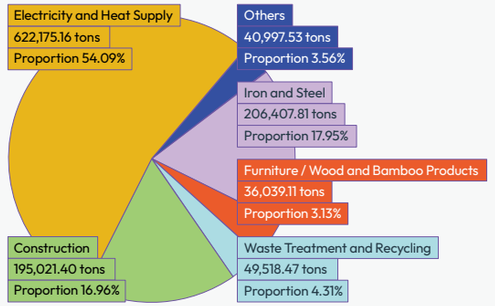
Industrial by-products such as calcium fluoride sludge from the semiconductor industry, reduction slag from the steel industry, and desulfurization gypsum and fly ash from the power industry are rich in silicon, aluminum, iron, and calcium — the four key elements of cement — and can be used as alternative raw materials.

Recycled resources such as waste wood, wood chips, waste plastics, and solid recovered fuel (SRF) serve as alternative fuels. After passing through the cement kiln precalciner and rotary kiln system, alternative raw materials undergo high-temperature calcination and mineralization/clinkering reactions together with other raw materials.

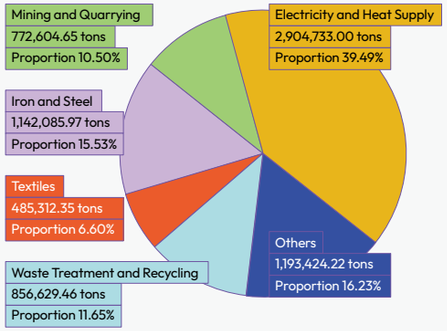
This integrates them into the clinker manufacturing process, further reducing the use of nature resources. Meanwhile, alternative fuels serve to reduce the consumption of traditional coal.

Sources of Waste Treatment at Global Plants

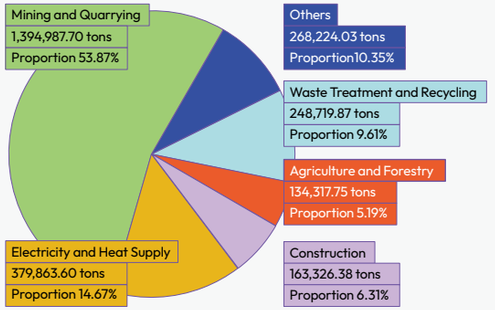
Taiwan



Mainland China



Europe & Africa



Note 1: For detailed information on the recycling of alternative raw materials and fuels in cement production, please refer to CH 7.1. The concrete manufacturing process uses slag and fly ash as alternative raw materials to reduce cement usage. The Cameroon gypsum plant was not commissioned during 2025. In addition, TCC does not produce or sell asphalt.

TCC KEY FACTS

Total Industrial Waste Treated

11,094,388.45 tons

| Cement and Environmental Protection Business

Taiwan	1,150,159.48 tons
Mainland China	7,354,789.65 tons
Overseas	2,589,439.33 tons

Alignment with SDGs

6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Development of Alternative Raw Materials and Fuels

Due to variations in the properties and compositions of different alternative raw materials and fuels, extensive testing is required to ensure their stable utilization. TCC conducts feasibility assessments for alternative raw materials and fuels, analyzes compositions, heating values, and moisture content, and performs hazardous element analysis, using them only after assessment and approval. The Low-Carbon R&D Center in Taiwan and the Central Laboratory in Portugal conduct professional inspection and testing to develop a more diverse range of material sources. To strengthen cost control, TCC established an environmental protection technology company in Mainland China to enhance the competitiveness of alternative material procurement.

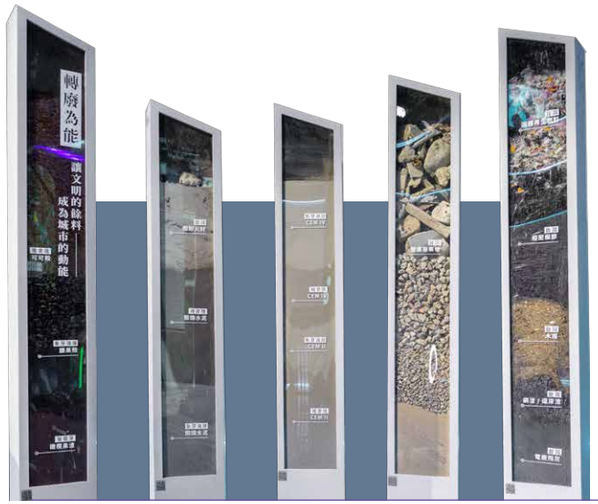
	Alternative Raw Materials and Fuels	Development Progress
Cement and Environmental Protection Business (Asia)	Waste glass fiber	The case-by-case reuse application has been approved, and an application to amend the stationary pollution source operating permit is planned for the first half of 2026.
	Non-hazardous oily sludge from science parks	The ash composition of the sludge is 30-40% silica. Its low alkali content can replace some high-priced high-silica sand; with a heating value of approximately 3,300–4,000 kcal/kg, it can be used as alternative fuel.
	Waste conveyor belts	Conveyor belts in the manufacturing industry are mostly made of rubber materials and possess heating value. Sources from the steel and petrochemical industries have been developed. After being processed by the plant's waste rubber crushing system, they can be used as alternative fuel.
Cement and Environmental Protection Business (Europe-Africa)	Corn stalks	Adana Plant has completed the installation, commissioning, and feeding trials of shredding equipment and storage facilities in 2025; continuous system optimization will gradually increase the replacement ratio. The annual usage is estimated at 80,000 tons, replacing 27,000 tons of fossil fuels.

ACTION SPOTLIGHT

Assisting the Semiconductor Industry — Calcium Fluoride Sludge Reuse

Hoping Plant and Suao Plant

Since 2002, TCC has collaborated with semiconductor-related industries, transforming unprocessable calcium fluoride sludge and waste molding compounds from major wafer manufacturing and packaging plants into alternative raw materials such as calcium and silicon for cement through cement kiln circular technology, helping solve the waste challenges of Taiwan's semiconductor industry.



Nut Shells, Traditional Chinese Medicine Residues, and Other Wastes as Biomass Fuel

Ivory Coast Plant, Adana Plant, Chongqing Plant, and Anshun Plant

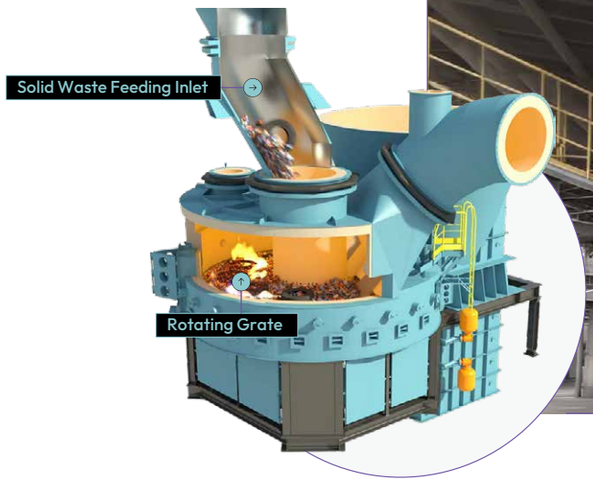
The Cement and Environmental Protection Business actively develops agricultural waste as biomass fuel.

The Ivory Coast plant uses cashew shells as a biomass fuel. In Portugal, the Loulé plant utilizes olive pomace, while the Alhandra plant employs a açaí lumps and olive pomace or lump as biomass fuels.

Türkiye's Adana Plant plans to use corn stover; it installed shredding equipment and storage facilities in 2025, officially beginning feeding trials. It will continue co-processing tests and system optimization to expand usage, aiming for an annual consumption of 80,000 tons to replace 27,000 tons of fossil fuels. Since August 2025, the Chongqing Plant has collaborated with the local government and villagers around Hechuan County to collect corn stover, reducing farmland fire pressure and traditional burning air pollution to achieve a win-win with the community. In 2025, it processed about 600 tons, reducing 660 tCO_2e. The Anshun Plant began using Chinese medicine residue in July 2025, reaching a cumulative usage of 2,070 tons by the end of May 2026. For more information, please refer to the TCC WeChat.

Alternative Fuel Technology Upgrades

The cement industry often faces significant processing costs when using alternative fuels, including substantial manpower and time required for on-site crushing and sun-drying to reduce moisture, as well as strict screening to remove impurities and avoid affecting production quality. Plants worldwide continuously improve system processes and equipment—such as optimizing feeding and combustion systems and introducing bypass chlorine bypass systems—to increase alternative fuel usage and the Thermal Substitution Rate (TSR). In 2023, the Suao Plant and the Industrial Technology Research Institute (ITRI) jointly completed the construction of the Cement Kiln High Calorific Value SRF Co-firing and Clean Integration System to collaborate on improving alternative fuel efficiency. The Solid Recovered Fuel (SRF) mixed with wood chips test burn verification was completed in March 2025, producing the optimal mixing ratio.



ACTION SPOTLIGHT

HotDisc System Increases Alternative Fuel Thermal Substitution Rate (TSR) by Over Two Times

Aslan Plant and Xuyong Plant

The HotDisc system significantly improves combustion efficiency through its rotating disc design and controllable speed, overcoming moisture content limits of alternative fuels. The feed size can be expanded to 2 meters, reducing crushing time, and ashes can be directly discharged through pipelines, no longer restricted by impurities. Aslan Plant in Türkiye implemented it in May 2020, increasing the alternative fuel thermal substitution rate (TSR) from 30% to 60%. Xuyong Plant will complete installation in May 2026. Combined with the stable material supply advantage from converting the nearby Naxi Plant's original site into an alternative fuel storage facility, the TSR is expected to increase from 15% to 50%. Compared to peers in Mainland China that mostly apply this system to waste treatment, Xuyong Plant is the first to apply it to alternative fuels.

TCC KEY FACTS

Alternative Raw Material Proportion

Cement	15.4%
Concrete	24%

Alternative Fuel Thermal Substitution Rate (TSR)

19.88%

| Cement and Environmental Protection Business

TARGET

2030

Alternative Raw Material Rate in Cement

| Cement and Environmental Protection Business

Asia	22%
Europe/Africa	5%

Alternative Fuel Thermal Substitution Rate (TSR)

| Cement and Environmental Protection Business

Asia	35%
CIMPOR	70%
OYAK Cement	58%

Alignment with SDGs

6 CLEAN WATER AND SANITATION
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Alignment with SDGs

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Household Waste Treatment

According to UN estimates, global urbanization continues to accelerate. By 2025, approximately 45% of the 8.2 billion population reside in urban areas. Population growth leads to two major issues: domestic waste and construction waste. Regarding domestic waste, in addition to its continuous growth, methane emissions generated from landfilling could further exacerbate global warming.

The Global Warming Potential (GWP) of methane is 27.9 times that of carbon dioxide. With current methane concentrations exceeding the targets set by the Global Methane Pledge—signed by over 150 countries—regions worldwide are increasingly utilizing cement kilns for the co-processing of waste. This technology has been widely adopted in developed regions such as Europe, the United States, and Japan since the 1970s.

Household waste has high moisture content and numerous impurities. If directly fed into cement kilns for combustion, it will cause heating value fluctuations, affecting cement process stability. Therefore, it must first be crushed and dehydrated before subsequent processing.

Cement and Environmental Protection Business (Asia) deepens partnerships with local governments and industry partners, combining cement kilns and gasifiers to treat household waste , which also diversifies TCC's revenue sources. The TCC DAKA Renewable Resource Recycling Center (RRRC) can assist the Hualien County Government in processing up to 200 tons of household waste daily, and cement plants in Mainland China can collectively process 600 tons of local household waste daily. TCC utilizes existing cement industry resources to help local governments solve methane problems caused by waste accumulation.

Combustible gases generated from waste incineration are introduced into the cement kiln preheater

→ **Reduces cement kiln fuel usage**

Odors generated during waste treatment are extracted into the gasifier and rotary kiln system, where the high temperature of the cement kiln completely burns off harmful gases and particles

→ **Generates no odors around the facility**

Sulfur, chlorine, and heavy metals in the exhaust gas are mixed with cement raw materials and absorbed to become cement clinker

→ **Significantly reduces acid gases, dioxins, and heavy metals**

TCC KEY FACTS

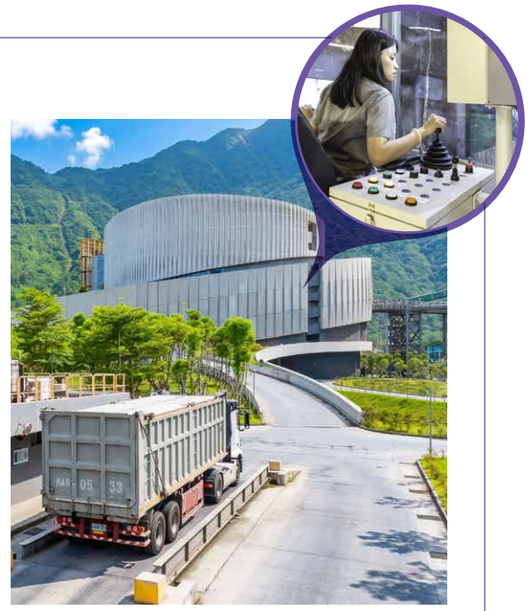
-90% **Dioxin** vs. Regulatory Standards

-3% **Coal** /Year

ACTION SPOTLIGHT

TCC DAKA Renewable Resource Recycling Center (RRRC)

TCC DAKA RRRC officially commenced operations on July 28, 2023, becoming the first facility in Taiwan to utilize cement kiln high-temperature co-processing for waste treatment. In the past, Hualien and Nantou were the only two counties in Taiwan without incinerators. Hualien's waste was transported to the Lize Incinerator in Yilan for a long time, resulting in transportation-related carbon emissions. Furthermore, the incineration process left behind bottom ash and fly ash that required alternative landfill sites. In 2019, the Hualien County Government sought TCC's assistance in processing Hualien's domestic waste, leading to a collaborative Build-Operate-Own (BOO) project for cement kiln co-processing of waste. This also marked the starting point for TCC to practice industry and community inclusion.



For more information, please refer to CH 6.1 and TCC's YouTube channel.

In addition to reducing methane emissions from landfills, it also reduces Hualien's waste transportation northward by 50 km, equivalent to an annual carbon reduction of 390 tCO_2e.

2025 Cement Kiln Co-processing Household Waste Status

Plant	Domestic Waste Treatment Volume (tons)	Avoided Methane Emissions (tons)
TCC DAKA RRRC	42,117	2,106
Shaoguan Plant	2,408	120
Anshun Plant	70,327	3,516
Jingzhou Plant	44,928	2,246
Total	**159,780**	**7,989**

Alignment with SDGs

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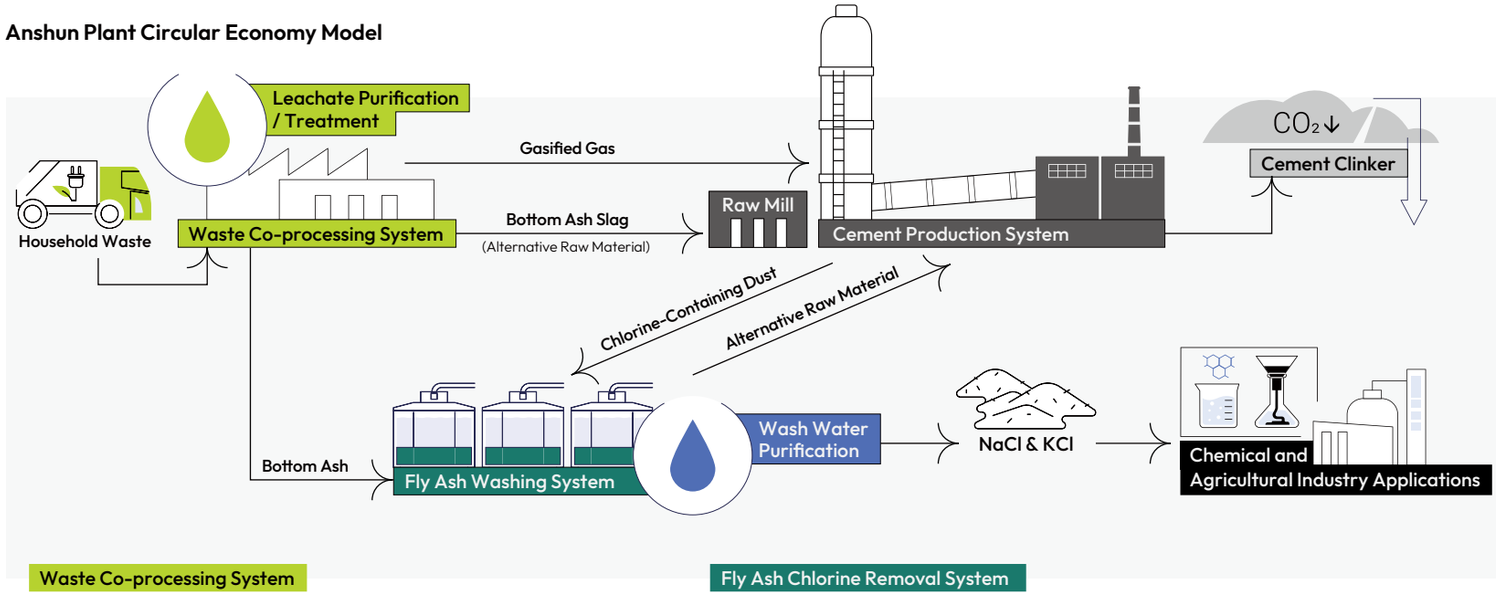
TCC Anshun Plant Co-processing of Fly Ash and Waste Treatment Selected as UN Convention "Waste-Free City"

Located in Pingba District, Anshun City, Guizhou, the Anshun plant is one of TCC's key cement production bases in Southwest China. In 2015, it added a household waste treatment project to assist in processing waste from surrounding communities and cities, becoming the Group's first environmental protection demonstration plant to invest in cement kiln co-processing of domestic waste. In 2024, it further established a fly ash treatment system, successfully selected as a UN Basel Convention Regional Centre for Asia and the Pacific "Waste-Free City" construction case. It is also among the first batch of 25 selected in Mainland China and the only hazardous waste fly ash resource utilization project in the circular economy field.

Anshun Plant Circular Economy Model



Waste Co-processing System

Through high temperature, fineness, concentration, adsorption, and uniformity combustion, the system effectively controls chlorine sources in gasified waste and completely decomposes dioxins. Combustible gases serve as alternative fuel for the cement kiln, and waste bottom ash is converted into alternative raw materials for cement. A fully sealed structure and extraction system keep the storage pit under negative pressure to prevent odor dispersion. In 2024, a leachate treatment system was added, treating refuse pit wastewater via nitrification and reverse osmosis for recycling within the waste co-processing system.

Fly Ash Chlorine Removal System

Constructed in 2024 to connect the cement kiln calciner and waste co-processing system. Fly ash undergoes washing, liquid purification, evaporation, and drying to detoxify chlorine ash from household waste and cement kiln combustion. Reusing fly ash eliminates soil and groundwater pollution from landfilling at the source and saves land resources. Washed fly ash become alternative raw material in the kiln , with each ton processed cutting ~0.3 tons emissions. The water purification system produces industrial-grade sodium chloride and potassium chloride by-products for chemical and agricultural industries. Remaining wastewater is recycled back to the fly ash system.

Basel Convention & "Waste-Free City"

The Basel Convention is the most authoritative environmental convention, established in 1989 by the United Nations Environment Programme (UNEP). At that time, as many developed countries dumped highly toxic hazardous waste into developing countries, nations legislated to control transboundary movements to maintain environmental justice, advocating for the harmless treatment and resource utilization of hazardous waste within domestic borders.

BASEL | ROTTERDAM | STOCKHOLM CONVENTIONS

TCC KEY FACTS

Household Waste and Hazardous Waste Treatment Volume at Anshun Plant

Cumulative Municipal Solid Waste Processed
580,751 tons

Annual Recycling of Wastewater and Leachate
Over 5,200 tons
(saving 260 MWh of electricity)

Annual Fly Ash Treatment Capacity
50,000 tons
(equivalent to a carbon reduction of 15,000 tons of CO_2e)

Alignment with SDGs

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2.3 Low-Carbon Production Management

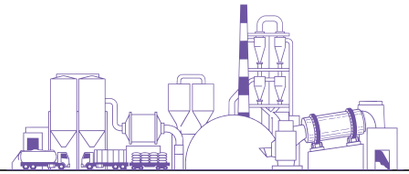
TCC actively implements full lifecycle management to minimize the environmental impact of its product manufacturing processes. To thoroughly execute environmental management, TCC introduces international standard management systems and professional certification training across key dimensions, including greenhouse gas emissions, energy efficiency, water resources, waste, air emissions, and transportation.

TCC KEY FACTS

100%
ISO 14001 Certification Obtained

Environmental Protection Policy

Cement Plants



- ISO 14001 — Environmental Management
- ISO 14046 — Water Footprint
- ISO 14064 — Greenhouse Gas Inventory
- ISO 14067 — Carbon Footprint
- ISO 14025 — Type III Environmental Declarations
- ISO 46001 — Water Efficiency Management
- ISO 50001 — Energy Management (In Progress)
- Alliance for Water Stewardship — Water Management Platinum Level
- BS 8001 — Circular Economy
- 綠色工廠 Green Factory — Green Factory Clean Production System Certification

RMC Plants

- ISO 14001
- ISO 14064
- ISO 14046
- ISO 14067
- ISO 46001
- ISO 50001
- ISO 14025
- BS 8001
- 綠色工廠 Green Factory

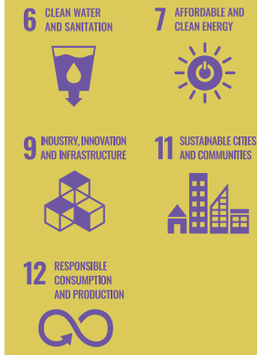
Office

- ISO 14001
- ISO 50001
- ISO 14064

- Taiwan
- Mainland China
- OYAK Cement
- CIMPOR

Note 2: For details on environmental management certifications, please refer to CH 7.1.

Alignment with SDGs



Environmental Management Process

STEP 1

Implement ISO Systems

By implementing international management systems including ISO 50001, ISO 46001, ISO 14001, ISO 14046, ISO 14064, and ISO 14067, TCC identifies energy and resource improvement opportunities to comprehensively enhance energy and water efficiency, while driving reductions in waste, air emissions, and greenhouse gases.

STEP 2

Environmental Management Target Setting | Cement and Environmental Protection Business

Environmental targets cover energy efficiency, water efficiency, waste reduction, air pollution reduction, and GHG reduction[3]

2030 Energy Intensity

- ≦2.306 GJ/t cementitious materials
- **Smart Energy Coalition (EP100) Target**: Increase energy productivity by 50% by 2040 compared to the 2016 baseline (Cement Plants)

Cement and Environmental Protection Business (Asia)

- ≦3,300 MJ/t clinker

CIMPOR Cement plant in Portugal

2030 Water Withdrawal Intensity

- ≦0.000248 million liters/t cementitious materials (Cement Plants)
- 1.5% reduction compared to the 2023 baseline (RMC Plants)

Cement and Environmental Protection Business (Asia)

- ≦0.0002 million liters/t cement

CIMPOR Cement plant in Portugal

Annual Waste Targets

- 0.5% annual reduction in in-house household waste (Cement Plants & RMC Plants)
- 100% of in-house waste converted into renewable energy and resources (Cement Plants)

Cement and Environmental Protection Business (Asia)

Air Pollution Targets

2030 Air Pollution Emission Intensity

	Cement and Environmental Protection Business (Asia)	Cement and Environmental Protection Business (Europe-Africa)
NOx	≦370 g/t clinker	<500 g/t clinker
SOx	≦39 g/t clinker	<200 g/t clinker
TSP	≦20 g/t clinker	<5 g/t clinker
Mercury	-	<0.005 g/t clinker

STEP 3

Develop and Implement Action Plans

Develop specific action plans, including:

- **Energy and GHG**: Implement energy-saving actions, use clean or renewable energy, and invest in innovation and R&D to reduce energy consumption.
- **Water resources**: Execute water-saving programs, promote water recycling and reuse, and implement water recycling technology.
- **Waste**: Implement waste reduction actions and recycling programs, and invest in innovative technologies.

STEP 4

Enhance Employee Capability

Build employee capacity and awareness through targeted programs:

- **Education and training**: Offer ISO system certification training[4] covering air emissions, water resources, waste, and energy management, and establish the Institute of Nextgen Sustainability to deepen professional knowledge and align with international standards.
- **Awareness courses**: Utilize platforms like the TCC Lyceum and New Employee Training to deepen sustainability awareness and integrate it into daily work.
- **Leadership communication**: Conduct Town Hall Meetings, chaired by the Chairman, to communicate the company's sustainability strategy directly to employees.

STEP 5

Engage with Stakeholders

Communicate environmental policies, requirements, and progress to all internal and external stakeholders. This is achieved through multiple channels, such as:

- Sustainability Newsletter
- Supplier Conference
- Product Promotion Events and Conferences

Note 3: For the 2050 targets and other environmental management goals, please refer to Sustainability Goals and Tracking. For environmental targets of other businesses, please refer to the ESG section of TCC's official website and individual subsidiaries' sustainability reports.
Note 4: For details on the action plans, please refer to the ESG section of TCC's official website.

Energy Efficiency Management

TCC continues to implement the ISO 50001 energy management system across the Group, integrating it with a smart energy management platform to systematically inventory energy use and detect energy-saving opportunities.

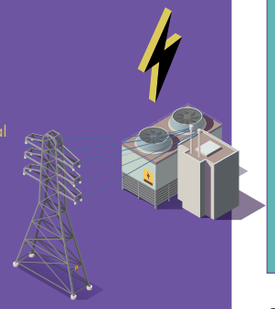
Meanwhile, TCC actively optimizes energy efficiency through process improvements and manufacturing energy conservation, incorporating energy management into daily operations and internal management mechanisms to regularly review performance.

In line with the Group's energy transition, TCC's sites also build on-site or purchase renewable energy, introduce energy storage systems, and install or optimize waste heat recovery (WHR) systems based on operational conditions, reducing reliance on external power and ensuring low-carbon production. For details on energy-saving solutions, please refer to CH 7.1.

Waste Heat Recovery Power Generation
100% of cement plants under the Cement and Environmental Protection Business (Asia) are equipped with waste heat recovery (WHR) systems. By in-troducing flash evaporation technology to improve heat recovery and power generation efficiency, these plants reduce purchased electricity for manufacturing processes by an average of 20% to 30%. The Cement and Environmental Protection Business (Europe-Africa) is also actively introducing these systems. Following the activation of systems at the Aslan and Bolu plants in Türkiye in 2023, new WHR installations of 4.3 MW at the Alhandra plant and 7.3 MW at the Souselas plant in Portugal will be added in 2025, which are expected to supply approximately 21% of the electricity required for manufacturing processes.

TCC KEY FACTS

100% obtained
ISO 50001
| Cement and Environmental Protection Business (Asia)



Waste Heat Recovery (WHR) Power Generation
846,000 MWh
Equivalent to Purchased Electricity for Processes 42.11%
| Cement and Environmental Protection Business (Asia)

97,000 MWh
Equivalent to Purchased Electricity for Processes 6.21%
| Cement and Environmental Protection Business (Europe-Africa)

TARGET
1% Annual Electricity Savings
| the Group Operation Headquarters Building

TARGET

Purchased Green Electricity
From 2025 Onwards
- Taiwan: **+100,000 kWh** Annually
- Mainland China: **+10,000,000 kWh** Annually

| Cement and Environmental Protection Business (Asia)

2030 Renewable Energy Proportion
- **30%** Energy Consumption from **Renewable Energy**
- **70%** Renewable Energy Proportion in Process Electricity

| Cement and Environmental Protection Business (Europe-Africa)

Self-Generation and Consumption of Renewable Electricity
Rather than relying on purchasing renewable energy certificates as its primary strategy, TCC adopts a parallel approach of self-generation and consumption alongside green power procurement. It actively installs solar power generation systems on rooftops and unused areas of its global operational sites. Among them, the Hoping and Suao plants are obligated renewable energy users and completed their obligations ahead of schedule in 2023. TCC also supports the development of the green power market at various sites; the Cement and Environmental Protection Business (Asia) has set green electricity procurement targets, while the Charging and Storage Business (Europe) also prioritizes purchasing green electricity for its office operations.

TCC KEY FACTS

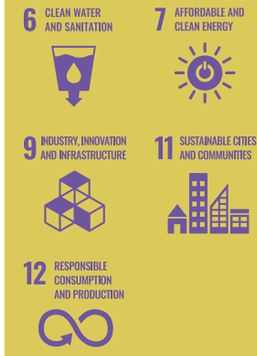
Self-Consumption Renewable Energy Installed Capacity:
217.81 MW

Renewable Energy Consumption Rate: 0.5%

| Global Sites

Note 5: Renewable Energy Consumption Rate = Renewable Energy Electricity / Total Energy Consumption. In 2025, the green electricity utilization rate for the Cement and Environmental Protection Business (Asia) was 4.71% of its total electricity consumption.

Alignment with SDGs



Integrating Solar and Energy Storage to Strengthen Power Resilience

TCC actively builds energy storage systems to support on-site power demands, participating in the electricity trading market by regulating peak and off-peak loads. During emergencies such as natural disasters or outages, these systems immediately discharge to supply power for production processes. In 2026, the Hoping and Suao plants commissioned 28.62 MWh and 12.876 MWh behind-the-meter energy storage systems, respectively. Featuring black start capability, they provide backup power during sudden outages for emergency material discharge into the kiln. Cement plants in Mainland China and CIMPOR's operations in Portugal also prioritize a "solar + storage" integration strategy. Among them, the Yingde Plant's 43.2 MW energy storage facility is the largest in Mainland China's cement industry.

Alignment with SDGs

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TCC KEY FACTS

Installed Capacity of On-Site Energy Storage

- Taiwan **41.496 MWh**
- Mainland China **140.8 MWh**

| Cement and Environmental Protection Business (Asia)

- Portugal **2.29 MWh**

| Cement and Environmental Protection Business (Europe-Africa)

ACTION SPOTLIGHT

OYAK Cement Selected for Industrial Development Bank of Turkey (TSKB) First Transition Finance Project **Secures Funding to Install Solar Panels and Waste Heat Recovery (WHR) Power Generation Systems**

OYAK Cement secured a EUR 75 million financing package in early 2025 to install additional waste heat recovery (WHR) power generation systems at its Ankara, Adana, and Mardin cement plants in Türkiye, and to build a 115 MW solar project for self-consumption in the Beypazarı district of Ankara. The solar project is expected to generate 237,000 MWh annually. Following its scheduled commissioning in 2026, the proportion of renewable energy in process electricity for OYAK Cement is projected to increase from 9% to 30%.

Jurong "3-in-1 Solar-Storage-Charging" Integrated Station **Creating High-Efficiency C&I Smart Energy Solutions**

TCC's Jurong Plant installed commercial and industrial (C&I) energy storage facilities and a "solar-storage-charging" 3-in-1 integrated station with a total capacity of nearly 17 MWh, including a 10 MWh containerized energy storage system and a 6.6 MWh newly launched EnergyArk® 418 energy storage system, enabling clients to enjoy energy-saving and cost-reduction benefits with zero upfront capital investment. Through virtual power plant (VPP) technology, the system integrates electricity price arbitrage, contract capacity optimization, and grid ancillary services, and is expected to participate in spot electricity trading in the future to maximize the value of green energy.

In addition, this 3-in-1 solution uses precast concrete construction methods to build solar PV carports, significantly shortening the construction period by 50% and enabling completion in as fast as two weeks. This solution overcomes grid feeder capacity constraints while still providing fast charging services, meeting employees' EV charging needs and realizing low-carbon transportation and smart energy integration.

Water Resource Management

Although the cement industry utilizes a dry process and is not considered water-intensive, TCC proactively strengthens its water management systems. To comprehensively grasp water resource risks, TCC follows the TNFD framework, prioritizing the Cement and Environmental Protection Business (Asia) and Cement and Environmental Protection Business (Europe-Africa) groups to identify the dependencies and impacts of its global quarries and operating sites on water flow and quality.

Using the WRI Aqueduct tool, TCC assessed water stress across sites in Taiwan, Mainland China, Europe, Türkiye, and Africa, identifying 108 sites in high water stress regions. Physical risks primarily involve potential shortages leading to rationing and production halts; transition risks encompass stricter wastewater discharge regulations, where non-compliance could result in fines or operational suspensions. Poor management could also disrupt surrounding domestic, agricultural, and ecological water supplies, impacting local communities and the environment.

To effectively manage consumption, TCC's cement plants in Taiwan and Mainland China have utilized a dedicated water footprint platform since 2022 to monitor supply, consumption, recycled water, and wastewater discharge data in real time, enabling instantaneous recycling rate calculations. TCC also actively implements ISO 46001 water efficiency management certification and ISO 14046 water footprint verification.

Cement plants in Taiwan and Molicel (Tainan plant) are subject to water consumption fees. In 2025, their water recycling rates reached 98.6% and 51.8%, respectively, both exceeding the Water Resources Agency's industry benchmarks. For detailed water-saving measures, please refer to CH 7.1.

Ecosystem Service Dependence Analysis of Water Resources | Dependence or impact levels are rated from 1 to 5, from lowest to highest

	Quarry	Cement Plant	RMC Plant	Aggregates Plant	Grinding Station	Port Area	Shipping Station	Environmental Protection Company	Power Plant	Paper Bag Plant
Dependency										
Water Flow Regulation Services	4	3	3	3	3	3	1	3	4	3
Water Purification Services	5	3	3	3	3	-	-	3	3	-
Water Supply	4	3	3	3	3	2	1	3	4	3
Impact										
Area of Freshwater Use	4	3	3	3	3	1	-	-	3	-
Area of Seabed Use	4	-	-	-	-	-	-	-	-	-
Emissions of Nutrient Pollutants to Water and Soil	-	3	3	3	3	3	1	4	-	-
Emissions of Toxic Pollutants to Water and Soil	4	5	5	5	5	2	1	4	5	3
Volume of Water Use	3	3	3	3	3	2	2	3	3	3

Alignment with SDGs

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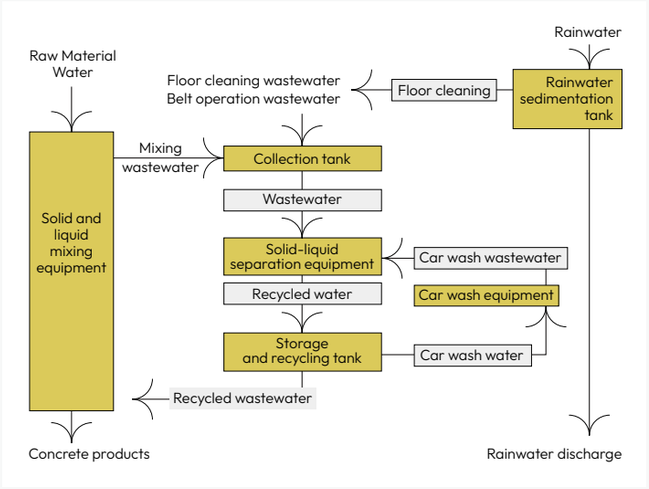
Water Withdrawal and Wastewater Management Mechanisms

Water Withdrawal Management Mechanism

- Rainwater recycling and reuse
  | Selected cement plants in Mainland China[6], CIMPOR and OYAK Cement plants and RMC plants, Ho-Ping Power Company, and Hoping EcoPort
- Establish water metering systems to monitor water consumption data
  | Cement plants and RMC plants
- Regularly inspect pipelines for aging and leaks
  | Cement plants and RMC plants
- Install additional filters and monitoring equipment to increase condensate recovery
  | Ho-Ping Power Company
- Replace equipment with water-saving models and install automated watering systems for landscaping
  | Ho-Ping Power Company

Wastewater Management Mechanism

Water Balance Diagram of RMC Plants



- 100% process wastewater recycled and reused with zero discharge
  | Taiwan RMC plants, Mainland China cement plants and Fuzhou grinding plant
- Establish remote monitoring platform for runoff wastewater
  | Taiwan RMC plants
- Install shipboard sewage treatment devices, discharge systems, and equipment complying with international marine environmental protection standards, and obtain the International Sewage Pollution Prevention Certificate (ISPPC)
  | Ta-Ho Maritime
- Regularly test wastewater discharge indicators
  | cement plants in Taiwan and Mainland China[7] cement plants, Liuzhou grinding plant, and Ho-Ping Power Company
- Regularly monitor wastewater treatment and pollution prevention measures, with continuous tracking and review
  | Taiwan and parts of Mainland China[8] cement plants, and Ho-Ping Power Company

Note 6: Includes Chongqing, Guang'an, Xuyong, Anshun, Kaili, Yingde, Guigang, and Shaoguan cement plants.
Note 7: Includes Chongqing, Guang'an, Huaying, Xuyong, Anshun, Kaili, Jingzhou, Huaihua, Jurong, and Yingde cement plants.
Note 8: Includes Chongqing, Guang'an, Huaying, Xuyong, Anshun, Kaili, Jingzhou, Huaihua, Jurong, and Guigang cement plants.

Internal Water Pricing

Starting in 2025, TCC implements an internal water pricing system across the cement plants, RMC plants, and grinding stations of Cement and Environmental Protection (Asia). By introducing a water cost pricing model based on the water intensity of different operating units, regional water resource risks, and water price trends, TCC aims to create economic incentives that drive water-saving improvements and achieve a win-win for environmental and operational sustainability.

Both Taiwan and Mainland China base their internal water pricing on the water consumption fee of NT$3 per cubic meter levied in Taiwan. The pricing for Taiwan sites is set at (local water price + NT$3) per cubic meter, and for Mainland China sites at (local water price + RMB 0.75) per cubic meter.

TARGET

Plants located in water-stressed areas
Water withdrawal reduced by
1.2%
Cement and Environmental Protection Business (Asia)

Water Management Commitment

Alignment with SDGs

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Alignment with SDGs

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Waste Management

TCC's global operations adhere to the ISO 14001 environmental management system (EMS) and have established waste management procedures to implement waste sorting and management, recycle recoverable waste, and enhance resource recycling awareness and actions through em-ployee education and training on waste reduction. Global operations are progressively setting waste reduction targets to strengthen the overall resource recycling efficiency of the Group.

▲ **Industrial waste**
● **General waste**
(e.g., employee household waste, waste plastics, waste rubber, and waste paper)
■ **Waste that cannot be reused on-site, such as scrap iron and other valuable metals**

Cement Plant
| Cement and Environmental Protection Business

▲	Sent to cement plants for processing in high-temperature cement kilns as alternative raw materials and fuels
●	Used as alternative fuels after sorting and crushing
■	Engages qualified waste clearance and disposal organizations for recycling according to regulations and sends waste to downstream industries such as steel mills for reuse, ensuring legal and traceable waste flows

RMC Plants, Grinding Stations, Offices, and Other Sites
| Cement and Environmental Protection Business, Charging and Storage Business, Battery Energy Business, and Investment Business

▲ ● ■	Implements waste sorting and engages qualified vendors for disposal

Energy for Social Transformation Business

▲	All coal ash generated during power generation is transported to cement plants for recycling as raw materials
●	Engages qualified vendors for disposal
■	Engages qualified vendors to recycle scrap iron and other valuable metals for reuse in steel mills

Note 9: At Hoping 3-in-1 of Port, Power, Cement Plant, over 99% of the waste from Hoping Cement Plant, Ho-Ping Power Company, and Hoping EcoPort can be interdependently utilized. For more information, please refer to CH 3.3.

TCC KEY FACTS

100% of plants in Türkiye obtained
Zero Waste _Certification
OYAK Cement

TARGET

100%
Proportion of Waste Converted into Renewable Energy and Resources
| Cement and Environmental Protection Business (Asia)

Total waste reduced by
15% year-over-year
| OYAK Cement

ACTION SPOTLIGHT / **INVESTING IN INNOVATIVE TECHNOLOGIES**

Hoping Plant & Yingde Plant Food Waste Processing Center

The Hoping and Yingde plants promote food waste recycling, converting it into fertilizers or soil improvement materials to give back to local neighborhoods. In 2021, the Hoping Plant established food waste recycling equipment to convert waste from TCC DAKA and surrounding community food stalls into soil improvement materials, provided free to villagers for agriculture and gardening. The Yingde Plant built an integrated food waste treatment center, recycling food waste from employee cafeterias and nearby residents to produce organic fertilizers, soap, hand wash, crayons, and more. From 2020 to the end of 2025, the Hoping and Yingde plants invested a cumulative NT$24,348,857.

Supporting Green Office and Green Mark Initiatives, TCC systematically implements eco-friendly measures across procurement, equipment management, and daily operations. This includes avoiding single-use items, prioritizing products with green marks or FSC certification, and promoting energy monitoring and efficiency.

- Procure eco-friendly toner cartridges and transition fuel official vehicles to electric vehicles.
- Promote paperless operations, prioritize electronic communication, and strengthen copy paper management.
- Recycle office supplies (e.g., paper clips, binder clips, file boxes) and adopt a "repair before replace" principle for photocopiers to maximize lifespan.
- Reduce trash cans to minimize garbage bags and install restroom hand dryers to reduce paper towel consumption.
- Install sensor lighting and program water dispensers to automatically shut down during specific hours to save power.
- Implements plastic reduction by introducing reusable glass cups and mugs, and completely phasing out coffee capsules | Atlante

Air Emissions Management

TCC strictly controls process air emissions across all business entities, covering the management of stationary pollution sources, process equip-ment, and transportation. It regularly engages third-party organizations to test air quality and environmental impacts and sets up air quality moni-toring stations around the plants to ensure compliance with government emission standards. The global cement plants of Cement and Environmental Protection Business and Ho-Ping Power Company are equipped with continuous emission monitoring systems (CEMS) for air pollutants, which monitor the concentration and emission volume of air pollutants in plant emissions in real time and provide continuous data for observing changes. The operations in Taiwan and Mainland China are connected in real time with local environmental competent authorities; CIMPOR, OYAK Cement also operate within local regulations. Ta-Ho Maritime adheres to International Maritime Organization (IMO) regulations, monitoring sulfur oxides (SOx), nitrogen oxides (NOx), and ozone-depleting substances (ODS) to ensure compliance with all control area regulations.

ACTION SPOTLIGHT

Ta-Ho Maritime Air Emissions Management

Ta-Ho Maritime adheres to IMO MARPOL Annex VI regulations, implements air pollution control management, and has obtained the International Air Pollution Prevention Certificate (IAPP) to ensure vessel operations meet international standards. The Company continuously monitors and controls pollutants such as SOx, NOx, PM_{10}, and volatile organic compounds (VOCs) to reduce environmental impact. In response to the 2020 global reduction of the sulfur content limit in marine fuel from 3.5% to 0.50%, and further to 0.10% in emission control areas (ECA), Ta-Ho Maritime fully complied by using low-sulfur fuel and optimizing operational management to reduce air pollution emissions.

Furthermore, the Company actively introduces energy-saving and low-carbon vessels, newly purchasing the TAHO COMPLIANCE and TAHO FANTASY to reduce pollutants and greenhouse gas emissions at the source by improving the Energy Efficiency Design Index (EEDI).

Through vessel equipment optimization, fuel management, and continuous monitoring mechanisms, Ta-Ho Maritime effectively enhances air pollution control performance, demonstrating its commitment to environmental protection and sustainable development.

TCC KEY FACTS

NOx −9% SOx −30%
Compared to 2024 | Cement and Environmental Protection Business

Obtained **International Air Pollution Prevention Certificate (IAPP)**
Ta-Ho Maritime

Top Rating for RightShip Document Compliance
Ta-Ho Maritime's Bulk Fleet

Air Pollution Management Mechanism

- Installs Continuous Emission Monitoring Systems (CEMS)
  | Global cement plants (under implementation in Ivory Coast), Ho-Ping Power Company
- Installs Selective Catalytic Reduction (SCR) systems to control NOx emissions
  | Taiwan and some Mainland China[10] cement plants, Ho-Ping Power Company, Kuan-Ho Refractories Industry
- Uses electrostatic or pulse jet bag filters to treat particulate pollutants
  | Ho-Ping Power Company, Kuan-Ho Refractories Industry, CIMPOR and OYAK Cement
- Strengthens the airtightness of equipment and transportation processes to prevent pollutant leakage
  | Taiwan and Mainland China cement plants, Fuzhou and Liuzhou grinding stations
- Uses denitrification equipment to remove NOx and wet limestone/gypsum desulfurization equipment to remove SOx
  | Ho-Ping Power Company, CIMPOR and OYAK Cement
- Installs a 250-meter-high chimney to increase the dispersion capacity of gaseous pollutant emissions
  | Ho-Ping Power Company
- Monitors air pollution emissions from ships in accordance with regulations and obtain the International Air Pollution Prevention Certificate (IAPP) issued by the International Maritime Organization (IMO)
  | Ta-Ho Maritime

Note 10: Includes Chongqing, Guangan, Huaying, Xuyong, Anshun, Kaili, Jingzhou, Jurong, Yingde, Guigang, and Shaoguan cement plants.

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Transportation Management

TCC is committed to reducing greenhouse gas emissions generated during transportation by establishing a comprehensive transportation man-agement mechanism covering land transport, maritime transport, and equipment efficiency management. Through measures such as vehicle elec-trification, the introduction of energy-saving technologies, and data-driven monitoring, TCC continuously improves transportation efficiency and reduces environmental impact. For more information on electric transportation, please refer to Pillar IV.

Transportation Management Mechanism

Raw Material Transportation	Product Transportation
Electric Mining Trucks: Replaced diesel trucks, saving 5.2 tons of diesel per truck monthly | Taiwan and parts of Mainland China[1] cement and RMC plants	**Electric Tractors**: Used for cement products, targeting a 32% carbon reduction | Taiwan cement plants
Enclosed Conveyors: Constructed corridors/belt conveyors in quarries/plants for direct limestone transport, replacing diesel trucks | Hoping and Liaoning cement plants	**Eco-Friendly Mixer Trucks**: Low-fuel models achieved a 97% ratio by year-end 2025 | Taiwan RMC plants
New Energy Vehicles: Deployed for raw material transport | Yingde, Guigang, and Shaoguan cement plants	**Electric Mixer Trucks**: Deployed at CIMPOR (launching 2026) & Taiwan RMC plants (on road by 2026). See Pillar IV **New Energy Vehicles**: Deployed for cement clinker transport | Yingde, Guigang, and Shaoguan cement plants

Note 11: Includes Chongqing, Jurong, Yingde, Guigang, and Shaoguan cement plants.

ACTION SPOTLIGHT

Ta-Ho Maritime Low-Carbon Transportation

Ta-Ho Maritime actively promotes a low-carbon transportation transition, significantly reducing emissions and enhancing energy efficiency through shore power, next-generation eco-vessel procurement, and smart management.

Alternative Maritime Power (AMP) System: Completed phased installations since 2020. In 2025, usage reached 6,963 hours, totaling 5,716,002.7 kWh.

TAHO COMPLIANCE Eco Cement Vessel: Purchased in 2025, complying with IMO EEDI Phase 2 standards. It plans optimal routes and speeds via real-time satellite data to boost efficiency and fuel savings. It also features fully enclosed pneumatic cargo systems and AMP for zero-dust, low-emission port operations, and introduces the ClassNK-certified NAPA Smart Ship Weather Navigation System.

TAHO FANTASY Eco-Friendly Bulk Carrier: Purchased in 2025, complying with IMO EEDI Phase 3 standards. It features optimized hull design, energy-saving propulsion, big data routing, and cloud fleet management, reducing fuel consumption by over 4.5% to maintain a top CII "A" rating. This complies with the CII regulation tightening 2.625% annually from 2027 and prepares for the 2028 GFI carbon tax. A similar Ultramax eco-bulk carrier will be introduced in 2026, paired with smart route data management to strengthen green capacity and competitiveness. It also features the ClassNK-certified NAPA Smart Ship Weather Navigation System.

Guigang Plant Builds a Low-Carbon Electric Heavy-Duty Truck Corridor

TCC's Guigang Plant actively deepens low-carbon transportation by partnering with NHOA.TCC to build a fixed electric heavy-duty truck corridor between the plant and Baisha Port (38 km one way). The plant deployed 63 electric trucks with 420 kWh batteries, expected to transport 1.8 million tons of cement and clinker in 2025. To manage the 2.4 MW grid load when 5 to 6 trucks charge simultaneously, the plant introduced a 1.67 MWh EnergyArk energy storage system and an energy management system (EMS), reducing peak power consumption and optimizing costs.

This green fleet reduces maintenance costs and replaces traditional diesel, decreasing annual diesel consumption by approximately 1.36 million liters. This is equivalent to a 3,645 tCO_2e emission reduction, achieving a win-win for environmental carbon reduction and supply chain economic benefits.

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