CTCI
Discover Reliable

2023 Sustainable Impact Valuation Report

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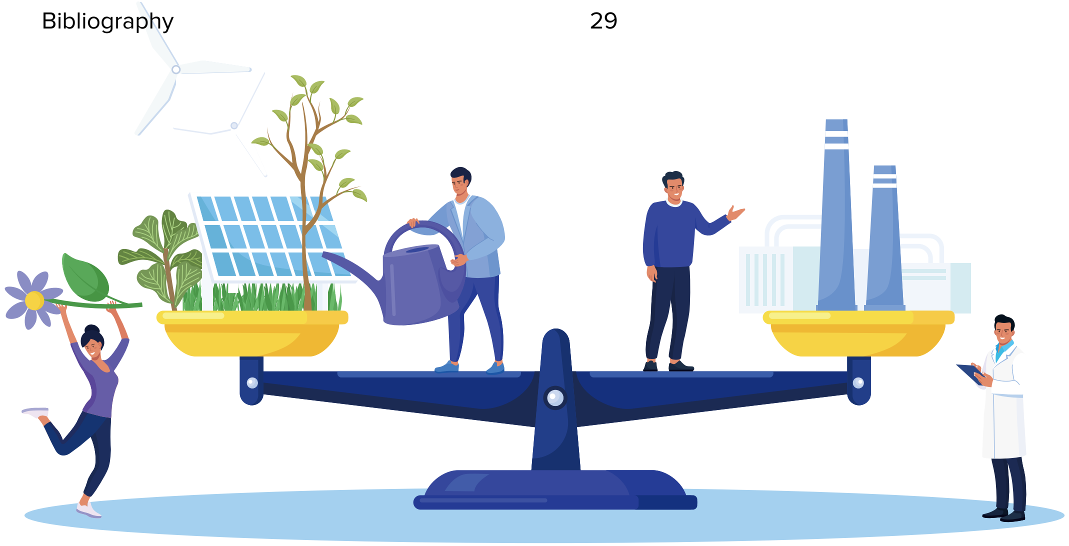
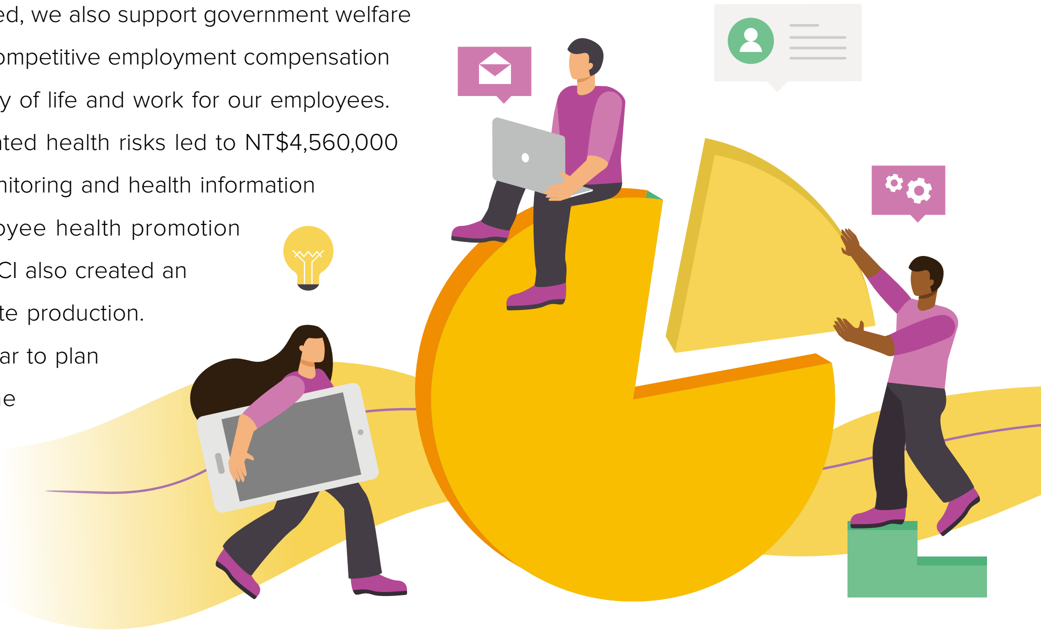


Mission Summary

Creating long-term value is at the core of implementing sustainable operations for CTCI Corporation (below referred to as CTCI). We examine the changes in social welfare brought about by all activities within our operations and our entire value chain from an external standpoint. To better grasp the opportunities and risks to our operations from ESG (environment, social, and governance), CTCI has been partnering with the Corporate Sustainability Impact Center of Tunghai University (THU) since 2022. By adopting a profit & loss mindset, combined with the Triple Bottom Line (TBL) framework incorporating economic, environmental, and social aspects, we evaluate the direct/indirect negative and positive impacts created by the company, which are then uniformly monetized to allow stakeholders to better understand the substantive value that CTCI creates, and to help drive effective decision- making within the company.

CTCI employs the Gross Value Added (GVA) method to assess the direct economic value created through business operations for stakeholders. In accordance with the Natural Capital Protocol, Social, Human Capital Protocol, ISO 14008:2019, Value Balancing Alliance (VBA), and Impact-Weighted Accounts (IWA) frameworks, CTCI evaluates the environmental and social externalities arising from business operations with the Impact Pathway method that focuses on causal relationships. CTCI utilizes the Input-Output Model to analyze the impact of procurement demand and engineering services on the entire industry supply chain, leading to increased output, employment opportunities, and income for workers. We also address environmental issues through the Environmentally Extended Input-Output Analysis (EEIO) for industry hotspot analysis and trade-offs.

In 2023, CTCI created NT$3.2 billion in economic value for external stakeholders through operations such as operating income, tax payments, R&D investments, depreciation, and amortization, etc. Not only do we help customers and suppliers succeed, we also support government welfare policies, provide excellent returns to investors, and also contribute to social and economic growth. Competitive employment compensation and training opportunities at CTCI created NT$0.19 billion in positive impacts, furnishing better quality of life and work for our employees. Through volunteering, CTCI employees also created NT$2,650,000 in social value. While work-related health risks led to NT$4,560,000 in social costs, employees' health conditions have been under control thanks to the long-term monitoring and health information distribution from the health center. Combined with diverse health promotion activities and employee health promotion measures, NT$9.21 million was created in positive social value. While contributing to the industry, CTCI also created an environmental footprint with a social cost of NT$110 million through resource consumption and waste production. To mitigate the environmental impact derived from its operations, CTCI has set 2022 as the base year to plan short-, medium-, and long-term carbon reduction targets. Various energy-saving schemes and the utilization of renewable energy have been implemented. In 2023, a total environmental benefit of NT$2.65 million was achieved. Going forward, the company will progressively work towards fulfilling its commitment to achieve net zero emissions by 2050.



In the procurement stage, CTCI’ s procurement demand created NT$72.7 billion in value for the supply chain, furnishing 15,000 jobs for supply chain workers and NT$4.3 billion in employee compensation. However, occupational accidents from subcontractors resulted in NT$70,000 in social cost, while NT$1.1 billion of social cost was incurred from environmental footprint and resource consumption through the process of providing raw materials and services. CTCI will therefore continue to promote a responsible supply chain, work with suppliers to discover opportunities for improvement, and facilitate sustainable transitions of the industry. CTCI's EPC projects generated a value of NT$66.3 billion for client industries through constructing and maintaining plants. Through the three dimensions of "Green Engineering" (green technology, green contracting, and green investment), innovative technologies are employed to assist clients in energy conservation, water conservation, and reducing resource consumption, resulting in environmental benefits valued at NT$12.5 billion.

In the future, we will expand the application of innovative technologies in green engineering. Simultaneously, we will strengthen sustainable supply chain management and adopt more efficient engineering service models to reduce environmental impacts along the value chain and enhance social well-being. Our aim is to create even more significant positive value for stakeholders.

Impact rating	Monetary Value (Million NT$)
●○○○○○	0~1
●●○○○○	1~10
●●●○○○	10~100
●●●●○○	100~1,000
●●●●●○	1,000~10,000
●●●●●●	>10,000

Sustainable Impact of CTCI	Output Metric	Impact Metric	External Impact: Type	External Impact: Rating	External Impact: Trend	Stakeholders	Cause of the Impact	ESG Issue
Supply chain output value elevated	Procurement demand drives industry supply and demand	Promote social and economic development	Positive(+)	●●●●●●	↗	Society	Supply chain (Indirect)	Supply Chain Sustainability Management
Supply chain employee salary income	Procurement demand creates job opportunities	Enhance quality of life and purchasing power	Positive(+)	●●●●●○	↗	External employees	Supply chain (Indirect)	Supply Chain Sustainability Management
Social cost of GHG emissions derived from the supply chain	Procurement demand contributes to GHG emissions along the supply chain	Elevates climate risks caused by global warming	Negative(-)	●●●●○○	↗	Environment	Supply chain (Indirect)	Supply Chain Sustainability Management
Social cost of air pollution derived from the supply chain	Procurement demand contributes to air pollution along the supply chain	Negative impacts on human health and ecosystems	Negative(-)	●●●●○○	↗	Environment	Supply chain (Indirect)	Supply Chain Sustainability Management
Social cost of wastewater derived from supply chain	Procurement demand contributes to wastewater along the supply chain	Emit methane that exacerbates global warming	Negative(-)	●●○○○○	↗	Environment	Supply chain (Indirect)	Supply Chain Sustainability Management
Social cost of waste disposal derived from supply chain	Procurement demand contributes to waste production along the supply chain	Negative impacts on global warming, human health, and ecosystems	Negative(-)	●●○○○○	↗	Environment	Supply chain (Indirect)	Supply Chain Sustainability Management
Social cost of occupational accidents from subcontractors	Subcontractors' occupational accidents	Impact and medical costs of employee well-being	Negative(-)	●○○○○○	↘	External employees	Company operations (Direct)	Safe and Healthy Work Environment
Economic value-added income	Create direct economic value for stakeholders	Enhance quality of life and purchasing power	Positive(+)	●●●●●○	↘	Society	Company operations (Direct)	Economic performance
Avoid social costs of GHG emissions	Use renewable energy to prevent GHG emissions	Mitigate climate risks caused by global warming	Positive(+)	●●○○○○	↗	Environment	Company operations (Direct)	Economic performance
Avoid social costs of GHG emissions	Promote energy saving measures to prevent GHG emissions	Mitigate climate risks caused by global warming	Positive(+)	●○○○○○	↘	Environment	Company operations (Direct)	Economic performance
Social cost of GHG emissions	GHG emissions from energy consumption	Elevates climate risks caused by global warming	Negative(-)	●●●○○○	↗	Environment	Company operations (Direct)	Climate Change and Net Zero Outcomes
Social cost of air pollution	Gasoline and diesel use causes air pollution	Negative impacts on human health and ecosystems	Negative(-)	●●●○○○	↘	Environment	Company operations (Direct)	Climate Change and Net Zero Outcomes
Social cost of water consumption	Water use depletes water resources	Causes water shortages or facilitates waterborne diseases, further impacting human health	Negative(-)	●●○○○○	↗	Environment	Company operations (Direct)	Water resource management
Social cost of waste disposal	Waste incineration and landfills causes air pollution and GHG emissions	Negative impacts on global warming, human health, and ecosystems	Negative(-)	●●○○○○	↗	Environment	Company operations (Direct)	Resource waste management
Employee training creates future income	Employee training hours	Training to improve professional skills and employability	Positive(+)	●●●●○○	↘	CTCI employees	Company operations (Direct)	Career Development and Training
Employee purchasing power and quality of life	Employee compensation and benefits	Enhance quality of life and purchasing power	Positive(+)	●●●●●○	↗	CTCI employees	Company operations (Direct)	Talent recruitment and retention
Social value of health promotion	People discovered to be obese or have high blood pressure, high cholesterol, or high blood sugar (2017-2021)	Risk of work-related cardiovascular diseases	Negative(-)	●●○○○○	↘	CTCI employees	Company operations (Direct)	Safe and Healthy Work Environment
Social value of health promotion	Health promotion reduces the risk of diseases (2017-2021)	Maintain work-life balance	Positive(+)	●●○○○○	↘	CTCI employees	Company operations (Direct)	Safe and Healthy Work Environment
Social value of health promotion	Investing in health promotion activities	Maintain work-life balance	Positive(+)	●●○○○○	↗	CTCI employees	Company operations (Direct)	Safe and Healthy Work Environment
Social costs of occupational accidents	Occupational accidents among employees	Impact and medical costs of employee well-being	Negative(-)	○○○○○○	—	CTCI employees	Company operations (Direct)	Safe and Healthy Work Environment
Social value of volunteering	Employee volunteering hours	Promote local and community connections	Positive(+)	●●○○○○	↗	Society	Company operations (Direct)	Social Influence
EPC projects create output value for our clients	EPC Projects facilitate industry supply and demand	Foster socio-economic development	Positive(+)	●●●●●●	↗	Society	Product and services (Indirect)	Economic Performance
Environmental benefits of green engineering	Help clients save energy and water and reduce emission of air pollution and carbon	Mitigate clients' environmental impact during maintaining and operating facilities	Positive(+)	●●●●●●	↘	Environment	Product and services (Indirect)	Net Zero Turnkey Projects and Green Engineering

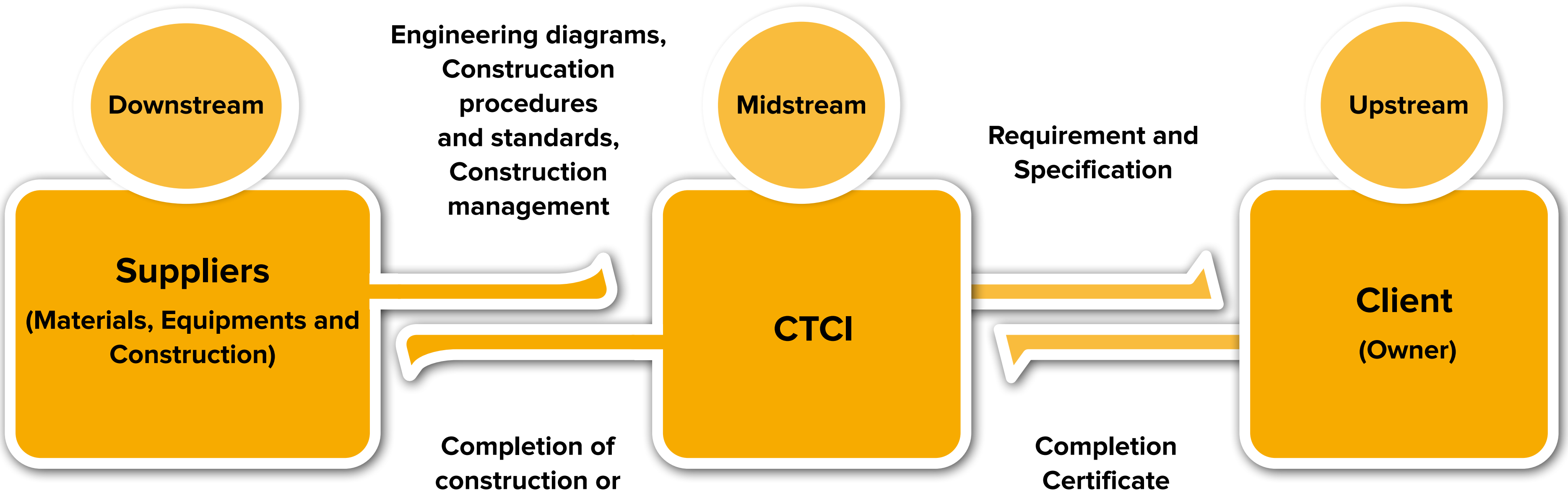
Methodology

There are four steps in assessing CTCI's sustainability impact: defining boundary and scope, mapping impact pathways, confirming data sources and quality, and establishing a valuation method. Each step is interconnected, and decisions made during each step may affect the integrity and accuracy of the final result.

Defining Boundary and Scope

CTCI provides services to the oil refinery, petroleum, chemical, natural gas, power generation, transportation, steel, and environmental engineering industries. CTCI, as an EPC (Engineering, Procurement, and Construction) turnkey company, is at the middle of the industry supply chain. CTCI provides comprehensive professional services by integrating upstream customer demands and collaborating with downstream partners, forming a complete industrial value chain.

- Downstream (Subcontractors): includes materials, equipment suppliers, and building contractors, etc.
- EPC (CTCI): includes CTCI HQ and construction sites all across the world.
- Upstream (Clients): includes feasibility analysis, planning, engineering design, procurement services, equipment supply, construction, and commissioning services for EPC projects.



Mapping Impact Pathway

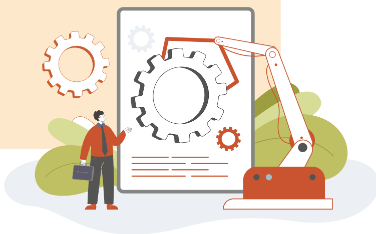
To assess the direct/indirect, positive/negative, long-/short-term, and global/local impacts of value chain activities on stakeholders, CTCI uses the Impact Pathway to track the input and output of operations, the changes to stakeholders' quality of life, and the subsequent social value or cost. We also connect them with ESG issues to evaluate complex causal relationships and identify impacts through systematic reasoning.

Sustainable Impact of CTCI		Output Metric	Impact Metric		Stakeholders	Cause of the Impact	ESG Issue
Supply chain output value elevated	➡ +	Procurement demand drives industry supply and demand	Promote social and economic development	➡	Society	Supply chain (Indirect)	
Supply chain employee salary income	➡ +	Procurement demand creates job opportunities	Enhance quality of life and purchasing power	➡	External employees	Supply chain (Indirect)	
Social cost of GHG emissions derived from the supply chain	➡ —	Procurement demand contributes to GHG emissions along the supply chain	Elevates climate risks caused by global warming	➡	Environment	Supply chain (Indirect)	
Social cost of air pollution derived from the supply chain	➡ —	Procurement demand contributes to air pollution along the supply chain	Negative impacts on human health and ecosystems	➡	Environment	Supply chain (Indirect)	Supply Chain Sustainability Management
Social cost of wastewater derived from supply chain	➡ —	Procurement demand contributes to wastewater along the supply chain	Emit methane that exacerbates global warming	➡	Environment	Supply chain (Indirect)	
Social cost of waste disposal derived from supply chain	➡ —	Procurement demand contributes to waste production along the supply chain	Negative impacts on global warming, human health, and ecosystems	➡	Environment	Supply chain (Indirect)	
Social cost of occupational accidents from subcontractors	➡ —	Subcontractors' occupational accidents	Impact and medical costs of employee well-being	➡	External employees	Company operations (Direct)	Safe and Healthy Work Environment
Economic value-added income	➡ +	Create direct economic value for stakeholders	Enhance quality of life and purchasing power	➡	Society	Company operations (Direct)	Economic performance
Avoid social costs of GHG emissions	➡ +	Use renewable energy to prevent GHG emissions	Mitigate climate risks caused by global warming	➡	Environment	Company operations (Direct)	
Avoid social costs of GHG emissions	➡ +	Promote energy saving measures to prevent GHG emissions	Mitigate climate risks caused by global warming	➡	Environment	Company operations (Direct)	Climate Change and Net Zero Outcomes
Social cost of GHG emissions	➡ —	GHG emissions from energy consumption	Elevates climate risks caused by global warming	➡	Environment	Company operations (Direct)	
Social cost of air pollution	➡ —	Gasoline and diesel use causes air pollution	Negative impacts on human health and ecosystems	➡	Environment	Company operations (Direct)	
Social cost of water consumption	➡ —	Water use depletes water resources	Causes water shortages or facilitates waterborne diseases, further impacting human health	➡	Environment	Company operations (Direct)	Water resource management
Social cost of waste disposal	➡ —	Waste incineration and landfills causes air pollution and GHG emissions	Negative impacts on global warming, human health, and ecosystems	➡	Environment	Company operations (Direct)	Resource waste management
Employee training creates future income	➡ +	Employee training hours	Training to improve professional skills and employability	➡	CTCI employees	Company operations (Direct)	Career Development and Training
Employee purchasing power and quality of life	➡ +	Employee salary and benefits	Enhance quality of life and purchasing power	➡	CTCI employees	Company operations (Direct)	Talent recruitment and retention
Social value of health promotion	➡ —	People discovered to be obese or have high blood pressure, high cholesterol, or high blood sugar (2017-2021)	Risk of work-related cardiovascular diseases	➡	CTCI employees	Company operations (Direct)	
Social value of health promotion	➡ +	Health promotion reduces the risk of diseases (2017-2021)	Maintain work-life balance	➡	CTCI employees	Company operations (Direct)	
Social value of health promotion	➡ +	Investing in health promotion activities	Maintain work-life balance	➡	CTCI employees	Company operations (Direct)	Safe and Healthy Work Environment
Social costs of occupational accidents	➡ —	Occupational accidents among employees	Impact and medical costs of employee well-being	➡	CTCI employees	Company operations (Direct)	
Social value of volunteering	➡ +	Employee volunteering hours	Promote local and community connections	➡	Society	Company operations (Direct)	Social influence
EPC projects create output value for our clients	➡ +	EPC Projects facilitate industry supply and demand	Promote local and community connections	➡	Society	Product and services (Indirect)	Economic performance
Environmental benefits of green engineering	➡ +	Help clients save energy and water and reduce emission of air pollution and carbon	Reduce clients' environmental impact when maintaining their facilities	➡	Environment	Product and services (Indirect)	Net zero turnkey projects and green engineerings

Confirming Data Sources

The activity data sources include primary data (original data collected from actual inventory) and secondary data (collected from relevant literature, databases, or estimation). When assessing the sustainability impact, primary data, whose quality is higher, takes precedence over secondary data. However, secondary data will be used when primary data is unavailable. For example, the relationships between supply and demand of each industry within the supply chain, and the volume of pollution generated per output value unit, could only be obtained from country-level investigation reports and estimated by industry average.

		Supply Chain	Production and Operation	Products and Services
Economic	Activity data	Amount of procurement/ Relationship between industry supply and demand	Internal financial profit and loss indicators	Construction revenue / Relationship between industry supply and demand
	Data quality	**Primary and Secondary data**	**Primary data**	**Primary and Secondary data**
	Impact Categories	Supply chain output value generated	Direct economic value generated	Industry chain output value generated
Environmental	Activity data	Industry average databases	Energy resources and pollution generation	Energy resources and pollution generation
	Data quality	**Secondary data**	**Primary data**	**Secondary data**
	Impact Categories	Social cost of carbon, Human health and Ecosystem loss		
Social	Activity data	Industry average databases	Employee occupational accidents, health examinations, remuneration, etc.	Methodology under development
	Data quality	**Secondary data**	**Primary data**	
	Impact Categories	Creating job opportunities and salary income	Change to personal or social welfare	



Establishing a Valuation Method

CTCI's sustainability impact management framework covers the three major stages of the value chain (upstream/midstream/downstream), the three significant sustainability management aspects (economic/environmental/social), and 13 impact indicators. The methodology refers to the practices of benchmark companies in Taiwan and abroad and relevant research.

Boundary	Scope	Impact indicators	Calculation methodology
Downstream (subcontractors)	Economic	Supply chain output value gained from procurement	The report uses Input-Output Analysis (IOA) model to assess the economic benefit derived from gains in supply and demand of the industry chain generated by procurement activities, the external environmental costs from greenhouse gas emissions, wastewater disposal, waste disposal (incineration) as well as air pollution, and the positive impact such as job opportunities and salary income gained to the supply chain.
	Environmental	Social cost generated by the environmental footprint of the supply chain	
	Social	Supply chain employee salary income generated from procurement	
Midstream (CTCI)	Economic	Direct economic contribution	The report uses Gross Value added (GVA) method to examine the value flow for stakeholders in operations, including business revenue (customers), R&D investment (customers), dividends (shareholders/investors), compensation and benefits (employee), taxes (government), depreciation and amortization (suppliers).
	Environmental	Social costs from greenhouse gas emissions, water consumption, air pollution, wastewater disposal, and waste treatment	The report applies the Environmental Profit and Loss (EP&L) mindset to assess the external environmental cost generated by energy and resource depletion, emissions, and pollution during the company's operations, and evaluate the company's efforts in mitigating the negative impact on the society.
	Social	Future income generated from employee training	The report refers to VBA (2021) methodology to assess the professional skills and knowledge that employees gained from the company's training programs, which improves their productivity, competitiveness, and salary income for their future career.
		Social cost from occupational accidents	The report refers to the research report by the UK's Health and Safety Executive (HSE, 2017), which considers the loss of productivity due to work injury, compensation for occupational accidents, and the willingness to avoid occupational accidents in calculating the social cost.
		Social benefit gained from health promotion	The aims are early detection of hypertension, hyperlipidemia, hyperglycemia, and obesity through regular health examinations to formulate health promotion plans to reduce or avoid cardiovascular diseases and the medical costs derived from such diseases.
Upstream (clients)	Economic	EPC projects create output value for our clients	The report considers the supply and demand relationship for customers' industry chain from EPC services to assess the generated indirect economic value.
	Environmental	Environmental benefits of green engineering	Through green technology, green contracting, and green investments, CTCI helps clients conserve energy, reduce carbon emissions, and cut costs, preventing producing external environmental costs derived from plant maintenance.

Since the currency value conversion factors come from several different studies, CTCI follows the ISO 14008:2019 definitions of environmental impact and relevant currency valuation frameworks. The base year is 2017, and the conversions are adjusted according to geography and time.

❶ Geographic adjustment：

the report uses the Purchasing Power Parity (PPP) of each region to adjust the weighting (OECD, 2012) of Gross National Income (GNI). The equation is listed below.

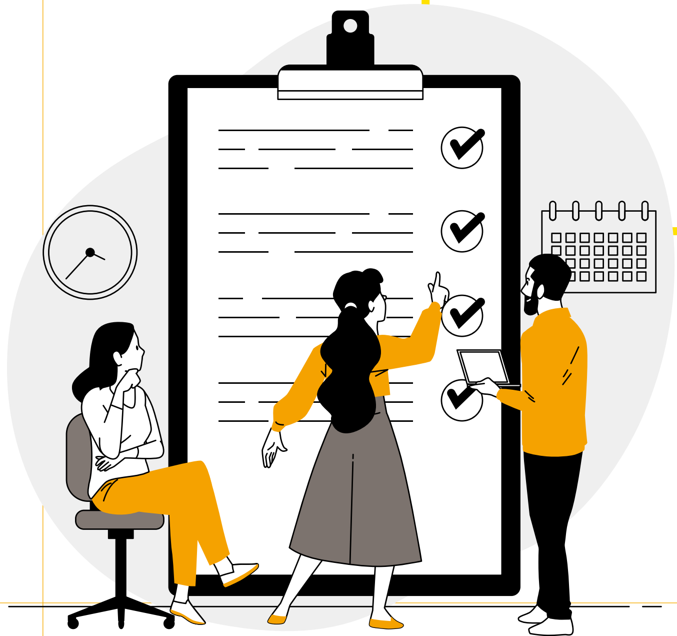
$$Ei=(Yi/Yref)^{\epsilon}$$

Ei is the weighting undergoing income adjustment

Yi is the adjusted GNI of the region undergoing value conversion according to the region's PPP

Yref is the adjusted GNI of the region for original studies according to the region's PPP

ϵ Income elasticity factor refers to the relationship between WTP and income. The value is between 0 and 1. 1 indicates a positive correlation between WTP and income, while 0 shows that the WTP is not correlated with income. The report adopts the recommended value of 0.6 by PwC UK (2015).



❷ Temporal adjustment：

the report considers inflation and exchange rates when adjusting the currency value in different periods to the currency value in the base year.

Results

Procurement-Driven Supply Chain Production Value

Due to the complex interdependencies present in economic activities across industries, the Input-Output model developed by Nobel Laureate Wassily Leontief in the 1930s and 1940s can allocate production input factors across industries to the final demand for goods, with company activities leading to changes in final demand (VBA, 2021). This model is typically compiled by governments or scientific research institutions based on real financial data and presented in the form of industry-related tables. In this report, the Input-Output model is used to identify the impact of procurement expenditure on the supply and demand structure within the industrial chain, including production value, employment, and wages. Additionally, it is extended to calculate emissions of various pollutants.

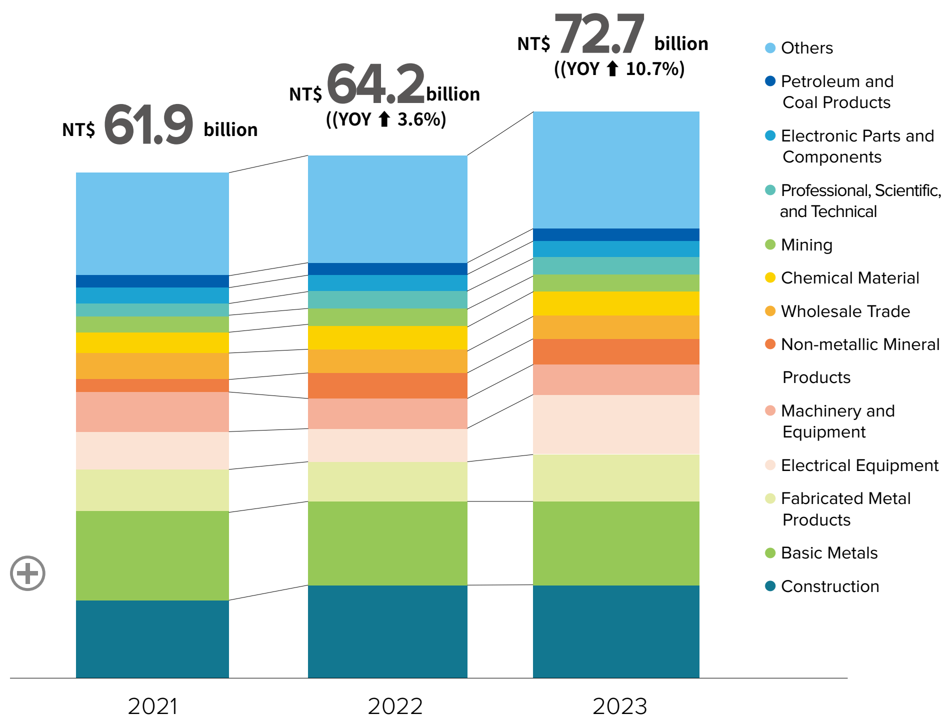
Calculation

- In this report, the supply and demand relationships across industries are calculated based on the 2016 Industrial Input-Output Table published by the Directorate General of Budget, Accounting and Statistics (2020).

Result

In 2023, the supply chain production value generated by CTCI's procurement demand was approximately NT$72.7 billion. The sectors contributing the most to this value were the "Basic Metal Industry" (accounting for 15.9%), the "Construction Engineering Industry" (accounting for 15.5%), and the "Machinery and Equipment Industry" (accounting for 10.1%).

By observing recent trends, the supply chain production value driven by CTCI in 2023 grew by 10.7% compared to the previous year. The most significant impact came from the "Machinery and Equipment Industry" where procurement contracts increased by 1.4 times. This growth was mainly due to several large-scale power plant projects undertaken by CTCI, which involved substantial equipment procurement and installation work in 2023.



Procurement creates wage income for supply chain employees

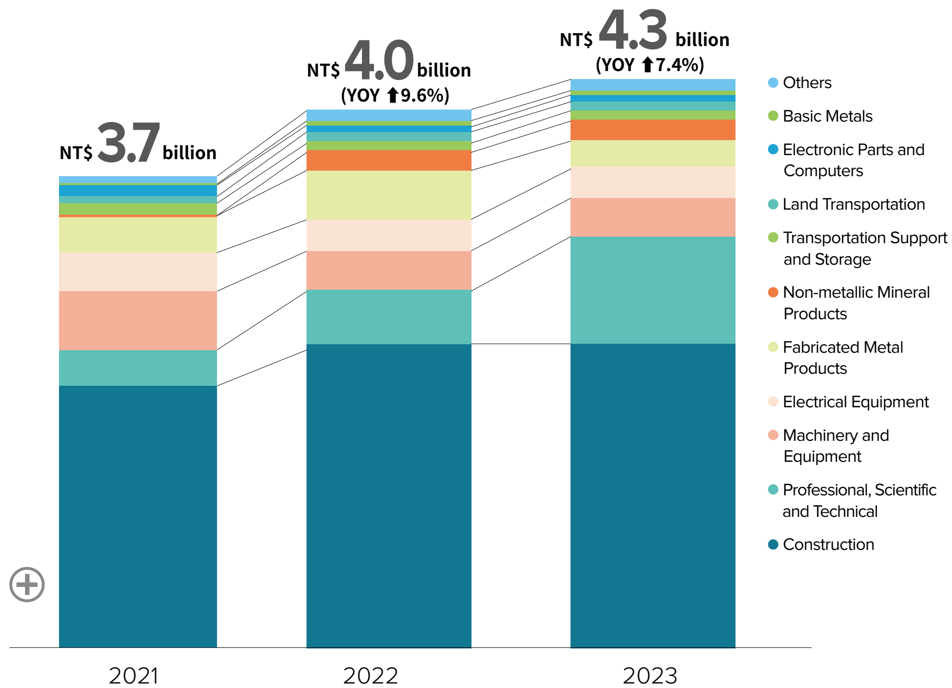
In the Input-Output analysis model, all input factors from both the direct production and service processes of suppliers (direct) and their upstream stages (indirect) are included in the calculations. These factors are allocated based on changes in final demand from company activities (VBA, 2021). This model allows the analysis of the entire industrial chain, assessing the direct and indirect resources needed to meet the changes in final demand from procurement needs. These resources include hiring employees and wage expenditures, among others.

Calculation

- This report refers to the Exiobase 2 Input-Output database and utilizes Taiwan's industry coefficients for calculations.

Result

In 2023, CTCI's procurement demand created 15,000 supply chain jobs, generating NT$4.3 billion in wage income as a social externality benefit for workers, with 54.9% from the "Construction Engineering Industry" contributing the most. By observing recent trends, it is found that the wage income generated from supply chain employment in 2023 grew by 7.4% compared to the previous year, with the "Machinery and Equipment Industry" experiencing the largest increase by 142%.



The environmental footprint derived from the supply chain.

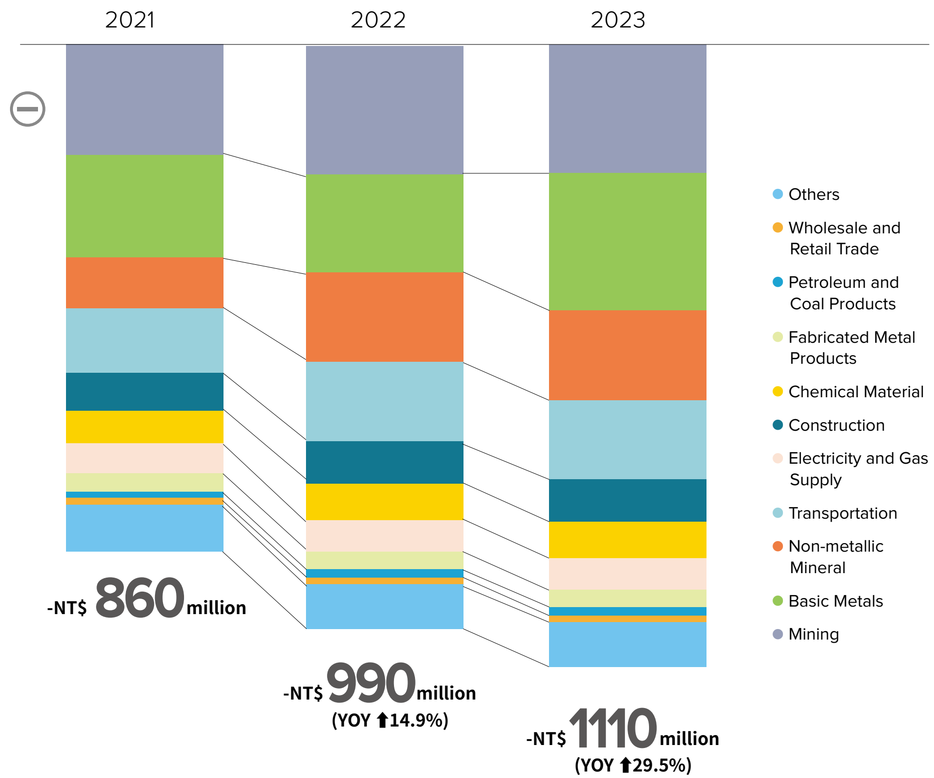
The Input-Output analysis model is widely used for Economic Impact Analysis (EIA) and Environmentally Extended Input-Output Analysis (EEIO) (VBA, 2021). Traditional Input-Output tables are used to clarify the interactions between various industries (Miller & Blair, 2009). In contrast, EEIO integrates environmental impact information from different industries, providing a straightforward and robust method for assessing the linkages between economic consumption activities and environmental impacts (Kitzes, 2013).

Calculation

- To identify the relationship between procurement expenditure across various industries and environmental impacts, this report follows the EEIO methodology, analyzing publicly available statistical information from the Directorate General of Budget, Accounting and Statistics and the Bureau of Energy for the calculation of pollutant emissions per unit of output for each industry. Pollutants include greenhouse gases, water pollution (COD), waste (incineration), and air pollution (PM2.5, NOx, SOx, NMHC, Pb), which are then evaluated using monetization coefficients to assess the resulting social costs.

Result

In 2023, CTCI's procurement demand resulted in approximately NT$1.11 billion in environmental externality costs within the supply chain, mainly from non-metallic mineral and basic metal product industries, along with their upstream raw material mining activity, accounting for 52.3%. The environmental footprint of the transportation sector ranked second, accounting for 16.7%. By observing recent trends, the environmental externality costs derived from the supply chain increased by 29.5% compared to the previous year. This increase is primarily related to higher procurement expenditures in the "Machinery and Equipment Industry", "Non-metallic Mineral Products Industry", and "Water Transportation Industry".



Direct Economic Contribution

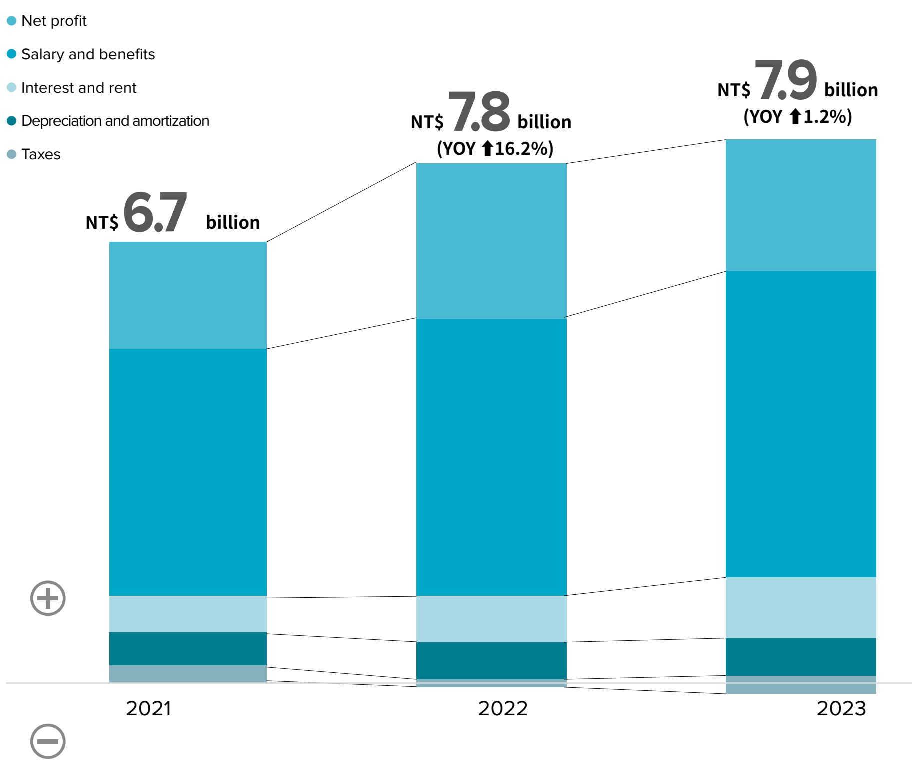
Gross Value added (GVA) method is used to assess the difference between the final output and the input during business operations. It also takes the benefits to various stakeholders, including operating income, employment costs, and taxes, from economic activities such as original input and public spending into consideration. Therefore, GVA serves as a foundation to understand the contributions to stakeholders' benefits from a company. (VBA, 2021). The report applies the GVA method to reexamine the value flows created through business operations for stakeholders, including operating income (customers/shareholders/investors), compensation and benefits (employee), taxes (government), depreciation, and amortization (suppliers).

Calculation

- Relevant information comes from the financial profit and loss data in CTCI's annual financial statement.

Result

In 2023, CTCI generated an economic value of NT$3.2 billion for external stakeholders through its operational processes. This includes operating income, investment in new technology research and development, interest and lease payments, tax contributions1, and depreciation and amortization. These efforts contribute to the success of customers and suppliers, support government welfare policies, provide investors with high-quality returns, and foster socio-economic growth. Additionally, expenses in compensation and benefits led to a NT$4.7 billion increase in improving CTCI employees' living standards and purchasing power.

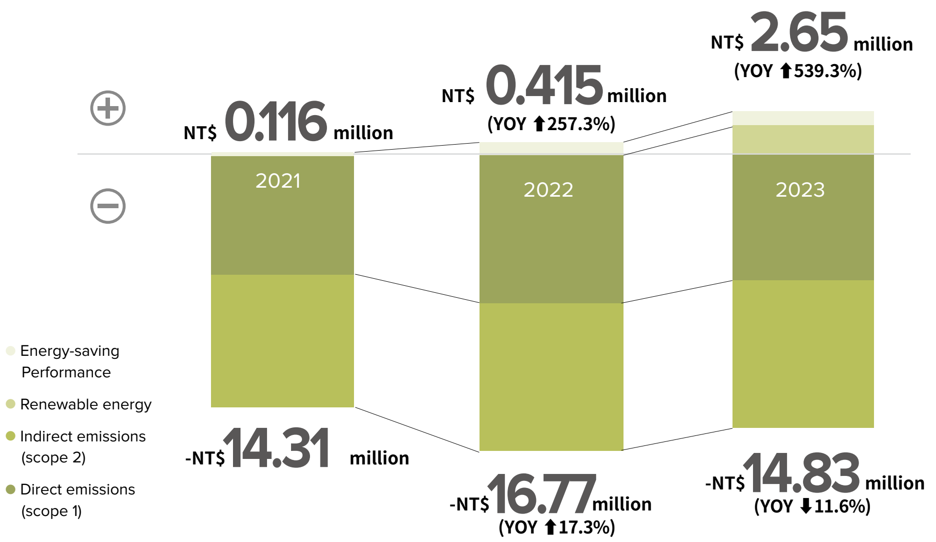


Social Cost of Greenhouse Gas Emissions

Greenhouse gas (GHG) refers to a kind of gas that absorbs and emits radiant energy, causing heat to be trapped in the Earth' s surface and troposphere, thereby resulting in greenhouse effects. Seven kinds of GHGs have been categorized by the Conference of the Parties (COP), including carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulphur hexafluoride (SF6), nitrogen trifluoride (NF3), various hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). The report calculated the external environmental value of business operations based on the social cost of carbon generated by greenhouse gas emissions.

Calculation

- The Social Cost of Carbon (SCC) developed by the US Environmental Protection Agency (US EPA, 2016) is used as the valuation factor of external costs per unit from greenhouse gas emissions. The external costs refer to the social costs of long-term physical and economic damage worldwide resulting from climate change, including loss of money, property, and damage to human health from natural disasters, as well as the economic tradeoff for energy transition to avoid further warming. The US EPA converts the costs of future damages at discount rates of 2.5%, 3%, and 5% to current values[1]. The report opted for the median value of 3%.
- The comprehensive assessment model adopted to evaluate social cost of carbon focuses on the global impact of the increase in the concentration of GHG from carbon emissions, which does not differ according to geographic backgrounds. However, various uncertain factors remain, including the impacts on catastrophe and non-catastrophe, adapting to climate change and changes in technology, the estimation of damages from rising temperatures, and the assumption of risk aversion.
- Scope 3 emissions (other indirect greenhouse gas emissions) are excluded from the report for covering a wide range of aspects and having limited cases of application on environmental profit and loss.



Result

CTCI headquarters and global construction sites generated a total of 9,494 metric tons of CO2e emissions through direct (Scope 1) or indirect (Scope 2) sources in 2023. The associated environmental externality cost totaled approximately NT$14.83 million, 44.7% of which were direct emissions from production and operational processes, including combustion, mobile sources, process emissions, and fugitive emissions. The remaining 55.3% of environmental externality cost was indirect emissions from energy consumption[4]. Additionally, a total of 3,030 MWh of renewable energy was subscribed and generated by CTCI. By implementing various energy-saving measures, CTCI saved a total of 400 MWh of energy and 1,700 metric tons of CO2e emissions - equivalent to approximately NT$2.65 million in carbon reduction benefits.

To demonstrate a stronger commitment to carbon reduction, CTCI set 2022 as the base year and, in accordance with the Science Based Targets initiative (SBTi) to limit global average temperature rise to 1.5°C, established carbon reduction targets and planned reduction pathways. The short-term goal is to achieve a 21% absolute reduction in greenhouse gas emissions (Scope 1 and Scope 2) by 2025, with the mid-term target of a 45% absolute reduction by 2030. The long-term goal is to reach net-zero emissions by 2050. In 2024, the company officially passed the review of SBTi, aiming to lead the engineering industry towards a sustainable future and create a better world for the next generation.

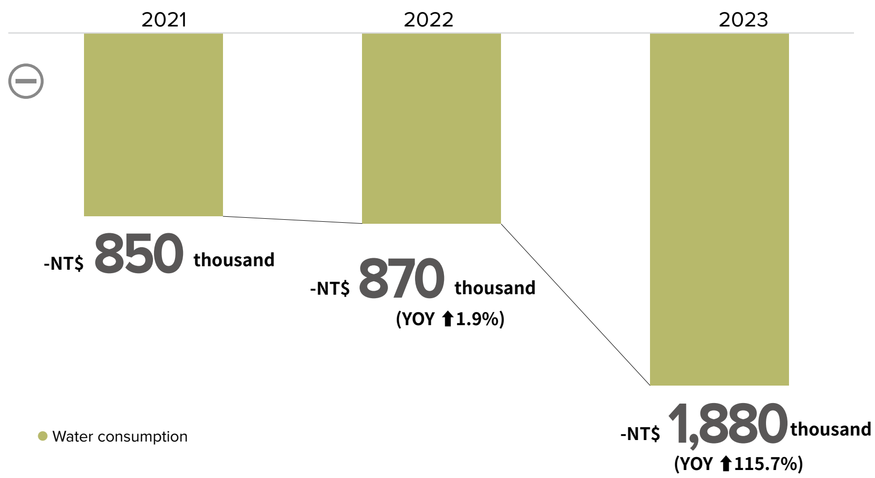
Note 1 ; A high discount rate means that people are willing to pay more attention to short-term rather than long-term benefits (Yan, 2014).
Note 4 ; Scope 2 Calculations with Market-Based Approach

Social Cost of Water Consumption

Water demand that meets basic human needs can be put in mainly three categories: domestic, agricultural, and industrial (UNEP, 2016). According to Bayart et al. (2010) and Kounina et al. (2013), water scarcity may pose potential health risk in various ways. For example, overconsumption of freshwater can lead to irrigation water scarcity , causing a reduction on food production, which subsequently results in health degradation due to malnutrition. On the other hand, the scarcity of clean domestic water may result in waterborne diseases. This report assumes that the water used in business operations directly impacts the water available for domestic and agricultural uses. Thus, we estimate the environmental externality derived from damage to human health using the characterization factors (CFs) [5], which determine the impact of water scarcity on human health and convert it into monetary value based on statistical life (VSL).

Calculation

- Agricultural water shortage: Refers to characteristic factors of malnutrition caused by agricultural water shortage (LC-Impact,2016). The regional differences factors are the agricultural water percentage, Water Stress Index (WSI), and human development index (HDI).
- Domestic water shortage: Refers to characteristic factors of waterborne diseases caused by domestic water shortage (Motoshita et al., 2011). The diseases include roundworm, whipworm, hookworm, and diarrhea.
- The valuation methodology of damage to the ecosystem from water depletion is still under development; therefore, this item is excluded from the assessment.
- The environmental impact of water supply facilities is excluded due to low data availability.



Result

In 2023, the total water consumption of CTCI headquarters and global construction sites is a total of 432,712 m^3 - resulting in NT$1.88 million in environmental externalities. This is a 115.7% slight increase from the previous year. The rise was primarily attributed to an increase in the number of staff at the headquarters compared to the previous year, although the per capita water usage did not surpass previous levels. Additionally, significant water usage was observed at several construction sites due to pile driving activities. CTCI has implemented measures such as installing automatic sensor faucets to control water usage by regulating water flow and duration. Moreover, various water-saving slogans have been placed to remind colleagues to conserve water. Rainwater harvesting systems have been installed on the rooftops of both the headquarters building and construction sites for construction purpose, as well as to irrigate plants in open spaces. Efforts have been made to improve water efficiency by incorporating the headquarters' domestic water consumption into efficiency enhancement goals and implementing measures to reduce water usage during construction processes. These measures include quantifying water recycling and savings, such as utilizing sedimentation tanks to reclaim rainwater and surface runoff, storing and reusing water from leak testing, and recycling water from pressure tests.

Note 5: Refers to changes caused by resource depletion and pollution, such as increased concentration of particulates in the air, that affect human health or the ecosystem.

Social Cost of Air Pollution

Air pollution that produces primary and secondary aerosols in the atmosphere can have a substantial negative impact on human health (WHO, 2006; HEIMTSA, 2011; Burnett et al., 2014; Lelieveld et al., 2015). After engine combustion, gasoline and diesel produce air pollutants including nitrogen oxides (NOx), sulfur oxides (SOx), total organic compounds (TOC), carbon monoxide (CO), and particulate matter (PM). The formation of NOx is directly related to the high temperature, high pressure, and nitrogen content in the fuel during combustion. SOx are mainly composed of sulfur dioxide (SO_2) and its formation is directly related to the nitrogen content in the fuel. Other pollutants result from incomplete combustion. Additionally, the ash content and metal additives in the fuel can increase the particulate matter content in the exhaust gases (US EPA, 1996). The report estimates the environmental externality using the characterization factors (CFs), which determine the impact of air pollutants on human health and the ecosystems, and convert into monetary value based on statistical life (VSL) and willingness to pay (WTP).

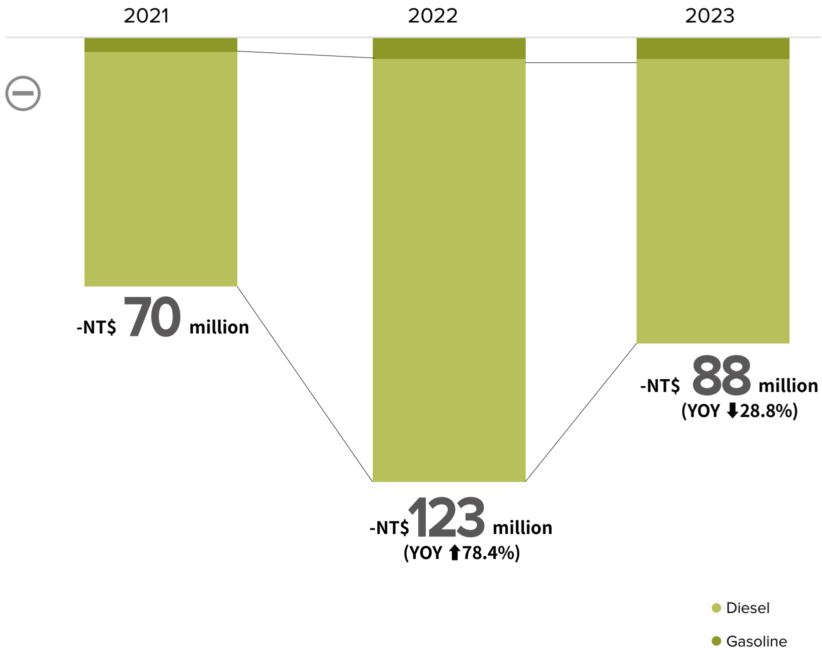
Calculation

- This report references the US EPA (1996) and the Eco-indicator 99 database to calculate the characterization factors for human health and ecosystem losses caused by air pollution.

Result

In 2023, CTCI headquarters and global construction sites consumed 276,126 liters of gasoline and 1,263,408 liters of diesel, incurring an environmental externality cost of approximately NT$87.67 million due to air pollution emissions. This represents a 28.8% decrease from the previous year, primarily attributed to reduced usage of emergency generators at construction sites, with grid electricity being the main power source, and enhanced energy usage performance management.

CTCI continues to monitor various energy consumption levels and performance indicators, compiling annual performance reports then presented to the Chairman. The aim is to analyze trends in operational energy efficiency over the years, aiding in the formulation and implementation of relevant policies. These efforts serve as a reference for future carbon reduction and energy-saving goals, gradually realizing CTCI's vision for low-carbon development.



Social Cost of Waste Disposal

Waste incineration produces a wide variety of air pollutants. PM, NOx, SOx, dioxins, and heavy metals are especially harmful, as they can greatly affect human health, causing cancer or cognitive impairment.(EXIOPOL, 2009; PwC UK, 2015). The atmospheric sedimentation of inorganic materials (such as sulfates, nitrates, and phosphates) would cause soil acidification, affecting terrestrial ecosystems (Goedkoop et al., 1999; Hayashi et al., 2004). The report estimates the environmental externality using the characterization factors (CFs), which determine the impact of air pollutants generated during waste incineration on human health and the ecosystems, and convert into monetary value based on statistical life (VSL) and willingness to pay (WTP). The report also considers the environmental externality derived from greenhouse gas emissions caused by waste incineration or landfill degradation.

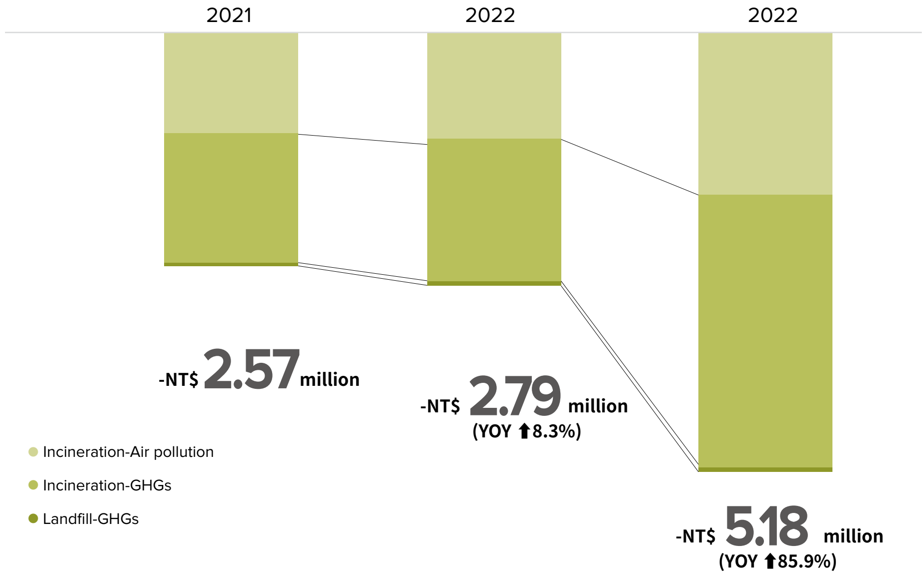
Calculation

- The volumes of waste air pollutants generated during waste incineration, based on the air pollution factor, are calculated using the actual monitoring data of 24 incineration plants in Taiwan. The study also refers to relevant characteristic factors in the USEtox and Eco-indicator 99 databases to estimate the impact of air pollutants on human health and biodiversity.
- The greenhouse gas emissions from waste incineration and landfill disposal are calculated using the IPCC (2006) methodology and EPA statistic data. The study also refers to US EPA's (2016) research to estimate the social cost of carbon.
- Other sources of externality are irrelevant to the main impact issues and thus are excluded.
- The waste recycling technologies are excluded due to their complexity and low data availability.

Result

In 2023, the incineration and landfill disposal of waste at CTCI headquarters and global construction sites amounted to 3,456 tons and 23 tons, respectively, resulting in an environmental externality cost of approximately NT$5.18 million, primarily due to greenhouse gas and air pollutant emissions from the incineration process. From recent trends, the social costs associated with waste disposal have increased by 85.9% compared to the previous year, mainly due to the peak construction activities at large-scale construction sites, resulting in increased general and construction waste generation.

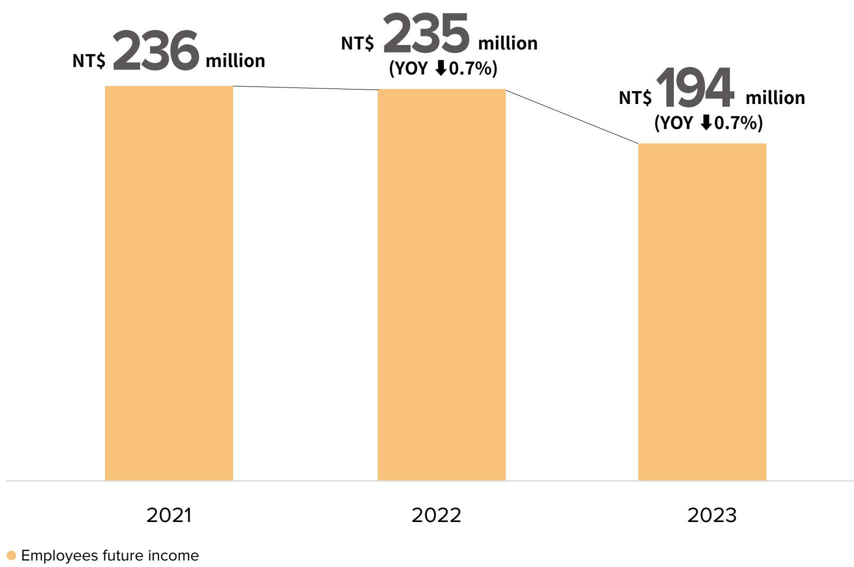
Principles for CTCI's construction focused on minimize waste generation at construction sites and setting comprehensive waste reduction targets in management and prevent wastage.



Additionally, manpower is invested in waste repurpose and reuse, such as crushing waste concrete blocks for use in gradation for on-site paving. All project execution should adhere to the Company's Project Engineering Surplus Materials Management Procedure, which discloses and controls surplus materials generated during project execution through real-time platforms. Furthermore, a purchase and repurchase mechanism is established to encourage staff to propose alternative solutions, aiming to minimize the amount of surplus material and maximize flexibility in utilization, thus reducing the environmental externalities associated with waste generation as much as possible.

Employee Training Creates Future Income

Employee experience and skills are crucial to a company's long-term development. Training increases productivity, which leads to a growth in business revenue for the company, along withemployment competitiveness for individual employees. This benefits the employees' future career development, boosting salary income and improving their quality of life and purchasing power. This study refers to the VBA (2021) methodology and targets indirect employees. The aim is to estimate the positive social externality, i.e., the expected increase in salary income in the future career development of the employees, generated by training resources a company provides that improve employee professional know-how and skills. The report considers impact factors such as employee salary, hours of training, salary adjustment rate, employee turnover, retirement age, and conversion rates to the current value.



Calculation

- Employee salary used to calculate the social externality from employee training is based on CTCI's internal statistic data. The retirement age used was 65, and the discount rate was 3%.
- Since the increase in revenue and decrease in operational costs resulting from improved productivity due to training is already reflected in the company's financial statement, such a positive impact was excluded. This indicator only reflects the contribution of CTCI's training program to the expected salary benefits for departing employees' future career development.

Result

In 2022, the average training hours per employee at CTCI was 61 hours. The training programs designed for employee career development resulted in a social externality benefit of approximately NT$235 million. CTCI invests significant resources in talent development, aiming to attract like-minded professionals. The company has a comprehensive plan for education and training, which includes programs for new employees as well as specialized training tailored to different job roles. In addition to individual development plans for each employee, CTCI consistently allocates resources for building management capabilities, implementing mentorship programs, and providing online learning courses. These initiatives encourage continuous learning and growth among employees, fostering a stronger identification with CTCI corporate culture and values. This ensures that talent development aligns with our strategic objectives, drives diversified business and global expansion, and creates a long-term positive impact on employees' future careers.

Social Cost of Occupational Accidents

A UK Health and Safety Executive (HSE, 2020) study states that the social costs derived from employee occupational accidents include financial and human costs. Financial costs included a loss in productivity, medical and recovery expenses, administrative and legal fees, salary, and insurance claims. Human cost refers to the individual's willingness to pay to reduce the risks of occupational injuries or death. While calculating the social externality derived from occupational accidents, this report includes disability and deaths in the assessment. The financial cost covered in this report contains loss in productivity and compensation for occupational accidents. In contrast, human cost consists of the willingness to pay to avoid occupational accidents and the economic loss caused by death in occupational accidents, all of which led to the social externalities derived from occupational hazards.

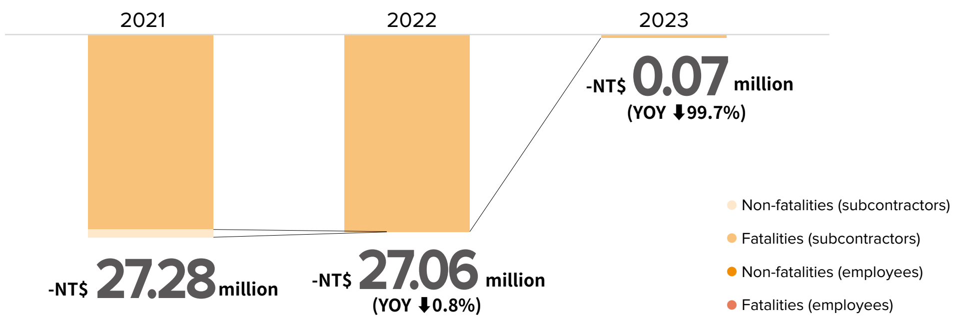
Calculation

- The reference of the financial cost caused by occupational accidents came from CTCI's internal statistic data. In contrast, the reference of the human cost came from the studies by Jiune-Jye Ho (2005) and Charng-cheng Tsaur et al. (2013) on the willingness to pay to avoid occupational accidents and the economic loss caused by deaths in occupational accidents.
- Loss in productivity and employer compensation for occupational accidents are reflected in a company's financial statement and thus are excluded.
- Since the methodology involving occupational illnesses is more complex, it is excluded from the assessment.

Result

In 2023, the social externality cost arising from occupational accidents in CTCI operations amounted to approximately NT$70 thousand. These costs were solely associated with occupational accidents involving subcontractors, resulting in losing 32 workdays. The main causes of these accidents were attributed to being caught in machines, objects flying, falling or collapsing. There was no occupational fatality in 2023, achieving the safety goal of zero fatalities.

To minimize the risk and damage after an incident, the Company has established a standard procedure for incident investigation. When an incident happens, the incident is first assessed in terms of severity level, and a corresponding seniority of personnel is assigned to investigate the matter within a given timeframe. Improvement measures will be adopted according to the investigation results, followed by the issuance of case studies (Lessons Learned) for future guidance, and require all the sites to enhance the training for employees and contractors. Feedback from engineering design, procurement, and construction units is collected to assess systemic risk. Improvements are made to policies and procedures to prevent future occurrences. For recent accidents, we continuously review and suggest improvements, including conducting audits on both weekdays and weekends and ensuring immediate correction of site defects within due days. In addition, we ensure effective HSE communication with subcontractors through various methods, including work safety analysis meetings, and HSE coordination meetings. Moreover, we have created lessons titled "CTCI Ten-Year Accident Analysis: Lessons and Learned" and "CTCI Manager HSE Management" at the CTCI University platform. These courses have been integrated into position-specific training programs for managers at all levels, as well as for HSE personnel and construction workers, to raise HSE awareness at all levels.



Social Value of Health Promotion

According to statistics from the Ministry of Health and Welfare, cardiovascular diseases have always been the top three on the list of top 10 causes of death in Taiwan. Epidemiologists view hypertension, high cholesterol, diabetes, and obesity as potential causes of cardiovascular diseases (Anderson et al., 1991). The report assesses the medical costs reduced by CTCI's measures to eliminate or reduce the risks of employees getting cardiovascular diseases from a risk attribution perspective. The measures include regular health examinations, personalized health management, and various health promotion activities.

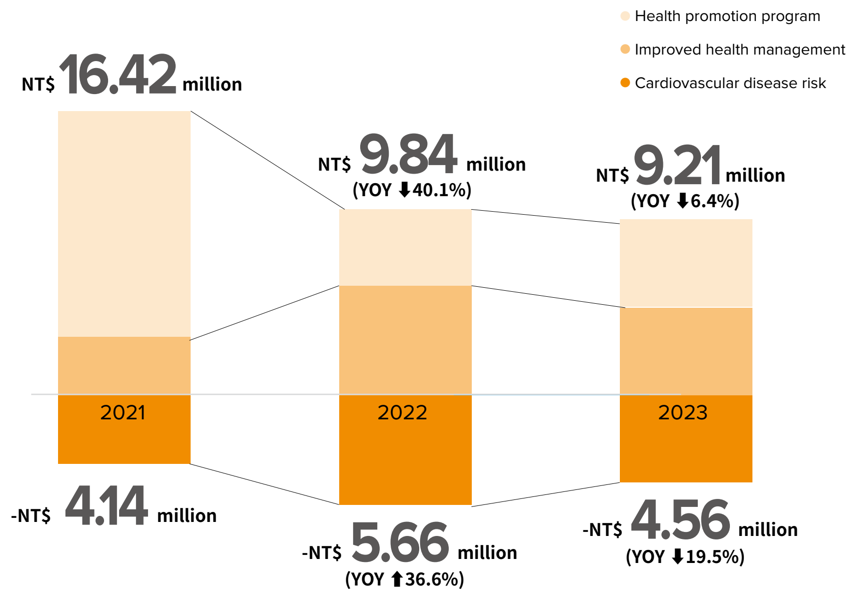
Comprehensive health check-ups contribute to the early detection of diseases. Each year, CTCI subsidizes health check-ups, and employees are encouraged to undergo requisite examinations within the regulatory time frame[2]. CTCI has a network of 18 partner hospitals across Taiwan, ensuring that employees have access to a wide range of examination options tailored to their individual health conditions. Employees may make informed decisions regarding suitable health check-up plans, self-care, and timely medical intervention when necessary.

Calculation

- The World Health Organization (WHO, 2008) stated that harmful work conditions would lead to a number of potential risks to the employees' health. In particular, 50% of the increased risk of cardiovascular diseases is related to stress at work (Marmot, 2004; Kivimäki et al., 2006).
- Chieh-Hsien Lee (2010) illustrated the attributing risk factors of hypertension, high cholesterol, diabetes, and obesity that may lead to cardiovascular diseases and applied the Travel Cost Method to discuss the economic benefit of eliminating cardiovascular diseases.

Result

In the 2023 health examination, the number of employees found to have potential factors for cardiovascular diseases such as hypertension, hyperglycemia, hyperlipidemia, and obesity were 198, 50, 230, and 361 respectively. The possible investment in social medical resources is approximately NT$ 4.56 million .CTCI Healthcare Center provided individual health monitoring and arranged for doctors to give health advice and remind patients to seek medical help. The subsequent health improvements for employees conserved roughly NT$4.56 million in healthcare costs. CTCI is dedicated to creating a health and friendly workplace environment. We keep our employees healthy and keep up with their health condition so as to provide them with a stable and safe working environment. Recently, the Healthcare Center has been making breakthroughs in traditional healthcare management applying system models.



A total of NT$ 4.66 million will be invested in health promotion in 2023, which will be used for employee health management, health management platform, epidemic prevention and control measures along with other health-related services. It is CTCI's hope to provide employees with comprehensive health management, prevent occupational diseases, and promote personal health.

Note 2: According to the Taiwan Ministry of Labor's regulations on labor health protection, the employer must provide regular health check-ups to working employees. Employees aged 65 and over should receive health check-ups once a year; Employees aged 40 to 65 should receive health check-ups once every three years; Employees under the age of 40 should receive health check-ups once every five years.

The Social Value of Volunteer Service

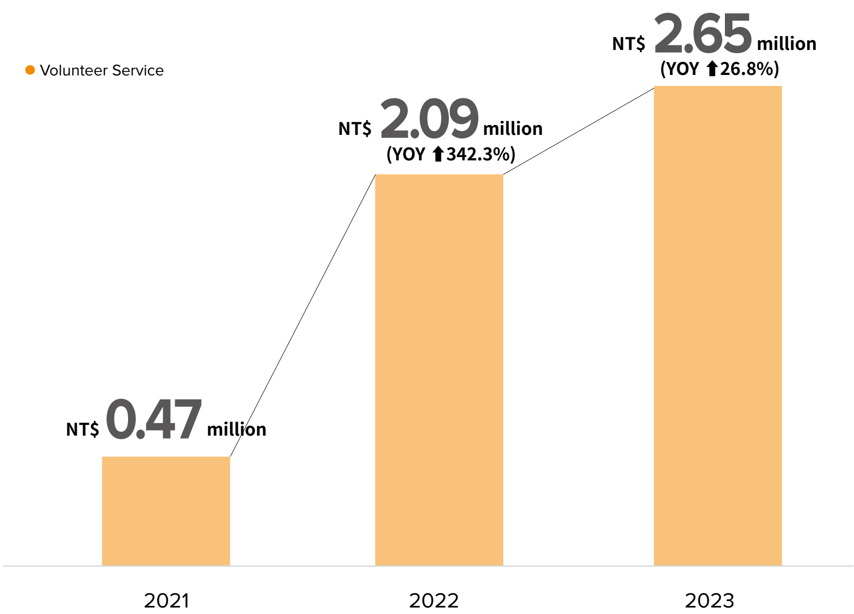
Corporate volunteering can provide valuable manhour, material, and financial resources to society. Through acts of goodwill, it assists in addressing and improving social issues, thereby generating benefits for the overall social capital (Muthuri et al., 2009). This report calculates the positive value created for society by converting the hours spent by colleagues in volunteering into an average hourly wage.

Calculation

- The value of corporate volunteering is calculated by multiplying the hours spent by colleagues in volunteering by the average hourly wage (National Statistics Office, 2022) of employees in the construction, engineering services, technical testing, and analysis services sectors.

Result

In 2023, employees at CTCI dedicated a total of 2,137 hours to volunteer service activities, generating a social value of NT$2.65 million. This marks a 36.2% increase from the previous year. CTCI is committed to bringing new vitality into Taiwan's engineering development through its expertise and core values, while actively giving back to society. CTCI follows the United Nations' Sustainable Development Goals (SDGs) and established three main pillars: promoting the application of eco-friendly technologies, nurturing engineering talents, advocating for sustainable engineering, and caring for society. Our vision is to promote environmental sustainability and advance green engineering construction. In addition to participating in public construction projects, industry-academic cooperation, recognizing academic achievements and outstanding students, organizing volunteer activities, and supporting charitable organizations, we also integrate resources from the "CTCI Education Foundation" and local communities to build internal and external networks and platforms for public welfare. Through these initiatives, CTCI actively make a positive impact on society.



EPC Projects Create Output Value for Our Clients

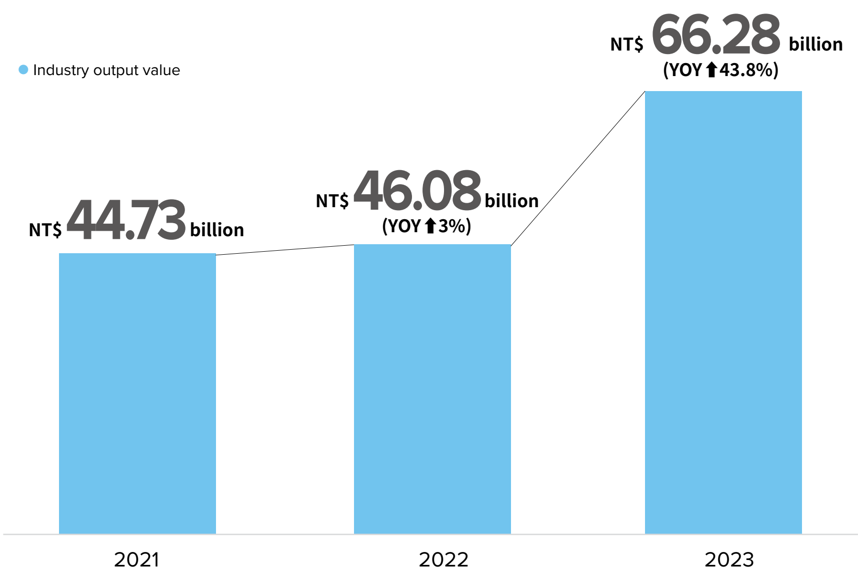
CTCI offers feasibility study, planning, design, procurement, equipment supply, construction, and commissioning services. Building plants and operations can also create revenue for our clients. The report calculates the indirect economic value that CTCI creates for clients, but takes into account the supply-demand relationship between EPC contractor and client to determine fair distribution.

Calculation

● The calculation is based on the BASF (2017) evaluation method.

Result

In 2023, CTCI's EPC projects generated NT$66.28 billion in positive social externality by increasing production and revenue for clients, marking a 43.8% increase from the previous year. The main reason for this increase is that the contract amount of CTCI group has continued to exceeds NT$100 billion for the last four years since 2020, leading to a gradual year-by-year increase in revenue. In the future, CTCI plans to extend its existing EPC services both vertically and horizontally. We aim to strengthen our international presence in current production fields. We are also actively exploring new technologies and venturing into new fields such as liquefied natural gas, green energy, circular economy, non-ferrous metal smelting, carbon capture, and more. CTCI seeks potential business opportunities by innovating our service models. Moreover, CTCI is committed to incorporating green technology throughout the entire project life cycle to minimize environmental impact. We strive to optimize construction methods and reduce the carbon footprint of plant construction to distinguish ourselves from our competitors. CTCI also aims to create a mutually beneficial arrangement with clients in advancing ESG initiatives. We aim to be the most reliable and trusted provider of engineering and constructions services worldwide, so that we may become an important driver for the growth of the economy and civilization.

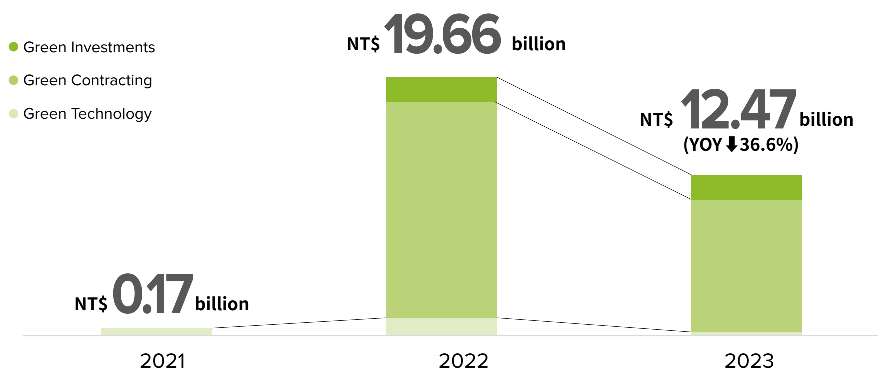


Environmental Benefits of Green Engineering

CTCI has long been developing green engineering technology. We approach projects by taking in the entire life cycle, from design, procurement, construction, commissioning , operation, to decommission. By providing clients with economically viable environmental and energy-saving solutions, we aim to reduce pollution and the negative impacts on human health and the environment. Our objective is to secure mutually beneficial outcomes for all parties involved: CTCI, our business partners, stakeholders, and the public. With the goal of being a Guardian of Sustainable Earth and the effort of carrying out Net Zero EPC, CTCI aims for "Green Engineering" , focusing on green technology, green contracting, and green investments. CTCI hopes that all our projects are energy-efficient and reduces carbon emission, and promote resource recycling.

Calculation

- Compared to traditional methods, green engineering reduces the negative impacts on the environment, including the social costs of carbon emissions, damages on human health, and damages to the ecosystem.
- The "Green Technology" category encompasses the projected environmental benefits that CTCI will provide for clients by incorporating green technology in project designing in 2023.
- The "Green Contracting" category encompasses the projected environmental benefits created upon completion of ongoing projects in 2023.
- The "Green Investments" category encompasses the actual environmental benefits derived from the operations of CTCI's investment projects in 2023.



Result

In 2023, CTCI will use its cross-field technology and experience to promote various green engineering projects and effectively integrate green technologies such as carbon reduction, energy conservation, pollution removal, waste reduction, and resource recycling to provide customers with complete net-zero sustainable solutions, creating external environmental benefits of NT$12.47 billion. Judging from recent trends, the external environmental benefits created by green projects in 2023 decreased by 36.6% compared with the previous year. The main reason is that the total offshore wind power installation capacity contracted by green projects has increased compared with the previous year. However, changes in capacity factors affect power generation, causing a decrease in the externalities. The other reason is the application transition and adjustment of green technology project. CTCI will continue to act as a trailblazer in green engineering, committed to the introduction and research and development of various green technologies, and propose the best green solutions to customers to help cope with climate change and coexist with the environment. In order to break through the current innovation bottleneck of green engineering, we strive to find solutions while expanding our business focus, extending from basic technology to research and development, and then gradually leading the development of the engineering industry to make contributions, and working together with the industry to protect the earth.

Green technology refers to the technical solutions that CTCI provides for the different engineering design, procurement, and construction phases of EPC projects. Through the use of green technology in our 2023 projects, CTCI generated an anticipated environmental benefit of NT$ 66 million for clients

Note 1：The environmental benefits of green engineering will include green contracting and green investment from 2022. In 2021, only the environmental benefits of green technologies will be calculated.

Green Engineering Category/Actions		Environmental Benefits				Currency Value (NT$)	
			2022	2023		2022	2023
Green Technology	Low-power solenoid valves	Conserve energy	684	-	kWh	531	
	Use of high-efficiency motors	Conserve energy	1,051,555	-	kWh	816,806	
	Green building HVAC (Heating, Ventilation, and Air Conditioning) systems	Conserve energy	41,900	1,379,000	kWh	32,546	1,065,915
	HVAC system uses windmill array to save energy	Conserve energy	-	28,853,000	kWh	-	22,302,284
	Improvement on power factors	Conserve energy	-	1,042,000	kWh	-	805,427
	Process renewal for energy efficiency and process heat recovery	Conserve energy	908,534,349	-	kWh	705,712,942	-
	Air conditioning condensate water recycling	Conserve water	2,600	-	m^3	118,881	-
	Rainwater/greywater harvesting and reuse	Conserve water	3,000	9,000	m^3	137,171	411,512
	Secondary RO concentrate water recycling and reuse	Conserve water	37,700	-	m^3	1,723,778	-
	Process water pollution control/water recycling	Conserve water	1,504,780	-	m^3	68,803,899	-
	Concentration and treatment water recycling for wastewater discharge	Conserve water	37,200	-	m^3	1,700,916	-
	Partial substitution of cement with fly ash or slag in concrete materials	Carbon reduction	38,075	26,434	ton CO_2e	58,104,836	41,277,754
	Use recycled pellets to replace some natural pellets in CLSM (Controlled Low Strength Material)	Carbon reduction	-	86	ton CO_2e	-	134,292
	Control system for graphics/ documents management optimization	Carbon reduction	-	3	ton CO_2e	-	4,528
	Use and promotion of mechanical joints	Carbon reduction	105	-	ton CO_2e	160,693	-
	Use of inert gases for fire suppression systems to replace GHGs	Carbon reduction	1,441	-	ton CO_2e	2,198,276	-
	Green building architecture - vegetation	Carbon dioxide sequestration	71	-	ton CO_2e	108,913	-
	Use of low-leakage valves	Reduce VOC emissions	53	-	ton VOCs	71,859	-

Green contracting refers to the implementation of environmentally beneficial engineering projects. The proportion of low-carbon and green engineering projects done by CTCI has increased from 23% to 56% between 2015 and 2023,a significant growth of 346% in ongoing construction projects. In 2023, the expected environmental benefits generated by CTCI's completed construction projects amounted to approximately NT$10.7 billion.

Green Engineering Category/ Actions		Environmental Benefits				Currency Value (NT$)	
			2022	2023		2022	2023
Green Contracting	Production of recycled water	Recycled water capacity	21,900,000	22,630,000	m^3	1,001,345,973	1,034,724,172
	Offshore wind power generation	Power generation capacity	19,520,000,000	11,206,623,105	kWh	16,526,664,620	9,708,773,911
	Major power generation equipment upgrade and expansion at the Tunghsiao Power Plant	Reduction in natural gas use	400,000,000	-	m^3	Methodology is developing	
		Carbon reduction	1,000,000	-	ton CO_2e		

Green investments refer to environmentally beneficial investments made via BOO and BOT models. Examples include the Water Reclamation Plant, Biomass Energy Center, and the Solar Power Plant, etc. In 2023, the actual operational environmental benefits generated by CTCI's investment projects amounted to approximately NT$1.66 billion, with 28.3% growth compared to the previous year.

Green Engineering Category/Actions		Environmental Benefits				Currency Value (NT$)	
			2022	2023		2022	2023
Green Investments	Water recycled plant	Recycled water capacity	26,483,645	34,208,466	m^3	1,210,926,541	1,564,132,86
	Solar power plant	Power generation capacity	109,500,000	123,210,000	kWh	81,211,837	93,505,121
	Energy-from-Waste Plant	Power generation capacity	1,426,000,000	1,306,000,000	kWh	Methodology is developing	
	Emissions from the group's waste treatment plant is below regulatory standards (conventional incineration plants)	Reduce NOx emissions	2,413	3,078	ton		
		Reduce SOx emissions	2,390	2,897	ton		
	Recycling and reuse f waste IPA solvents	Carbon reduction compared to incineration	14,710	11,708	ton CO_2e		
		Carbon reduction compared to virgin IPA	2,381	3,772	ton CO_2e		

Appendix

Sustainable Impact Historical Data

Sustainable Impact of CTCI		Monetary Value of External Impact			Stakeholders	Cause of the Impact
		2021	2022	2023		
Supply chain output value elevated	Positive(+)	61,943,296,347	64,163,220,185	72,725,529,813	Society	Supply chain (Indirect)
Supply chain employee salary income	Positive(+)	3,684,578,327	4,037,996,682	4,338,362,769	External employees	Supply chain (Indirect)
Social cost of GHG emissions derived from the supply chain	Negative(-)	396,269,786	446,753,690	509,685,247	Environment	Supply chain (Indirect)
Social cost of air pollution derived from the supply chain	Negative(-)	453,947,045	529,999,006	591,708,440	Environment	Supply chain (Indirect)
Social cost of wastewater derived from supply chain	Negative(-)	1,942,162	2,153,545	2,377,892	Environment	Supply chain (Indirect)
Social cost of waste disposal derived from supply chain	Negative(-)	7,710,512	8,611,904	9,615,258	Environment.	Supply chain (Indirect)
Social cost of accidents' occupational accidents from Subcontractor	Negative(-)	27,279,840	27,056,910	70,631	External employees	Company operations (Direct)
Economic value-added income	Positive(+)	3,022,172,000	3,679,538,000	3,243,784,000	Society	Company operations (Direct)
Avoid social costs of GHG emissions	Positive(+)	0	77,676	2,342,090	Environment	Company operations (Direct)
Avoid social costs of GHG emissions	Positive(+)	116,225	337,577	312,524	Environment	Company operations (Direct)
Social cost of GHG emissions	Negative(-)	14,294,481	16,765,192	14,825,263	Environment	Company operations (Direct)
Social cost of air pollution	Negative(-)	69,038,193	123,151,956	87,668,123	Environment	Company operations (Direct)
Social cost of water consumption	Negative(-)	854,341	870,398	1,877,384	Environment	Company operations (Direct)
Social cost of waste disposal	Negative(-)	2,573,518	2,787,042	5,180,257	Environment	Company operations (Direct)
Employee training creates future income	Positive(+)	236,490,002	234,795,487	193,729,017	CTCI employees	Company operations (Direct)
Employee purchasing power and quality of life	Positive(+)	3,699,149,000	4,131,274,000	4,666,118,000	CTCI employees	Company operations (Direct)
Social value of health promotion	Negative(-)	4,142,911	5,660,095	4,555,866	CTCI employees	Company operations (Direct)
Social value of health promotion	Positive(+)	4,142,911	5,660,095	4,555,866	CTCI employees	Company operations (Direct)
Social value of health promotion	Positive(+)	12,275,399	4,181,364	4,657,532	CTCI employees	Company operations (Direct)
Social costs of occupational accidents	Negative(-)	0	0	0	CTCI employees	Company operations (Direct)
Social value of volunteering	Positive(+)	472,821	2,091,085	2,652,017	Society	Company operations (Direct)
EPC projects create output value for our clients	Positive(+)	44,726,212,337	46,081,053,156	66,283,395,495	Society	Product and services (Indirect)
Environmental benefits of green engineering	Positive(+)	165,580,782	19,659,841,020	12,467,137,777	Environment	Product and services (Indirect)

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