Introduction of Internal Carbon Pricing : Methods and Application

2023

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www.delta-foundation.org.tw

Chung-Hua Institution for Economic Research (CIER) is a think-tank for international and domestic economic and industry-related issues in Taiwan. CIER is trusted as an objective source that is concerned with social welfare and sustainable economies and will offer sincere and constructive policy recommendations. Aligning with its efforts to work towards a sustainable economy, CIER has worked with Climate Group as the Local Campaign Partner for RE100 in Taiwan since 2019.

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CDP is a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. Over the past 20 years it has created a system that has resulted in unparalleled engagement on environmental issues worldwide.

www.cdp.net

Executive Summary

The business risks associated with climate change have extended from natural disasters and extreme weather to regulatory risks, such as mandatory emissions disclosure, carbon taxes and increasing pressure consumers and investors to accelerate low-carbon transformations.

In 2021, as a way to navigate Greenhouse Gas (GHG) regulations, to drive low-carbon investment, to improve energy efficiency and to change internal behaviour, more than 800 companies worldwide and 30 companies in Taiwan have adopted internal carbon pricing (ICP) systems.

This report discusses global and Taiwanese benchmark case studies to help companies identify and understand the characteristics of ICP mechanisms and develop an ICP-implementation roadmap. The main findings are:

- The implementation of the ICP system can follow four major steps: (1) establishment of objectives and consensus; (2) price and mechanism design; (3) trial and promotion; (4) rolling review and adjustment.
- The system design can be viewed from four dimensions to ensure effectiveness and feasibility of ICP, which are carbon price level (height), business influence (depth), GHG emissions coverage (width) and development journey (time).
- There are five major ICP types, (1) implicit price: price level is set according to unit reduction cost from past low-carbon investment; (2) shadow price: price level is set with reference to external public carbon prices and is included in the calculation of return on investment. It is currently the most commonly applied type of ICP; (3) offsets: companies can(x) earn credits from carbon reduction or removal activities to offset carbon emissions.; (4) internal fee: conversion of emissions from business unit into operating expense (OPEX). Carbon fees go into a carbon fund, which will be used for investing or giving incentives for carbon reduction; (5) internal trading: allocate emission allowances to each regulated subject and allow business units to trade the allowances internally to reach the reduction target.
- The implementation of ICP should be adjusted on a rolling basis. For instance, enterprises may start with implicit price in its introduction-of-ICP stage, and then gradually introduce more complex mechanisms, such as internal fee or internal trading, to progressively deepen ICP influence within the enterprise.

Note. This report USD exchange rate on December 16, 2022 rounded to dollar

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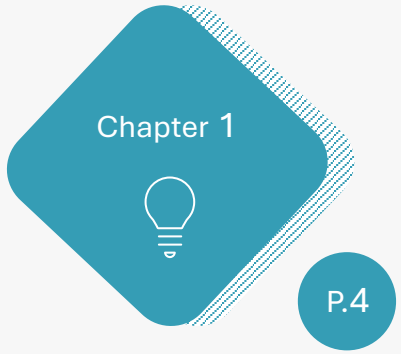

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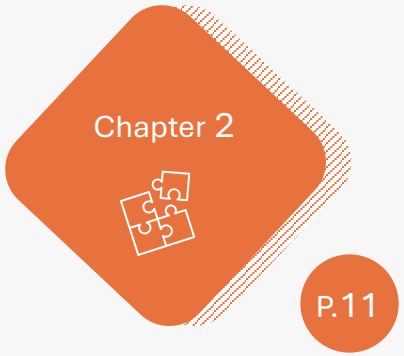

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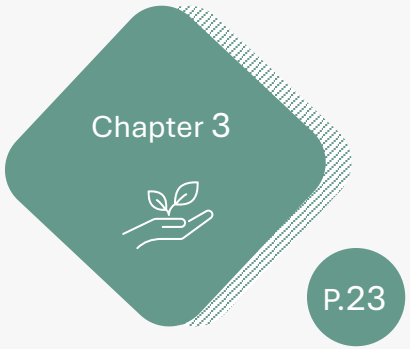

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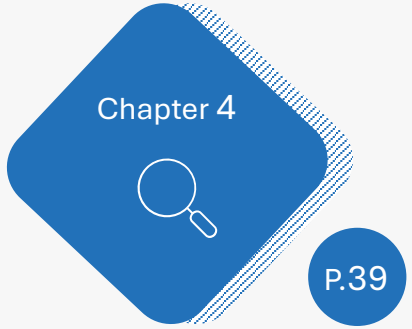

Conclusion & Recommendation

- Data Transparency
- Reflect Actual Carbon Reduction
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- Building Internal Consensus

01

Motive and Opportunities

Assessing Risks and Opportunities Under Climate Change

Climate change has become a pressing issue for humanity and the planet. It is also causing significant losses for businesses, as it is forces changes in the way of extracting raw materials and transporting goods. The Carbon Disclosure Project (CDP) has estimated that over US $4 trillion of global assets will be at risk due to climate change by 2030. In response, more and more governments and companies are setting net-zero carbon emission goals by 2030 to align with the Paris Agreement.

To internalize costs of carbon emissions in production and consumption activities, on a national scale, country can implement carbon pricing mechanisms, for instance, carbon taxes, the EU's cap and trade program, the Emissions Trading System (ETS) and its carbon tariffs system, Carbon Border Adjustment Mechanism (CBAM).

Companies are using ICP to embrace the consideration of carbon emission costs when making production and investment decisions. By 2020, over 800 companies worldwide have implemented ICP, contributing to the transformation of global supply chain decarbonization.

In addition to helping companies reconcile the risks of climate change, a carbon pricing system can also help companies seize potential green opportunities. According to the World Bank, government revenues from carbon pricing policies globally reached US $84 billion in 2021, a 60% increase from the previous year. This income can be used to aid investment in green technology and create a public-private partnership to promote growth in sustainability.

Objectives for ICP

Since the Industrial Revolution, global economic activities have been highly dependent on limited natural resources such as fossil fuels, producing huge amounts of greenhouse gas(GHG). According to the World Meteorological Organization (WMO), in 2020, the global average surface temperature will be at least 1.2°C higher than before the industrial revolution, causing severe environmental problems such as drought, wildfires, storms, and declining biodiversity, and also creating risks for raw material production, transportation and business operations. In the U.S., for example, annual losses from natural disasters such as droughts and hurricanes was significantly higher in 2019-2021 (US $105.1 billion) compared to a decade ago (US$91.9 billion).

In order to address the environmental risk, 195 countries around the world signed the Paris Agreement in 2015, aiming to limit global warming to 2°C by this century and requires member countries and corporates to set their carbon reduction targets, including adoption of proactive policy measures such as carbon taxes/fees, emissions trading and carbon tariffs, in order to internalize the costs of external environmental impacts generated by corporate economic activities.

The business risks associated with global climate change can be categorized as: (1) Supply chain risks due to raw material price volatility or supply chain disruptions due to natural disasters and extreme weather; (2) Policy regulation risks such as carbon fees or tightening emission standards; (3) Market competition risks arising from consumer's green procurement strategies and competitors' low-carbon solutions; (4) Reparations or conservation costs.

The aforementioned risks will not only affect investor attitudes, but also cause companies loss if previous investments fail to take carbon emission cost into evaluation.

Regulatory Factors

Mandatory Carbon Tax / Levy, ETS, carbon emission standards, disclosure of corporate carbon emission data, etc.

Incentive Tax reduction, carbon credit offset mechanism, low-carbon technology research and development subsidy, etc.

Supply Risks

Fluctuations in Raw Material Prices

Extreme weather cause shortage in the supply of water, minerals and crops, resulting in higher prices.

Supply Chain Disruptions

Supply chain transportation disrupted by natural disasters, causing raw material shortages.

Operational Risks

Stranded Assets

When prior investment fails to realize expected return due to changes in the regulatory system, technology, market and environment.

Investor Attitudes

Corporate ESG and climate change influence investors' long-term investment intentions and portfolio allocation.

Competitive Risks

Change in Customer Demand

Brands require suppliers to meet low carbon emission standards.

Low-Carbon Innovation

Competitive landscape changed by development and use of low-carbon technologies.

Costs of Environmental Impact

Reparations Reparations for damages to agriculture, forestry, tourism and other industries that are caused by GHG emissions from business activities.

Conservation Costs Cost of subsequent restoration, namely planting trees and sequestering carbon, due to the negative environmental impacts of current and past business activities.

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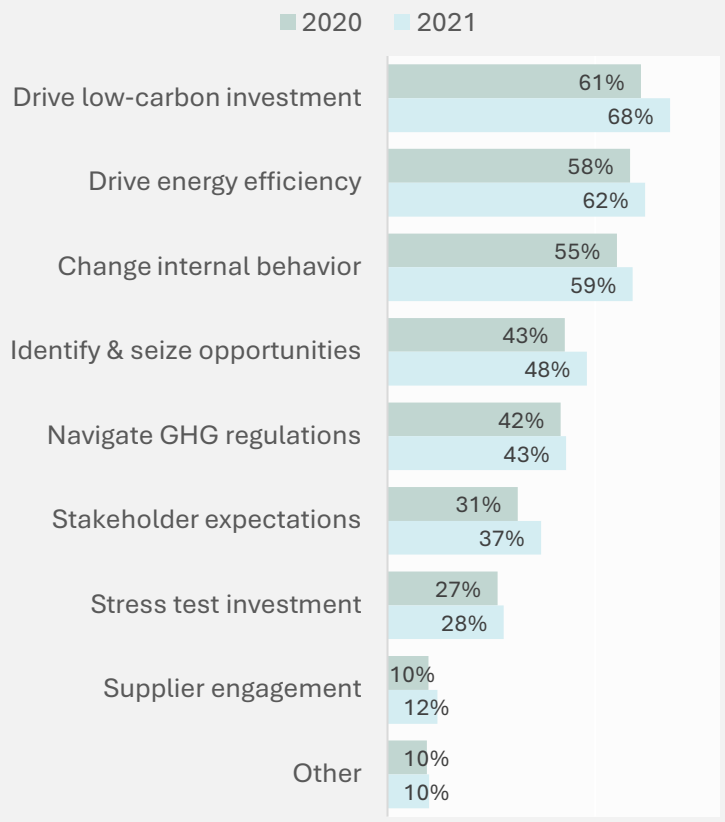


Note. Data sorted by CIER from CDP climate change questionnaire

Opportunities for ICP

The purpose of carbon pricing is to incorporate and convert the potential damages of GHG emissions into the calculation of economic costs. Internal carbon pricing is a tool for companies to manage and reduce carbon emissions by setting a price for each internal unit of GHG emissions so that the "external environmental costs" are internalized, prompting companies to exercise restraint in their emissions. ICP also helps companies to maintain a balance between their economic development and carbon reduction goals, which enables them to move towards low-carbon or net zero emissions.

Clarify GHG emission rights & responsibilities

With ICP, carbon emission is monetized so that companies can clarify the environmental costs and potential benefits of carbon reduction across each business unit.

Evaluate low carbon investment & procurement

When companies invest resources in energy efficiency improvement or low carbon product development activities, ICP is a useful tool which takes both economic and environmental benefits into consideration .

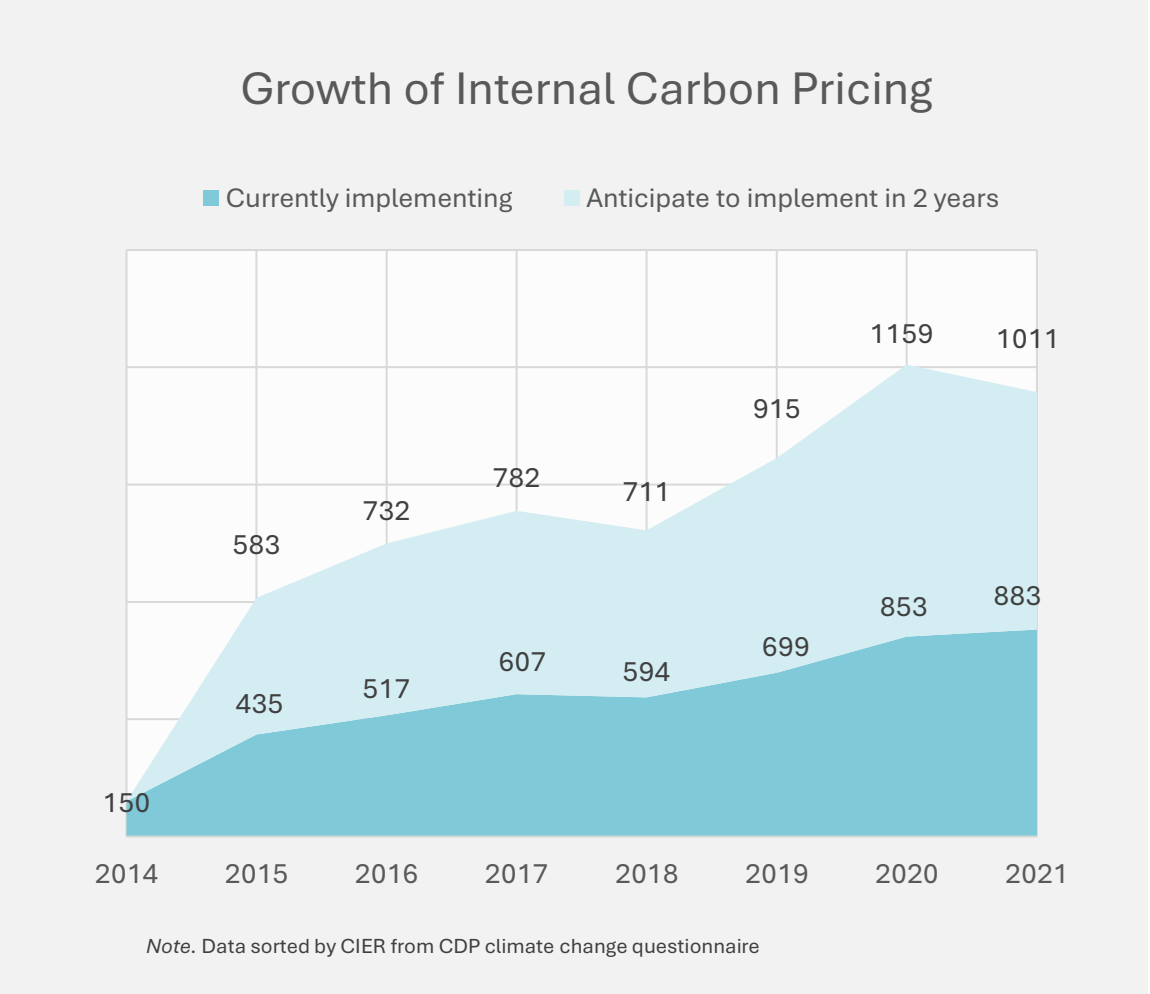
Internal & external decarbonization strategy communication

ICP can be used as an economic indicator and communication tool for corporate carbon reduction actions. Internally, it can embed environmental consciousness through daily business operations. Externally, investors can make re-evaluate the value of enterprises based on their carbon pricing models.

Global Climate Initiatives and Trends in ICP Systems

Internal carbon pricing is one of the most important tools for companies to manage the risks and opportunities of climate change. In 2016, the Financial Stability Board (FSB) released the Task Force on Climate-Related Financial Disclosures (TCFD), which identifies ICP as one of the key assessment items. It is used by international advocacy groups, notably CDP and the Climate Disclosure Standards Board (CDSB) to encourage corporations and financial institutions to promote financial market stability through climate risk transparency.

CDP was launched in 2003 by a group of international investment institutions, including HSBC and UBS, to assess the evolving risks given climate and environmental changes for various investment targets. In 2013, CDP released its first ICP report, which showed high correlation between ICP systems and carbon reduction actions. The year following that finding, questions on ICP systems was included in CDP's disclosure reports to encourage global companies to implement ICP. In addition, the World Bank also called on corporations to introduce carbon pricing systems in 2014, resulting in more than 1,000 companies issuing joint statements of endorsement and making ICP a management strategy tool to help companies achieve carbon reduction.



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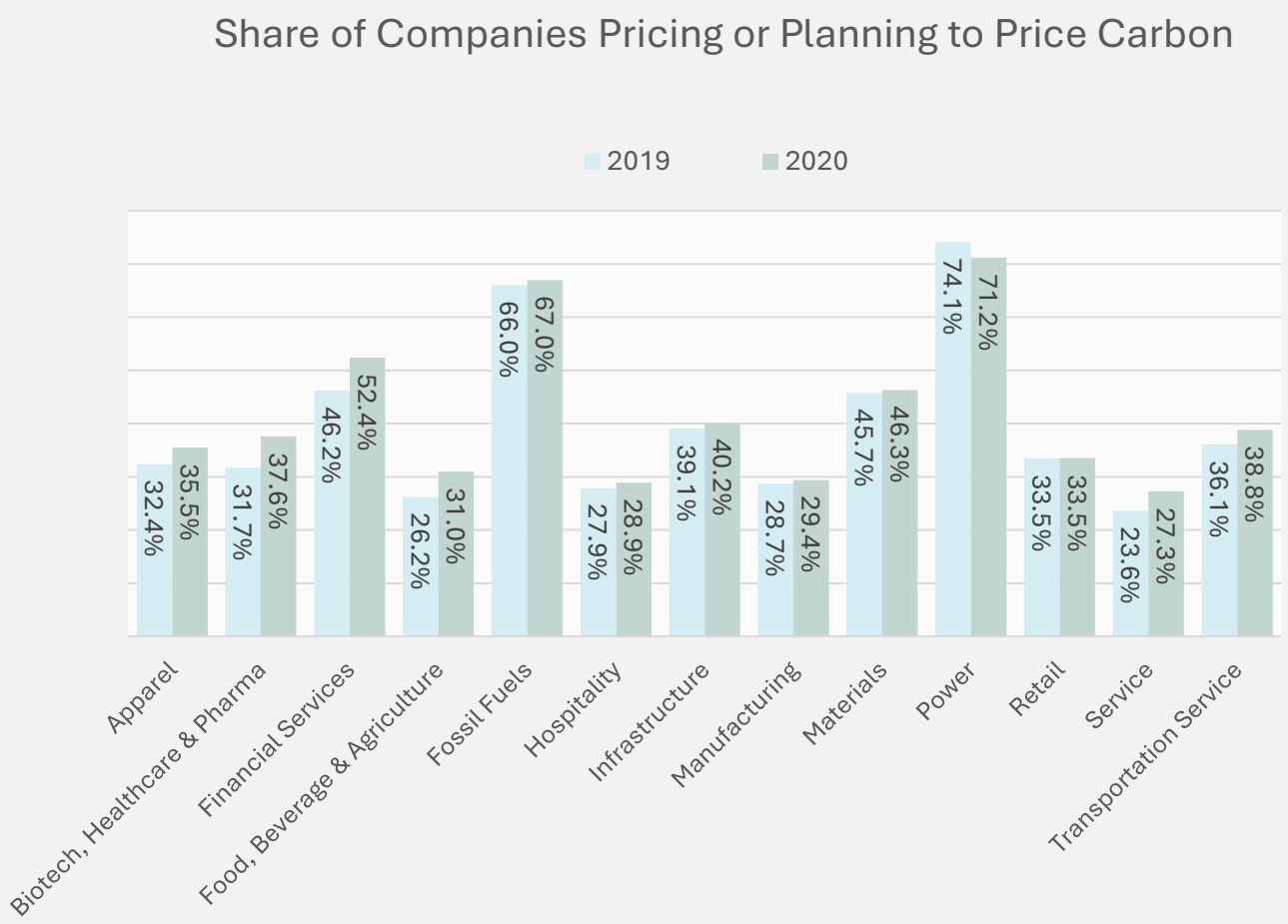


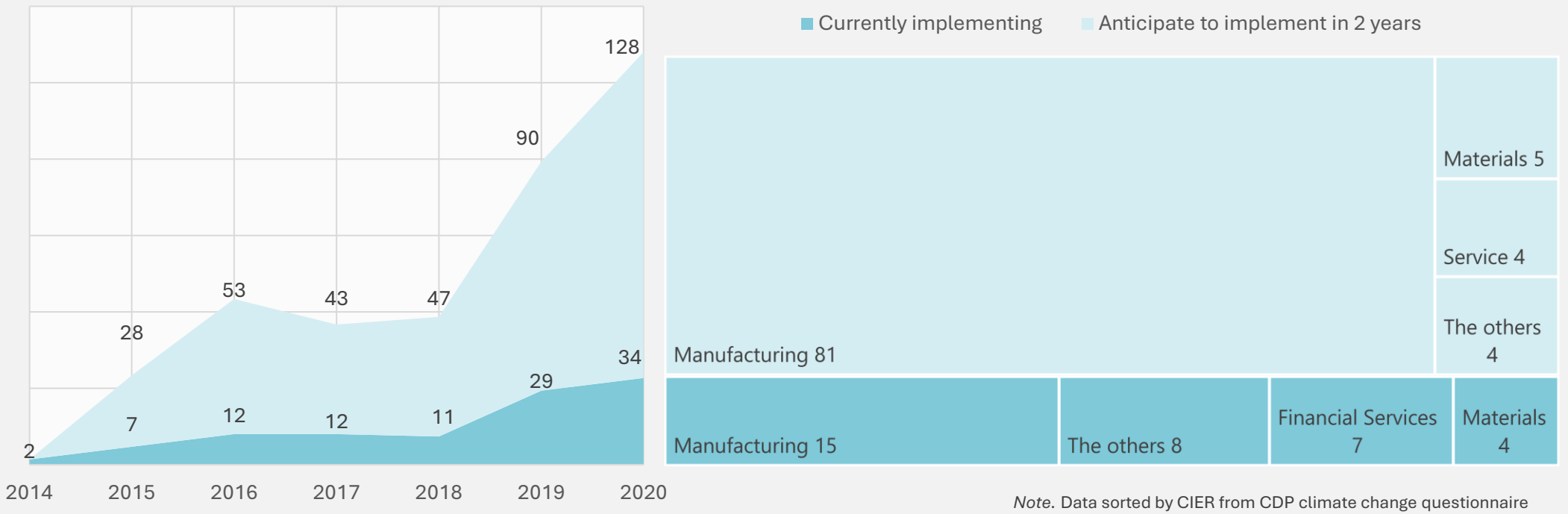
Note. Data sorted by CIER from CDP climate change questionnaire

According to the CDP questionnaire, more than 883 companies worldwide will and have implemented ICP systems by 2021, while nearly half of the world's top 500 companies already have. The number of companies that plan to do so within two years has increased by 26.6% from the previous year. Moreover, 6-7% of companies in the energy and fossil fuel industry (e.g. ExxonMobil, Shell and BP) have already started to implement the system. The financial services industry, guided by carbon disclosure initiatives such as TCFD and CDP, has also started to actively promote ICP implementation (e.g. Wells Fargo and Westpac Bank) to assess the environmental risk of investment portfolios.

Opportunities & Threats for Taiwan

In recent years, more than 34 companies in Taiwan, such as Delta Electronics, TSMC, First Financial Holding and Chunghwa Telecom, have started using ICP systems to meet the requirements of the Greenhouse Gas Reduction and Management Act and the pressure from investors.

While globally, energy and fossil fuel industries are the most active in implementing ICP, Taiwan's manufacturing industry is one of the main players, with 81 manufacturing companies planning to execute the system by 2022. This report summarizes the implementation methods and examples of ICP in Taiwan and abroad through literature review and case studies to help Taiwan enterprises reduce climate change risks and realize low-carbon opportunities.



Note. Data sorted by CIER from CDP climate change questionnaire

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Types and Implementation

What is ICP ？ How is It Implemented ？

In response to the expanding global climate risks and to ensure market competitiveness, many companies are promoting low-carbon transformation. However, there are many methods and strategies to reduce carbon emissions, from process equipment replacement, employee commuting behavior changes to reforestation. Due to factors such as market supply and demand and technology maturity, the cost-effectiveness and carbon reduction effects of various methods are different.

ICP thus serves as a top-down carbon management tool that coordinates the internal assessment and implementation of various carbon reduction measures to change the original operating behavior and enhance the overall competitiveness of the enterprise. According to the CDP questionnaire, there are five mainstream applications: Implicit Price, Shadow Price, Emission Offset, Internal Carbon Fee, and Internal Trading. Industries and enterprises can adopt different strategies according to their own market characteristics, organizational structure, GHG emissions coverage, corporate culture, operational processes, and different purposes of implementation.

The implementation of the ICP system can follow 4 major steps: (1) establishment of objectives and consensus; (2) price and mechanism design; (3) trial and promotion; (4) rolling review and adjustment. The system design can be viewed from 4 dimensions to ensure effectiveness and feasibility of ICP, including Carbon price level (height), Business influence (depth), GHG emissions coverage (width) and Development journey (time).

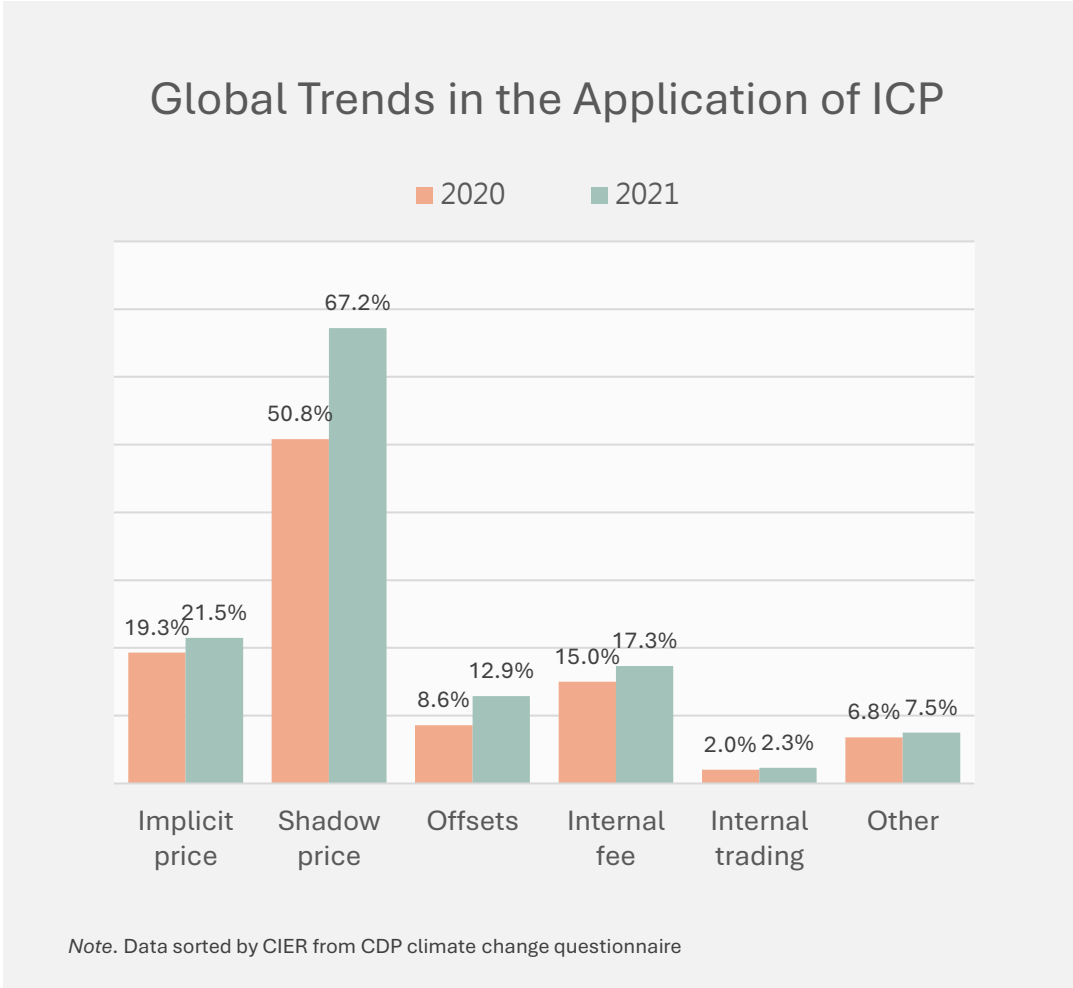
ICP Types and Application

The establishment of an ICP mechanism involves 2 major aspects: How to set it? How to apply it?

In terms of pricing types, according to the ICP guidelines published by the Ministry of the Environment of Japan, the pricing methods include reference to international carbon pricing, peer carbon pricing, regulations in major operating regions, cost-benefit data after actual carbon reduction, and backward evaluation based on carbon reduction targets.

In terms of pricing types, according to CDP questionnaire statistics, five major types includes: Implicit Price, Shadow Price, Offsets, Internal Fee and Internal Trading. Among them, the concept of implicit price and shadow price are used as evaluation tool for low-carbon investment and are relatively easy to implement. Internal Fee and Internal Trading, on the other hand, are more complicated and more difficult to manage since they involve the overall management structure and financial flow of the enterprise. Despite the complexity, through the clear responsibility attribution internally, these methods can significantly help motivate internal efforts of carbon reduction.

Each type corresponds to different pricing mechanism and has different degrees of impact on the actual operation of enterprises. Companies can choose a more easily-operated pricing type in the early stage, and then gradually adjust the pricing level and methods according to the progress of carbon reduction. In addition, according to the statistical results of the CDP questionnaire, more and more enterprises have adopted multiple types at the same time based on different application situations.



Note. Data sorted by CIER from CDP climate change questionnaire

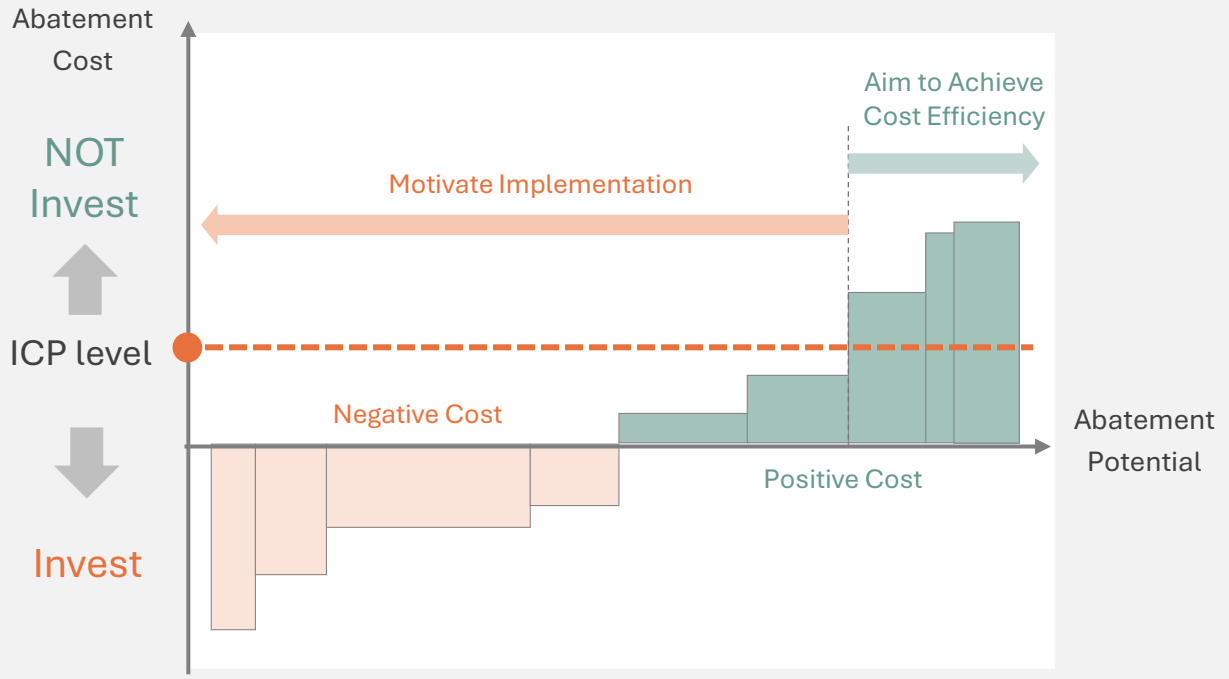
Type 1：Implicit Price

The implicit price is usually based on the marginal abatement cost of carbon reduction. It takes the evaluation of past reduction investments and cost incurred from reduction efforts to adjust for future carbon reduction investment projects. It is often used as a precursor or auxiliary tool for more advanced ICP types.

When setting the implicit price level, corporations can refer to two aspects: past investment experience and future carbon reduction targets. The former calculates the average unit cost of previous abatement efforts, and the latter can refer to domestic and foreign reduction cost data (e.g. GACMO and Taiwan offset project costs) to identify feasible reduction technologies that can be adopted. By combining both references, a reduction cost curve can be created to prioritize each reduction project. Companies can then calculate the average costs of these measures as implicit price and then filter for the reduction measures they are willing to execute.

When the reduction cost of a specific reduction measure is lower than the implicit price, then enterprises are encouraged to invest. In contrast, if the cost of a reduction measure is higher than the implicit price, then the investment should be suspended until cost efficiency is met.

Implicit Price： Carbon Reduction Cost Curve ＆ Investment Decision Based on Price Level



Note. Information sorted by CIER

Type 2：Shadow Price

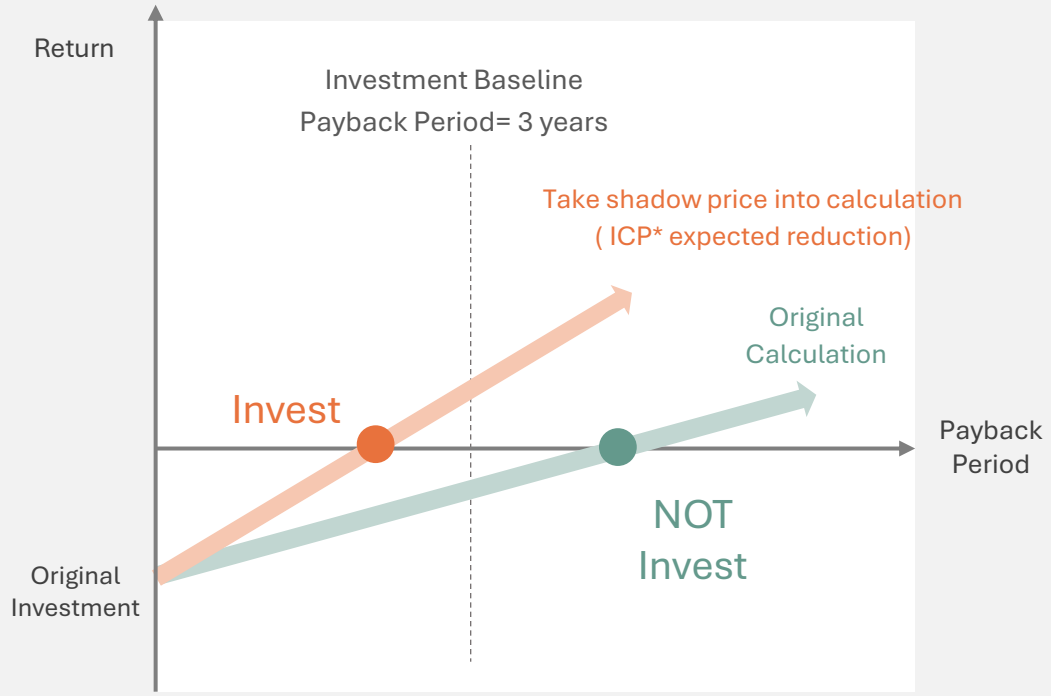
Shadow price refers to the marginal impact on the desirable output resulted from change of specific factors. It is currently the most widely used method of internal carbon pricing application.

Through shadow price, the carbon price is included in the calculation of return on investment. Payback period of carbon reduction investment decision will thus be shortened than previous calculation without considering the implicit carbon price. For example, if an investment project can create 100 tCO2e reduction per year, the payback period of the investment project will be shortened from 5 years to 2 years when shadow price is considered in expected revenue, and thus change the company's investment decision.

The shadow price level can be set with reference to external public carbon prices, competitor prices in the same industry, and internal implicit price. External public prices can refer to *The Social Cost of Carbon (SCC)* published regularly in the U.S. or local regulations, etc.

In Taiwan, for example, shadow price may be set at US $50 per tonne, which is the penalty for each ton of excess carbon emission, according to the *Greenhouse Gas Reduction and Management Act*. To further enhance the effectiveness and applicability of the price level, enterprises can also adopt the aforementioned implicit price method to calculate the past or future carbon reduction costs of the enterprise as the price level and incorporate it into the evaluation system.

Application of the Shadow Price Combined with Payback Period



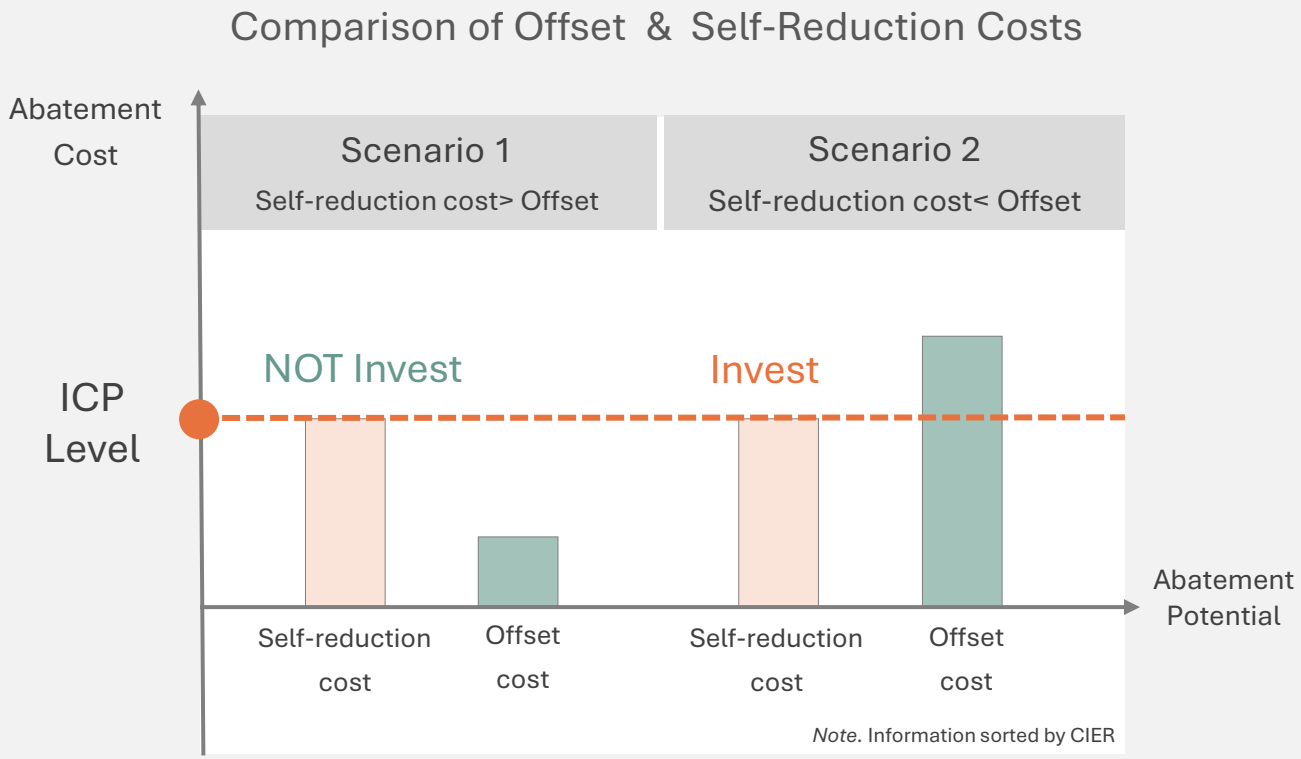
Note. Information sorted by CIER

Type 3：Offsets

Emission offsets is a method used by companies to earn credits from carbon reduction or removal activities to counteract its carbon emissions.

Specific actions include: companies purchasing emission allowances to comply with the mandatory ETS or companies purchasing carbon credits or Renewable Energy Certificates (RECs) to meet carbon reduction commitments, such as carbon neutrality or 100% renewable energy.

When the unit cost of self-reduction measures is higher than the unit price of the purchased credits, enterprises can choose to purchase credits to achieve the reduction target. Conversely, if the unit cost of self-reduction is lower than the unit price of the purchased credits, enterprises should choose to implement its own reductions.

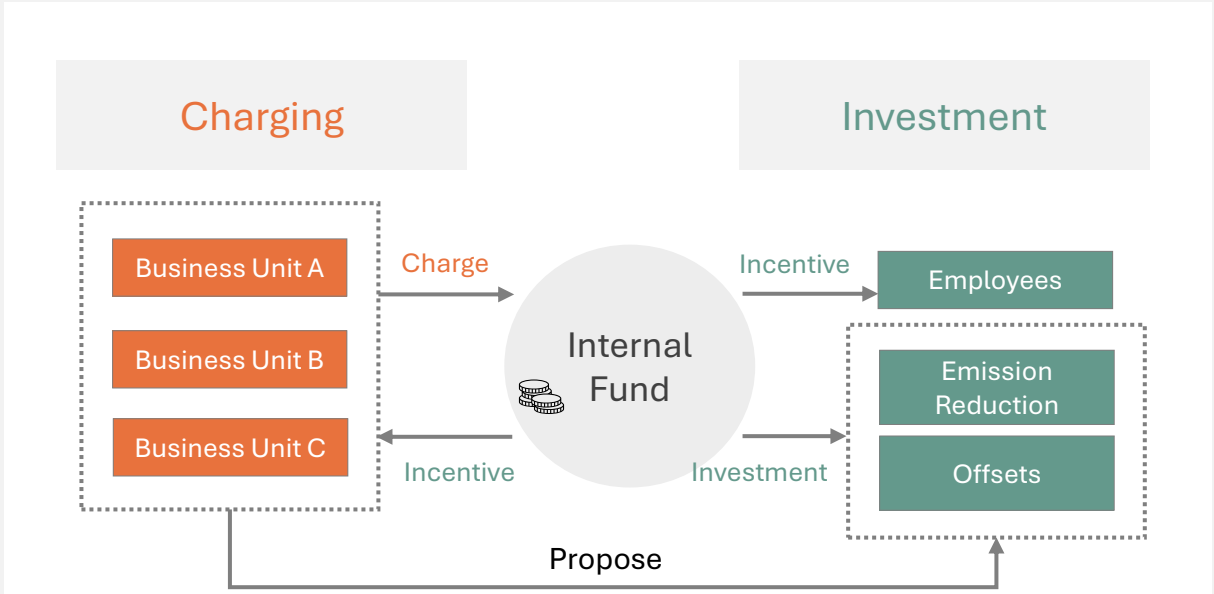


Type 4：Internal Carbon Fee

The internal carbon fee (or internal carbon tax) converts the emissions of each business unit within an enterprise into operational expenditure (OPEX). In practice, each business unit pays a fee that is based on its emissions to a carbon fund. The fund is used as a subsequent investments or incentives for carbon reduction. The purpose is to make each unit take responsibility for its emissions and to direct internal resources to low-carbon investments.

The system design can be divided into two parts: charging and investing. Firstly, the charging mechanism should be clearly set up with price of the internal carbon fee, standardized emission audit method and individual financial flow of each regulated unit. In terms of the investing mechanism, common approaches include: business units propose emission reduction investment programs for funding, such as department/employee incentives, emission reduction programs or investment in negative carbon technologies. Companies can then consider the overall carbon reduction goals and progress to allocate the funds.

Internal Carbon Fee Implementation



Note. Information sorted by CIER

Type 5 ： Internal Emissions Trading

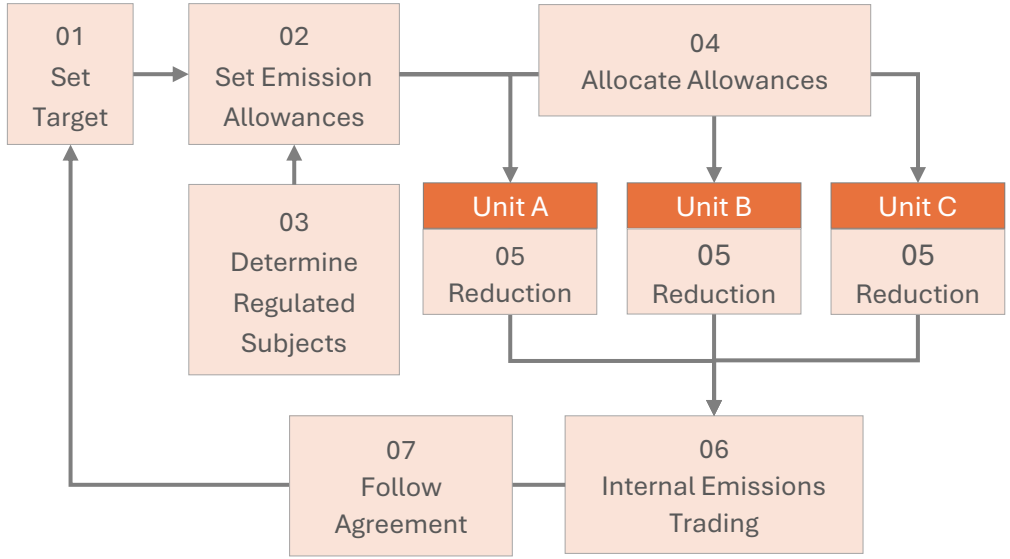
Internal emissions trading, also known as cap-and-trade, was first designed and applied by large global energy companies in response to international climate agreements. It takes into account the U.S. Acid Rain Program's allowance trading system and is similar to the European Union’s ETS.

Once a company establishes a carbon reduction target, it proceeds to define and allocate limited emission allowances to each regulated department. These allowances are then linked to the business unit's performance assessment or incentive system. This approach enables each department to adjust its business plan and target based on the allocated emission allowances. If a department anticipates emitting more than its assigned allowance, it must either plans its reduction measures or allocate additional funds to purchase excess allowances from other departments.

Due to the limited amount of emission allowances, the price level is determined by supply and demand. This can be observed through the concept of the "equilibrium price" in the trading market.

To conclude, the internal emissions trading and internal carbon fee methods both involve the calculation and internal trading of “carbon allowances.” Though these methods may require relatively complicated administrative and regulatory work, they can help enterprises achieve reasonable allocation of resources in a cost- effective way to achieve carbon reduction .

Internal Emissions Trading Application



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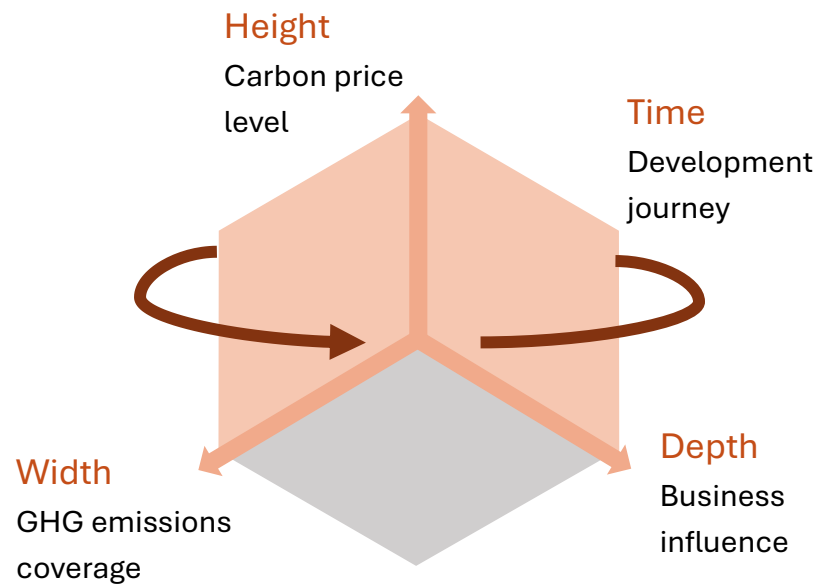
4 Dimensions of Internal Carbon Pricing



Note. Informaiton sorted by CIER from 2017 CDP report

Practical Design of Internal Carbon Pricing

The ICP system is a top-down management tool for carbon reduction strategies. Companies set ICP strategies according to industry and company characteristics, GHG emissions coverage, corporate culture, operational processes and reason for ICP implementation.

The application of ICP should be adjusted on a rolling basis according to the goal and application scenarios of the companies, and also the overall business environment. For instance, enterprises may gradually increase the pricing level or expand the scope of implementation to achieve more aggressive carbon reduction goals.

According to the ICP Guidelines released by CDP, the ICP system is recommended to be formulated and dynamically adjusted based on four dimensions: price level (height), GHG emissions coverage (width), business influence (depth), and development journey (time).

4 Dimensions of Internal Carbon Pricing

Height
Carbon price level

When companies use ICP as a carbon risk management tool, they must ensure that the price level reflects the company's current carbon reduction targets and actual carbon reduction costs. After taking into account external data such as competitors' pricing, local government carbon fee levels or public information on carbon reduction costs, price levels can be flexible and can be adjusted to ensure that companies enhance their competitiveness in the market by promoting carbon reduction measures. In addition, companies can also set multiple price levels for different targets, for example, they can set a higher price for long-term R&D than for the general purchase of carbon by taking the future rising external environmental costs into consideration.

Width
GHG emissions coverage

The coverage of ICP includes the following: regulated subjects, scope (1-direct emissions, 2-indirect emissions or 3-other indirect emissions), types of gas emissions (CO2, CH4, HFCs, PFCs, SF6, etc.) For example, if a company wants to promote the carbon reduction of a product through ICP, it can choose to apply ICP to raw material procurement or product design, and thus change the decisions related to those areas.

Depth
Business influence

The influence of ICP on business depends on the price level, types and coverage of application. In general, the greater the impact, the more resources and time are required to promote and manage the system, including planning implementation measures and internal communication. For example, if the directors of a company adopt the shadow price approach when evaluating major investment decisions, the impact on short-term operations may be relatively small; however, if they want to further adopt the internal carbon fee approach, the company's daily work patterns and operational processes are further impacted through actual operating costs linked to the performance bonuses of managers and employees.

Time
Development journey

The time dimension refers to the dynamic development journey of ICP. ICP should be adjusted on a rolling basis according to internal and external pressure changes. In the initial trial stage, enterprises usually choose to set a lower price level or adopt a small-scale pilot approach to facilitate the initial promotion of the internal carbon pricing system. Later, in response to changes in the external environment or the maturation of the system, it can further expand the scope of coverage and regulated subjects, modify the ICP system or increase the price level so that the overall effectiveness of carbon reduction can be enhanced.

4 Steps toward ICP Implementation

The ICP promotion process can be divided into four major steps: (1) establishing carbon reduction targets and consensus, (2) price mechanism design, (3) internal communication and promotion and (4) rolling adjustment.

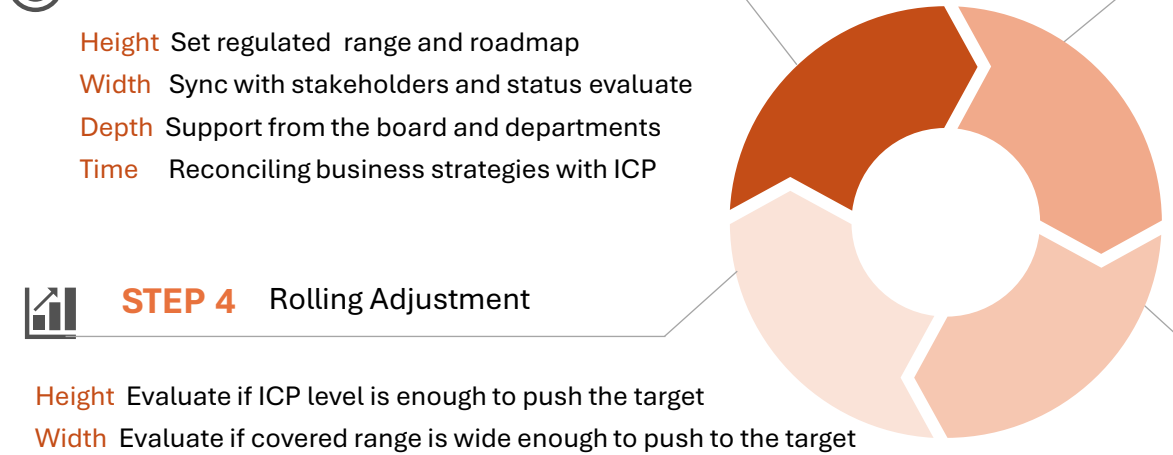
Firstly, an enterprise should determine its own climate risks and opportunities and set short-to-long-term reduction targets and roadmaps to determine the price range and mechanism design. Moreover, prior communication and consensus building within enterprise is crucial.

Secondly, in the pricing and mechanism design stage, many factors will be involved, such as the operation structure and scale of enterprises, workflow, product and service characteristics and emission source structure. Depending on the purpose of use, an enterprise can gradually explore its own pricing logic and implementation methods through small-scale pilot projects.

Lastly, ICP systems should be continuously reviewed and adjusted to achieve the expected carbon reduction target of the enterprise. This will prevent the carbon pricing strategy from being untethered from the actual carbon reduction work and prevent the enterprise from losing focus on the overall strategy and the huge administrative burden.

Evaluation Item	Content
Target	Is ICP in line with reduction target?
Height	Does price level need to be adjusted to meet the aggressive carbon reduction targets?
Width	Does scope and coverage need to be adjusted to include major corporate GHG emissions?
Depth	Is ICP integrated into corporate operational decisions?
Time	Is ICP aligned with the reduction path and with the current business operations and external climate policy?
Administrative Burden	Does administrative efficiency in the implementation of ICP need to be improved?
Strategy Adjustment	Is ICP aligned with corporate emission reduction strategies and priorities?

ICP Implementation: 4 Dimensions and 4 Steps



STEP 1 Reduction Targets and Consensus

- Height Set regulated range and roadmap
- Width Sync with stakeholders and status evaluate
- Depth Support from the board and departments
- Time Reconciling business strategies with ICP

STEP 2 Price Mechanism Design

- Height Set price level
- Width Emission scope and regulated target
- Depth Evaluate impact on operation
- Time Timeline arrangement

STEP 3 Internal Communication and Promotion

- Height Set ICP logic and implementation method
- Width Extend from pilot to practice
- Depth How to promote internally to raise acceptance
- Time Set implementation timeline

STEP 4 Rolling Adjustment

- Height Evaluate if ICP level is enough to push the target
- Width Evaluate if covered range is wide enough to push to the target
- Depth Examine if impact on operation align with expectation
- Time How ICP impact decisions throughout implemented period

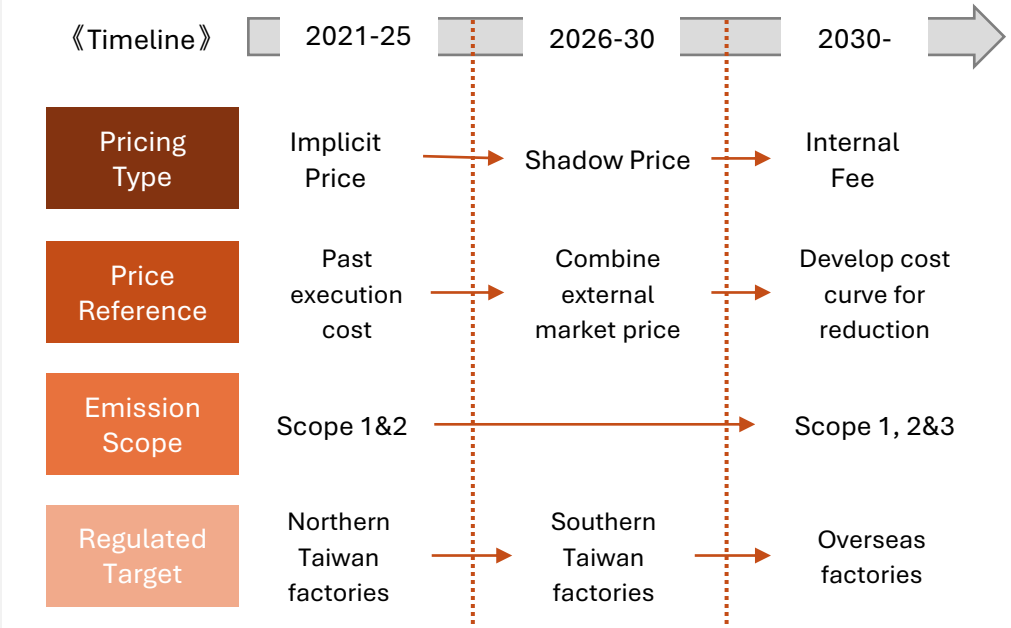
Note. Data sorted by CIER from CDP report

ICP Implementation Roadmap

To summarize, the key to the design and implementation of the ICP system is to match the carbon reduction goals and progress of the enterprise, to build internal consensus and to coordinate the overall resources to enhance the effectiveness of carbon reduction. Therefore, ICP should follow the development journey of carbon reduction, build internal consensus and gradually deepen and adjust.

In practical operation, enterprises can plan ICP roadmaps based on Science Based Target (SBT) and implement it step by step: the initial planning can start with implicit price to calculate the unit cost of implementing carbon reduction in some plants and prioritize the implementation of more cost-effective carbon reduction measures as a reference for subsequent investment. The next step is to refer to external pricing to implement shadow price to further change the decision-making process, such as plant investment, product line adjustment, etc., to direct corporate resources to low-carbon investment projects. Finally, corporations can charge internal carbon fees to each business unit and establish an internal carbon fund. By doing so, the concept of carbon pricing is established from top to bottom to promote the overall low-carbon transformation.

Example of ICP Roadmap



Note. Information sorted by CIER

03 Case Study

ICP Benchmarks

This chapter examines the practice of Internal Carbon Pricing (ICP) in both domestic and foreign enterprises. It analyzes how benchmark companies in various industries set appropriate ICP levels in response to external reduction pressure and to achieve voluntary reduction targets. It also covers the different types of applications, namely implicit price, shadow price, internal carbon fee and internal emissions trading, and how to create hybrid models of these ICP types.

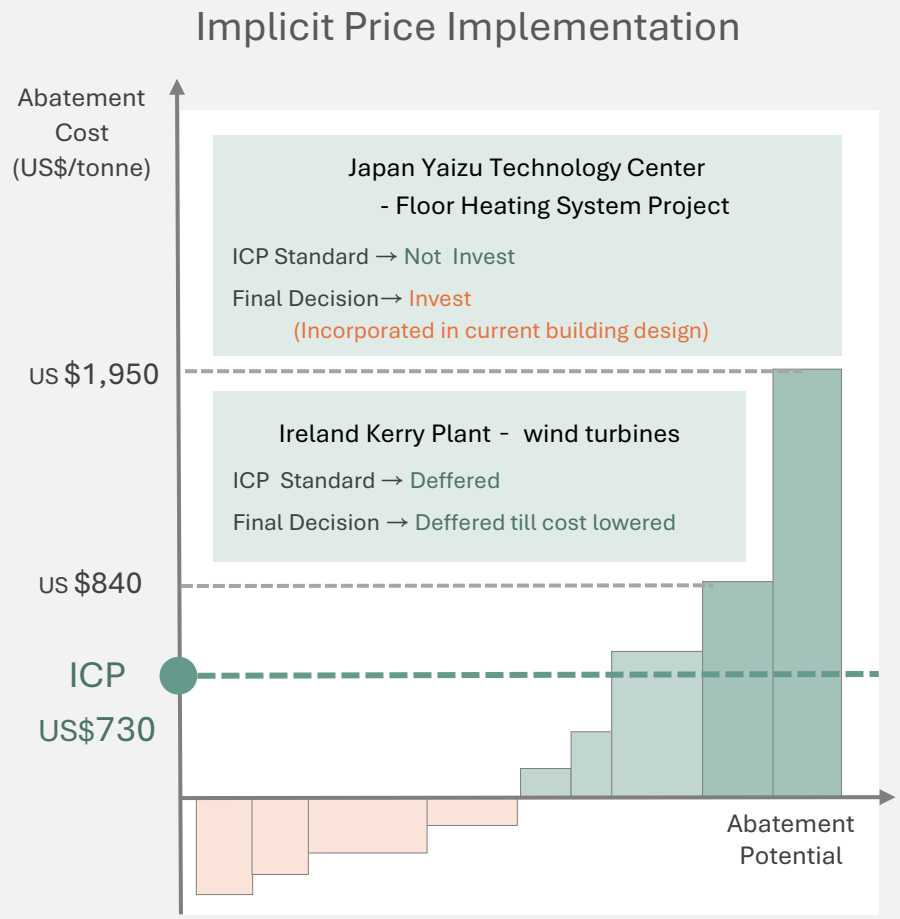
The discussion will focus on how these benchmark companies can expedite the process of carbon reduction by changing the price, scope and application of their ICP systems. This is done to address potential climate and regulatory risks, to promote reduction in a more cost-effective manner and to capture future low-carbon opportunities.

Global Benchmark Astellas- Implicit Price

Astellas is a world-renowned pharmaceutical company specializing in urology. It is operating in more than 50 countries and has eight manufacturing plants worldwide. Astellas conducted an internal emission assessment and found that electricity used for air conditioning is a major source of emissions in the plants. For instance, for its 4 Japan plants, Scope 1 & 2 emission account for 78% of the overall emissions, out of which, 70% comes from air conditioning equipment.

In order to mitigate the operational risk brought by climate change, Astellas adopted the strategy of “internal reduction first, emission trading second" and set up an implicit price in 2009 as a reference for carbon reduction investment. The overall system is promoted by the Tokyo headquarters and established the Environmental Health and Safety Committee (EHS) to be responsible for collecting information on carbon reduction plans, estimated costs, annual emission reduction, investment payback period and carbon reduction potential of each operating site. With this information, it creates a carbon reduction budget list and uses ICP as a benchmark for decision-making. For example, in 2011, the Kerry plant in Ireland proposed an investment case for self-built wind turbines, which cost about US$840 per tonne of carbon abatement, slightly higher than ICP of US$730 per tonne, and thus the decision was deferred.

Flexible adjustment was also conducted under the ICP structure. Take the investment in Japan Yaizu Technology Center's self-built floor heating system, for example. Although the carbon abatement cost per tonne was about US$1,950, much higher than the ICP level, the floor heating system had to be incorporated into the original design of the building. If they waited until the unit cost is lowered, the re-construction may cost more, and generate higher emissions.



Note. Information sorted by CIER from CDP report

Case Study Astellas

		Scope 1	Scope 2	Scope 3
Reduction Motives	External Pressure	Japan Carbon Tax US $2/ tonne Ireland Carbon Tax US $32/ tonne		
	Voluntary Target	SBT 2015-2030 30% Reduction		2015-2030 20% Reduction
	Emission Status (unit: tCO2e)	2019 82,093 2020 63,276 2021 63,691	2019 112,280 2020 59,320 2021 54,988 * market-based data includes renewable resources certificate	2019 228,183 2020 194,415 2021 200,017 Purchased goods & services Capital goods The other
ICP	Objective	• Drive low carbon investment • Identify & seize low-carbon opportunities		
	Mechanism	Reduction Investment **Type** Implicit Price (2009-) **ICP** US $730 / tonne **Scope** 1, 2 **Impact** Baseline for Reduction Investment		

Actions

Scope 1 Production improvement

- Gas boilers to replace diesel boilers
- Wood pellet boilers using biomass fuel

Scope 2

Reduce external energy demand

- Self-built wind turbines
- Self-built photovoltaic system
- Floor heating system

Renewable energy

Wind, photovoltaic, hydro, etc.

Purchase RECs

Scope 3

Shared warehouse

Collaborated with three pharmaceutical companies to build a joint logistics center and distribution platform in Hokkaido to improve transportation efficiency and share product transportation emissions

Renewable packaging

Sugar cane replaces traditional PVC capsule packaging material

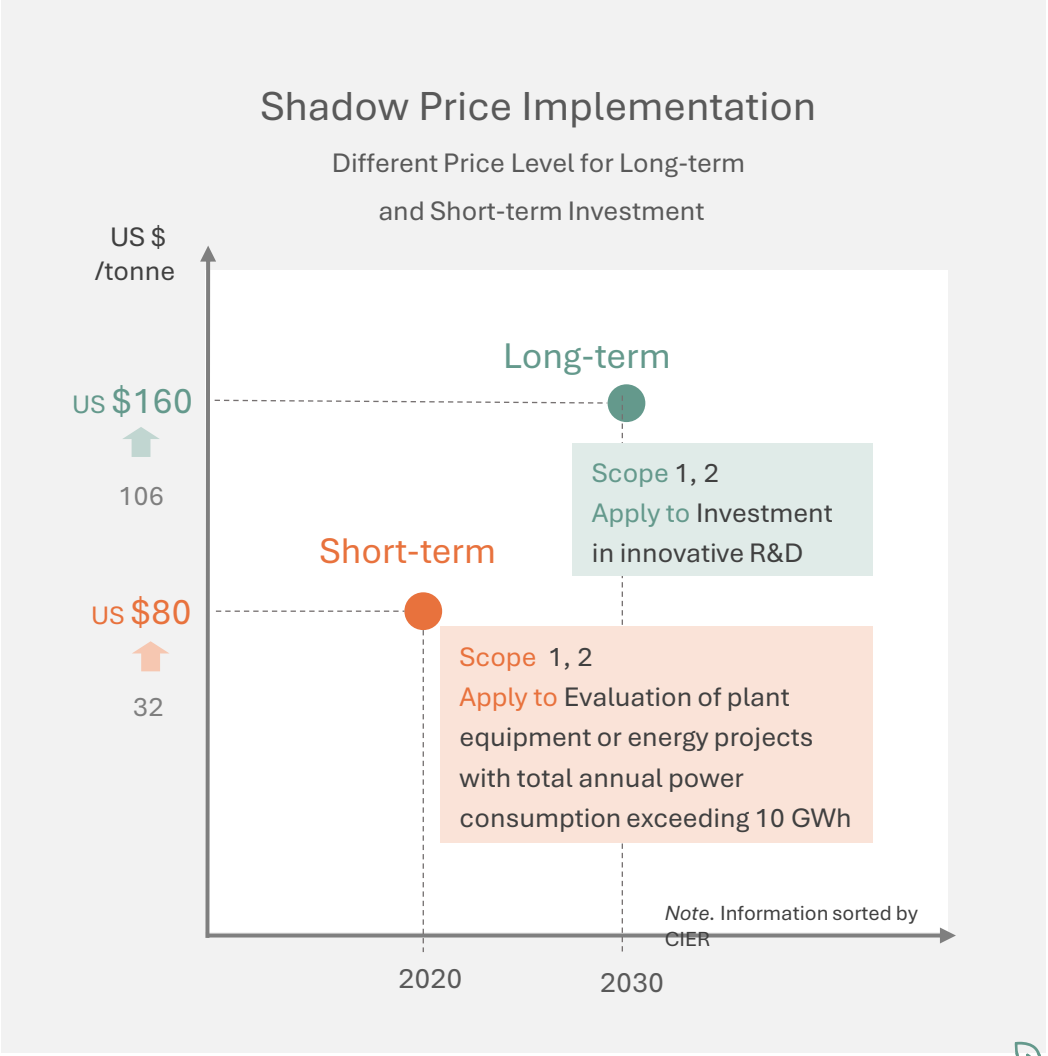
Note. Information sorted by CIER from CDP climate change questionnaire and Astellas Public Information

Global Benchmark Saint Gobain- Shadow Price

Saint Gobain Group, a global construction leader operating in 75 regions worldwide, generated US$46.96 billion revenue in 2021, of which 87% comes from construction and renovation, civil engineering and infrastructure. 40% of Saint Gobain Group's scope 1 emissions is covered by the EU's ETS. With the advancement of the EU's ETS system and the implementation of ETS pilots in Quebec, California and Korea, Saint Gobain Group introduced ICP in its global operations in 2016 to support its low-carbon investments in response to future regulations. Construction is a energy- intensive industry, and Saint Gobain Group's scope 3 emissions, including electricity and heating for buildings, account for approximately 70% of its overall emissions.

Saint Gobain Group implemented shadow pricing with different pricing levels for energy-consuming equipment in factories and for investments in R&D. For short-term investments in plants and equipment with greater impact on operations, a price level of $32 per tonne is set. When making investment decisions on plants consuming more than 10 GWh of electricity per year, the cost of carbon reduction is included in the return on investment assessment, encouraging global plants to invest in production process improvement projects, such as waste heat recovery equipment.

In anticipation of increasingly stringent regulations, higher ICP levels are set to encourage long-term low-carbon technology breakthroughs, such as hydrogen for glass production and raw material preheating technology. In 2019, Saint Gobain Group pledged to achieve carbon neutrality by 2050, and to further push to this goal, in 2021, it officially increased the price level from US$32 and US$106 per tonne to US$80 and US$160. Additionally, approximately US$100 million per year is set aside as budget for carbon reduction investments.



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Case Study Saint Gobain

		Scope 1	Scope 2	Scope 3
Reduction Motives	External Pressure	Carbon tax and fees and emission trading 40% EU ETS regulated emission		
	Voluntary Target	SBT 2017-2030 33% reduction 2050 carbon neutral		2017-2030 16% reduction
	Emission Status (unit：tCO2e)	2019 8,051,569 2020 7,915,725 2021 8,402,819	2019 2,707,306 2020 2,531,002 2021 1,927,391 * location-based excludes renewable resources certificates	2020 85,193,157 2021 132,653,527 Use of sold products Purchased goods & services The other
ICP	Objective	Drive low carbon investment		
	Mechanism	Short-term Investment Type Shadow Price Price Level US $32 (2016) → US $80 (2021) Scope 1, 2 Impact Equipment and energy procurement		
		Long-term Investment Type Shadow Price Price Level US $106 (2016) → US $160 (2021) Scope 1, 2, 3 Impact Investment in innovative R&D		

Actions

Scope1 Production Improvement

- Electric furnace for steel manufacturing process
- Waste heat recycling system
- Hydrogen energy for glass process research and development of raw material preheating technology

Scope 2

Reduce energy consumption

- Waste heat recycling
- Energy management system

Green energy

- Sign power purchase agreement
- Purchase RECs

Scope 3

Supply chain management

Sign procurement terms with suppliers and require completion of questionnaire on their platform

Substitute for original materials

Expanding the use of broken glass materials

Low-carbon products development

- Low carbon cement development
- 30% reduction in windshield size
- Strengthened product insulation function

Note. Information sorted by CIER from CDP climate change questionnaire and 《 Saint Gobain carbon neutrality: leading towards sustainable Building & Industry 》

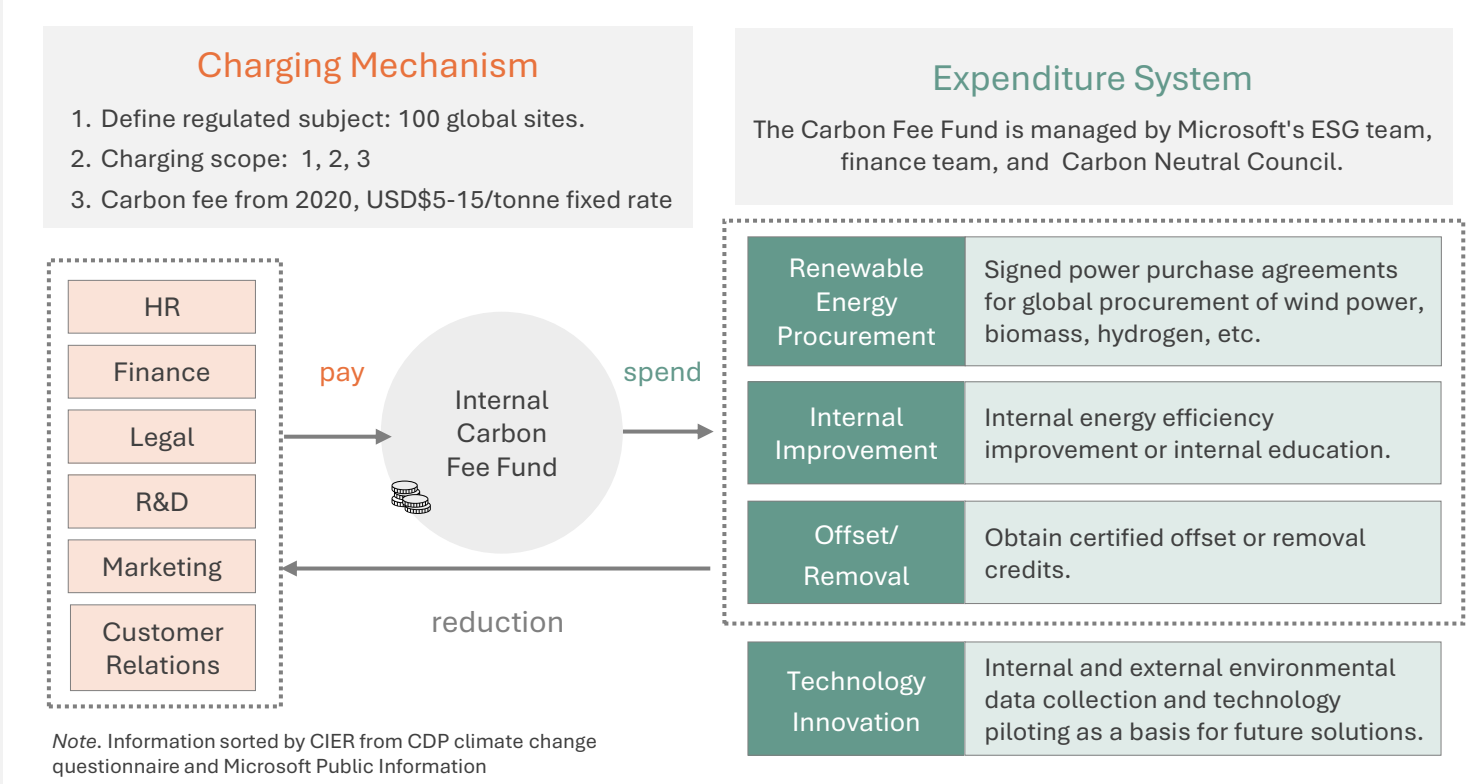
Global Benchmark Microsoft- Internal Carbon Fee

After setting its first emission reduction target in 2009, the global technology company, Microsoft, began investing in carbon reduction and offsets. After reaching 100% carbon neutrality in 2012, it set a negative carbon emission target by 2030, and thus introduced an internal carbon fee system.

Establish Internal Low-Carbon Consensus

To guide internal low-carbon consensus, Microsoft's ICP focuses on the design of carbon funds. Firstly, the Microsoft Carbon Neutral Council plans the budget for the fund. Secondly, the cost per unit of emissions during that period is set, and with the assistance of the sustainability and finance team, operations in more than 100 countries around the world are charged for scope 1 and 2 emissions, including from business trips.

Internal Carbon Fee Fund Implementation

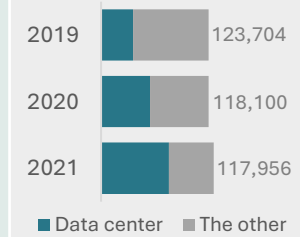
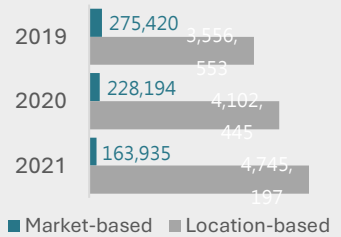
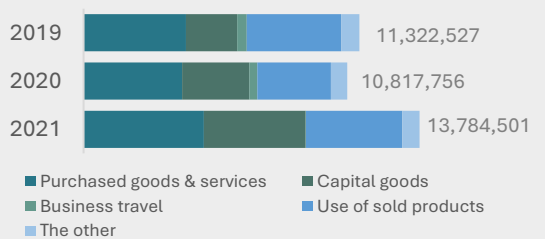


Note. Information sorted by CIER from CDP climate change questionnaire and Microsoft Public Information

Finally, the funds are used on low-carbon actions, such as collection and disclosure of carbon emissions data, renewable energy procurement and emissions offset investments. The goal of the fund is to promote the concept of carbon reduction through technology and business model innovation.

Microsoft's sustainability team considers internal education and communication and carbon emissions data tracking and disclosure to be important tasks in the initial phase of ICP. According to the CDP questionnaire, Microsoft's ICP was approximately US $4.4 per tonne in 2014. Aside from external renewable energy purchases and carbon offset investments, the carbon fee collected is also used for fostering internal carbon awareness and driving carbon reduction. For example, for data centers that are major sources of scope 1 and 2 emissions, Microsoft invested part of its carbon fund into developing underwater data centers and renewable energy procurement. In addition to working with airlines to increase the use of sustainable fuel, internal carbon fee mechanisms also internalize the cost of a business trip's carbon footprint, which can guide employees to choose lower-emission transportation.

Case Study Microsoft

		Scope 1	Scope 2	Scope 3
Reduction Motives	External Pressure	2017-2030 75% Reduction 2030 Negative Emission / 2050 Offset Historical Emission		SBT 2017-2030 30% Reduction
	Voluntary Target (unit: tCO2e)			
ICP	Emission Status	• Change internal behavior • Drive energy efficiency	• Drive low carbon investment • Supplier engagement	• Identify & seize low-carbon opportunities
	Objective	Scope 1 & 2 Type Internal Carbon Fee Price Level US$ 4.4 (2014) → US$15 (2020) Scope Scope 1, 2 Impact Global Operation Emission Fee		Business Travel Type Internal Carbon Fee Price Level US$ 4.4 (2014) → US $15(2020) → US $100 (2022) Impact Business Trip Emission Fee Other Type Internal Carbon Fee Price Level US$5(2020)→ US$8 (2022) Scope 3 Impact Product Design & Procurement Decision

Note. Information sorted by CIER from CDP climate change questionnaire and Microsoft Public Information

* Market-based Data excludes RECs

Promote Low-Carbon Innovation

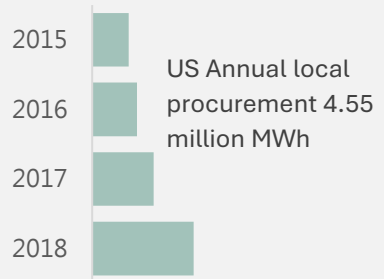
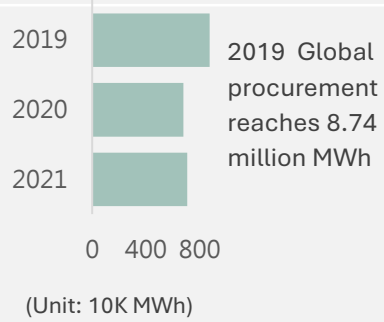
The purpose of Microsoft's internal carbon fee system is not only to change internal behaviour and improve energy efficiency, but also to promote innovation to capture low-carbon business opportunities. In addition to routine carbon reduction efforts, the fund will also be used for the AI for Earth program. In addition, in 2019, Microsoft announced it would increase the carbon fee of scope 1 and 2 to US$15 per tonne and also include scope 3 with the fee of US$5 per tonne to further change raw material procurement decisions and promote to develop low-carbon products.

Offset and Carbon Removal

In order to achieve negative carbon emissions by 2030, Microsoft not only extended the internal carbon fee system to Scope 3, but also shifted the fund's investment focus from carbon offsets in developing countries to carbon removals in 2021. This meant approximately 1.4 million tonnes of removals purchased in the first year, with this gradually increasing in the following years.

In March 2022, Microsoft announced further ICP adjustments, maintaining US$15 per tonne for electricity usage, while increasing business trip emissions from US$15 to US$100 per tonne. Other emissions also increased from US$5 to US$8 per tonne. In addition, Microsoft is committed to expanding its low-carbon product offerings, developing new business models, and investing in negative carbon technologies.

Use of Internal Carbon Fee

ICP	Internal Actions	Renewable Energy Procurement	Technology Innovation	Offsets / Carbon Removal
Internal Carbon Fee (2012-2018) Rate target budget/ total emission Range Scope 1 & 2, business trips	**Data center energy-saving** • Hydrogen fuel cells replace diesel generators • 78% reuse of assets and equipment • LEED certification for energy and water conservation in buildings • Underwater data center development **Business trip carbon reduction** • Teams Meeting replaces physical meetings • Choose airlines using sustainable fuels	**Sign PPA for wind, biomass, hydrogen, photovoltaic, geothermal, etc.** 		**Carbon Offset** (2012-2020) • South America Reduced Emissions from Deforestation and Forest Degradation Plus (REDD+) project • Methane from pig farms in Brazil • Inefficient Stove Improvement Project in Africa
Internal Carbon Fee (2019-2021) Rate US$5-15 Range Scope 1, 2, 3	**Develop low-carbon products** • Xbox product power saving mode reduces energy consumption by 80% • Surface laptop reduces carbon footprint by 30% over previous generation **Supply chain reduction** • Request suppliers to disclose of Scope 1-3 emissions	 (Unit: 10K MWh)	**AI for Earth** (2018-2023) Invested US$50 million in 5 years to cooperate with NASA and USDA to collect data related to the Earth's natural system and use AI cloud computing technology to build the world's first Planetary Computer.	**Carbon removal** (2021-) • Afforestation and carbon sequestration • Scientific farmland management • Biochar • Carbon capture & storage

Note. Information sorted by CIER from CDP climate change questionnaire and Microsoft Public Information

Global Benchmark BP- Internal Emissions Trading

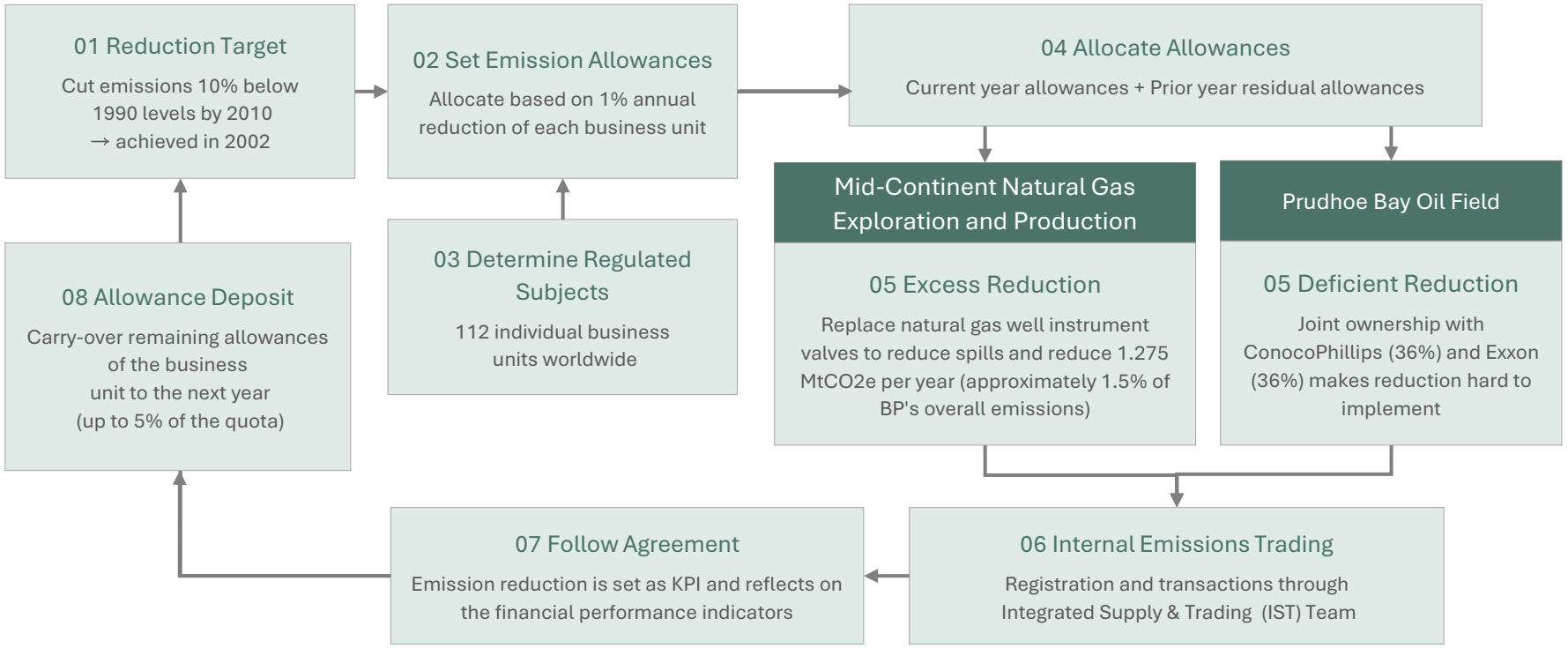
Following the adoption of the Kyoto Protocol by UNFCCC COP3 in 1997, British Petroleum (BP) responded by announcing a goal to reduce emissions to 10% below 1990 levels. The biggest challenge is that BP has more than 100 business locations around the world with diversity in operating models. Each location faces different policy pressures and marginal abatement costs. To effectively allocate and manage resources, BP established an internal emissions trading system in 2000 after a one-year trial period to manage emissions from four major business groups and 112 independent business units worldwide.

BP's internal emissions trading system is led by its sustainability department alongside representatives from each business unit. With external accounting firms, they work together to standardize emission calculations and to establish data auditing and verification methods. Furthermore, an internal open database of carbon reduction is established to share cost-effective practices and experiences. Through internal communication and consensus meetings, each unit is assisted in selecting the most appropriate reduction plan according to its current operating conditions.

Each business unit is required to reduce 1% of its annual emissions every year. To facilitate subsequent trading and flow tracking, all allowances are assigned with serial numbers, labeled with the year, and then issued to business units.

After allowances are allocated, internal emissions trading can be conducted. For instance, Mid-Continent Natural Gas Exploration and Production Group are the biggest internal allowance sellers. They utilized US$4 million in emission reduction funds to replace 11,000 natural gas well instrument valves, which reduced fugitive emissions by more than 3 million metric million British thermal unit (MMBTu) per year and 1.275 metric tonnes of carbon dioxide equivalent (MTCO2e). Moreover, they now generate US $5 million in revenue for the company. On the other hand, Prudhoe Bay Oil Field has to buy allowances since its largest emission facility has not yet reached the retirement date, causing deficient reduction values.

Internal Emissions Trading Implementation



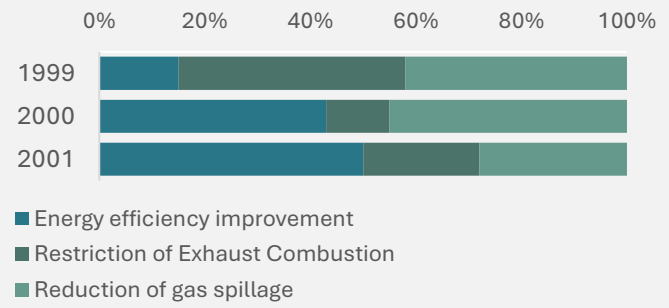
Note. Information sorted by CIER

In 2000, BP traded 2.7 million tonnes of allowances internally at an average price of about US $7.60 per tonne, while the average price of 4.5 million tonnes of allowances traded in 2001 rose to US $36 per tonne. However, the weakness of the system is that since BP allows unused allowances to be carried over to the following year. Consequently, the price of allowances generally rises in the second half of the year due to supply and demand mechanism.

Although the BP emissions trading system still needs to be adjusted and optimized, it has been effective in building a consensus on emission reduction for all business units and promoting emission reduction measures, helping BP to achieve the 2010 reduction target ahead of schedule in 2002 and generating US$650 million value through cost avoidance and additional revenue.

Case Study BP (British Petroleum)

		Scope 1	Actions
Reduction Motives	Voluntary Target	10% reduction target by 2010 compared to 1990→achieved in 2002	
	Emission Status (unit: MtCO2e)	1998 94.4 1999 91.4 2000 83.7 2001 80.5	
ICP	Objective	Promote Internal Reduction	
	Mechanism	Type Internal Emissions Trading Price Level US$7.6 (2000) → US $36 (2001) Scope Scope 1 of 112 Business Units Impact Push internal implementation of carbon reduction to comply with allocates allowance	



Note. Information sorted by CIER

Taiwanese Benchmark Delta Electronics- Internal Carbon Fee

Delta Electronics, a Taiwanese power management and thermal solutions provider, has been building sustainable buildings and promoting energy-saving measures since 2006. Delta has also been tracking global carbon prices and has established an internal management system and communication network to internalize the economic costs of its emissions and reduce its carbon footprint.

In 2017, Delta established shadow pricing of US$50 per tonne in response to the carbon fee in the Greenhouse Gas Reduction and Management Act. Furthermore, in 2021, it introduced an internal carbon fee system of US$300 per tonne.

Delta continuously reviews the carbon reduction trends and adjusts its ICP annually. For Delta, ICP is both an internal tool to support the company's decarbonization strategies as well as a risk management tool. The internal carbon fee not only supports the achievement of Delta's RE100 and net-zero targets, but also encourages investment in negative carbon or low-carbon technologies. Meanwhile, each business unit makes carbon-conscious decisions through carbon cost management.

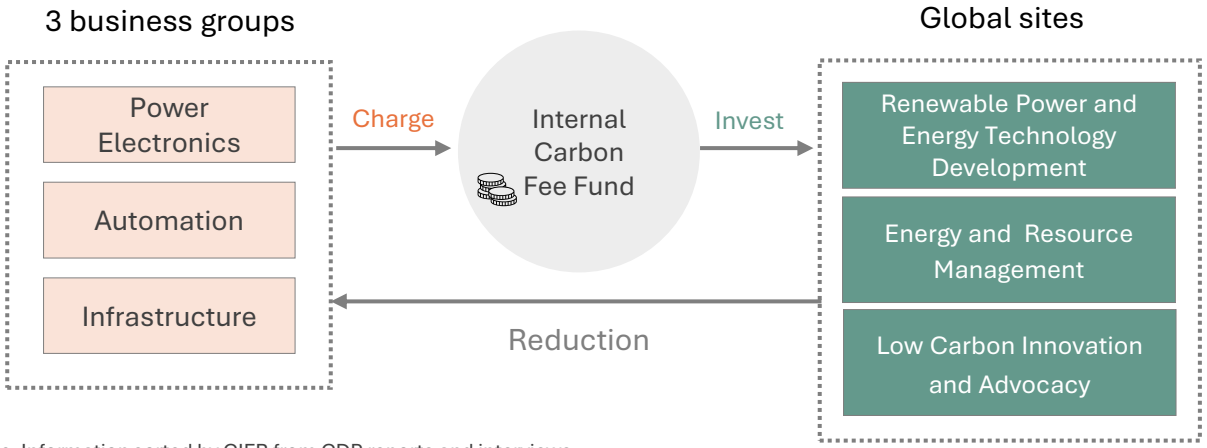
Internal Carbon Fee Fund Implementation

Charging

1. Define regulated subject：All global sites
2. Charging Scope：1, 2
3. Carbon fee：US $300/ tonne

Investment

1. Managed by Delta's ICP project under the Sustainability Committee
2. Expenditure Scope：1, 2, 3



Note. Information sorted by CIER from CDP reports and interviews

Case Study Delta Electronics

		Scope 1	Scope 2	Scope 3
Reduction Motives	External Pressure	Customer expectation: Commitment to RE100/ SBT/ CDP		
	Voluntary Target	SBT Net Zero: 2030 Carbon Neutral 2021-2030 90% Reduction; 2050 Net Zero / RE100		2021-2030 Scope3 25% Reduction 2021-2050 Scope3 90% Reduction
	Emission Status (unit：tCO2e)	2019 18,598 2020 14,183 2021 17,808	2019 238,962 / 378,648 2020 163,628 / 390,868 2021 133,207 / 415,448 Market-based / Location-based	2019 397,498 2020 594,288 2021 652,952 Downstream transportation & distribution Fuel & energy- related activities Use of sold products the others
ICP	Objective	• Change internal behavior • Drive energy efficiency • Drive low carbon investment • Identify & seize low-carbon opportunities		
	Mechanism	Shadow Price: Type Shadow Price; Price Level US $50 (2017-2021); Scope 1, 2; Impact Low-carbon investment decision making		
		Internal Carbon Fee: Type Internal Carbon Fee; Price Level US $300 (2021-); Scope (1) Charging: Scope 1,2 (2) Investment: Scope 1, 2, 3; Impact Encourage low-carbon innovation		

Actions

Scope 2

Energy saving programs

More than 2,000 programs during 2011-2021, reducing emissions by more than 245K tonnes

- Infection molding machine
- Production Process Improvement
- Burn-in Energy Recovery
- Others (management, etc.)

Renewable energy

- Self-generation
- Unbundled REC
- Sign power purchase agreement
- Invest in renewable power plants

Scope 3

Supplier ESG management

Set short- and medium-term key objectives and provide education to help develop carbon reduction measures.

Energy-saving products

Continuously improve product energy efficiency

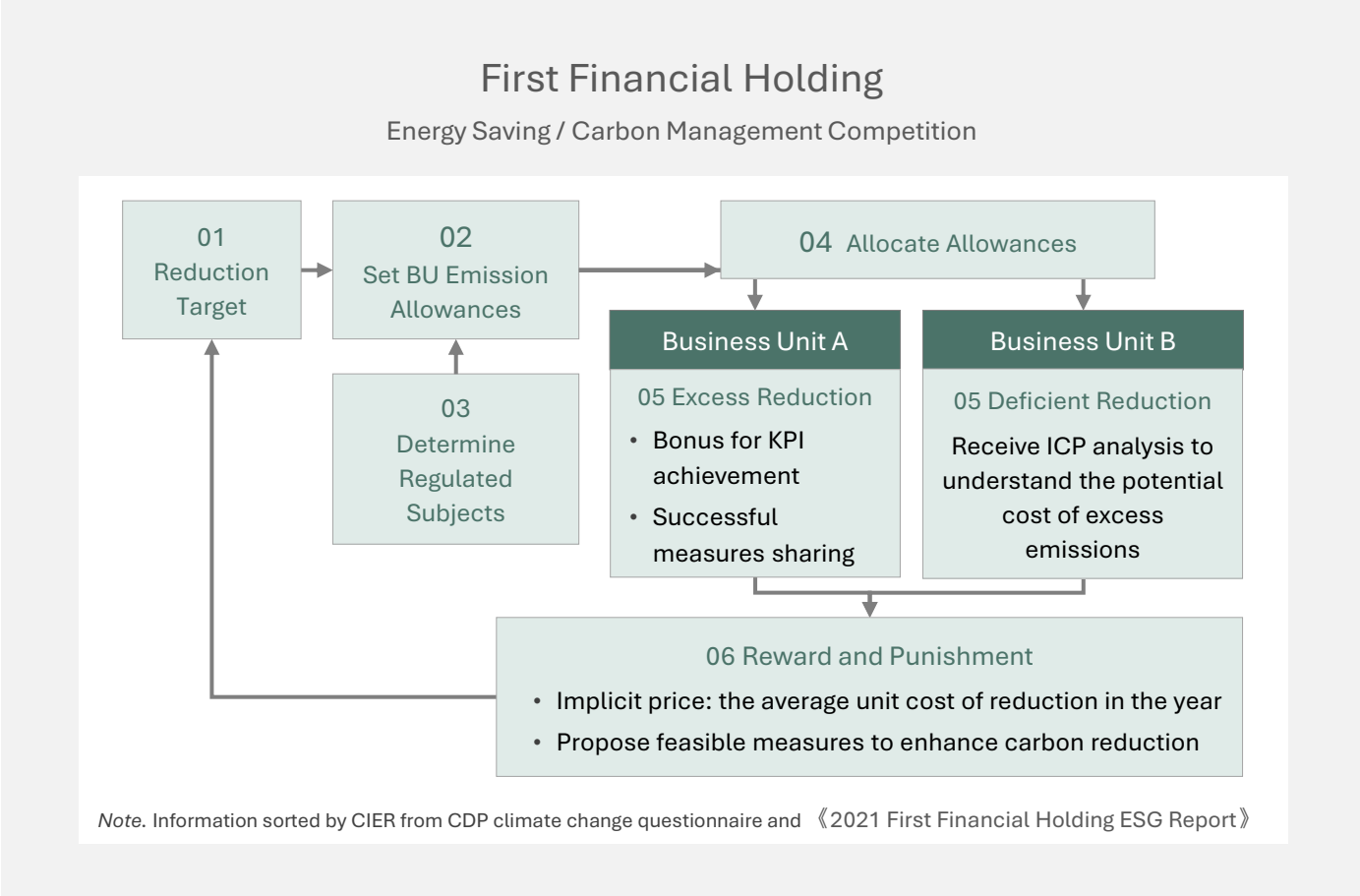
Note. Information sorted by CIER from CDP reports and interviews

Taiwanese Benchmark First Financial Holding- Hybrid ICP

In 2010, First Financial Holding formed the "Green Building Label Acquisition Program" to promote energy-saving and carbon reduction in its own buildings. The company has created a system that generates internal competition based on emissions-management. Since 2015, each business unit must propose and implement its own reduction plans.

The internal energy saving/carbon management competition integrates various ICP types, such as internal emissions trading, internal carbon fee and implicit price. With the internal emissions trading practice, the enterprise sets reduction targets for its business units, such as First Commercial Bank, First Securities and First Securities Investment Trust, and allocates emission allowances. Business units that fail to reach reduction targets are required to submit a reduction plan with feasible actions that increase energy savings and strengthen carbon reduction policies for the following year.

According to First Financial Holding's sustainability report, the units that achieved the carbon reduction target in 2021 reduced emissions by 207 tonnes compared to the previous year, saving approximately US $30,000 in operating costs based on an implicit price level of US $147 per tonne.



Note. Information sorted by CIER from CDP climate change questionnaire and 《2021 First Financial Holding ESG Report》

Case Study First Financial Holding

		Scope 1	Scope 2	Scope 3
Reduction Motives	External Pressure	Decrease in potential investment portfolio profits		
	Internal target	SBT: 2016-2030 58.8% Reduction; 2016-2050 90% Reduction		
	Emission Status (unit: tCO2e)	2019: 2,487 2020: 2,579 2021: 2,470	2019: 20,282 / 20,282 2020: 19,961 / 20,032 2021: 19,409 / 19,422 Market-based / Location-based	2020: 98,645 2021: 82,291 Product and Service Purchase Energy Generation Sale of Processed Products Others
ICP	Objective	• Navigate GHG regulations • Drive energy efficiency • Change internal behavior		
	Mechanism	Energy Saving Competition Type Internal Emissions Trading, Internal Fee, Implicit Price Price Level US $147 (2020) → US $149 (2021) Scope 1, 2 Impact Motivate internal carbon reduction.		

Actions

Scope 1

Business Vehicles Replacement

Replace 96 traditional fuel motorcycles with electric motorcycles by the end of 2021

Scope 2

Renewable Energy

- Roof-top solar power system
- Purchase RECs

Reduce energy consumption

- Green building standards

Scope 3

Green Financial Products

Green loans offering interest rate discounts, energy financing programs, etc.

Promote electronic documents

Paperless meetings and operations, reducing emissions from paper

Local Procurement

From 2021, 100% procurement from local suppliers

Note. Information sorted by CIER from CDP climate change questionnaire and 《2021 First Financial Holding ESG Report》

04 Conclusion and Recommendation

Lessons Learned from Implementing ICP

In response to the increasing global climate risks and to ensure market competitiveness, many companies are promoting low-carbon transformation. However, there are many methods and strategies to reduce carbon emissions, from process equipment replacement, employee commuting behavior changes to reforestation. Due to factors such as market supply and demand and maturity of technology, the cost-effectiveness and carbon reduction effects of various methods are different.

ICP thus serves as a top-down carbon management tool that coordinates the internal assessment and implementation of various carbon reduction measures to change the original operating behavior and enhance the overall competitiveness of the enterprise. According to the CDP questionnaire, there are five types of applications: Implicit Price, Shadow Price, Emission Offset, Internal Carbon Fee, and Internal Trading. Industries and enterprises can adopt different strategies according to their own market characteristics, organizational structure, GHG emissions coverage, corporate culture, operational processes, and different purposes of implementation.

The implementation of the ICP system can follow 4 major steps: (1) establishment of objectives and consensus; (2) price and mechanism design; (3) trial and promotion; (4) rolling review and adjustment. The system design can be viewed from 4 dimensions to ensure effectiveness and feasibility of ICP, including Carbon price level (height), Business influence (depth), GHG emissions coverage (width) and Development journey (time).

First of all, an enterprise should determine its own climate risks and opportunities and set short to long-term reduction targets and roadmaps to determine the price and mechanism. Most importantly, ICP systems should be reviewed and adjusted on a rolling basis to ensure that it helps achieve the enterprise's expected carbon reduction targets. This will ensure the carbon pricing strategy will remain tethered to the actual carbon reduction work and prevent the enterprise from losing focus on the overall purpose.

Keys to effective ICP systems lie in two aspects, including good communication along with consensus-building in advance, and rolling adjustments after implementing ICP system, which significantly impacts operation for companies with pricing strategy.

The Case Study chapter reviews the ICP approaches and experiences of global and Taiwanese companies: the pharmaceutical company, Astellas, the construction group, Saint Gobain, the technology company, Microsoft, the oil and energy group, BP, the electronic component manufacturer, Delta Electronics and the financial institution, First Financial Holding.

Based on the case studies, it is evident that successful implementation of an ICP framework is not only dependent on data support but also on the company's emission patterns and the ICP development journey. To achieve the desired reduction effect, it is important to choose an ICP system that is both easy to implement and flexible. This ensures that the price level will accurately reflect the company's reduction target and cost.

To Increase Data and Information Transparency

Data and information transparency can be divided into two aspects: emission data and information on reduction measures. Microsoft, which employs an internal carbon fee system, and BP, which uses an internal emissions trading system, have made reliable and consistent emissions data across departments is a key preparatory task when introducing an ICP system. Standardized emission data collection and disclosure within the enterprise not only helps managers identify the sources of emissions and track historical reduction performance but also guarantees the credibility of investment decisions based on ICP.

Transparency in reduction measures can help companies achieve their reduction targets in a cost-effective way. For instance, BP and Astellas promote effective reduction practices within the group by compiling a cost-benefit list of reduction measures. First Financial Holdings encourages business units with excellent reduction performance to share their reduction practices, enabling cross-department learning.

To Reflect Actual Carbon Reduction

ICP not only needs to correspond to the company's reduction targets and organizational structure but also needs to align with the actual cost of reduction to ensure applicability and effectiveness. BP's experience shows that although the internal emissions trading mechanism helped the group achieve its reduction target within a short period, by 2001, its internal market price was significantly higher than the actual average reduction cost of each business unit. In contrast, Saint Gobain Group gradually adjusted its carbon price level to meet climate regulations. Delta Electronics took into account both internal and external carbon costs, including regulatory fines, emission trading prices, international benchmarking cases, and the cost of renewable energy, in order to establish an internal carbon pricing scheme. Lastly, First Financial Holding used the implicit price of the current year as the standard for charging carbon fees. All of the above practices are exemplary for corporations to follow.

To Ease Implementation and Flexibility

“The need to keep things simple" is Microsoft’s Sustainability team's recommendation for ICP. While systems such as internal carbon fees and internal emissions trading can help companies accelerate their reduction goals, incomplete management systems such as complicated administrative procedures can also lead to a waste of manpower and conflict between departments.

To Build Internal Consensus on Carbon Reduction

Building consensus for carbon reduction is another key reason for companies to promote ICP. Saint Gobain's use of shadow pricing, for example, influences many significant corporate investment decisions, as well as considerations for board resolutions. Therefore, consensus within the board and between executives are keys for top-down implementation. Delta Electronics spent 1-2 years on internal education and communication while transitioning from shadow price to internal carbon fee. Microsoft’s Sustainability team also recommends spending 1-3 years on internal education to reach carbon reduction consensus in the early stages of ICP implementation.

However, with increasing awareness on climate change and the popularization of the carbon cost concept, the consensus-building period should shorten in the future. In addition, starting with a relatively simple form of application and establishing a roadmap to promote the concept of carbon cost step by step can help enterprises implement ICP more effectively. Ultimately, with the successful establishment of ICP, companies can mitigate the operational risks brought by climate change and seize low-carbon business opportunities.

Abbreviation Table

Abbreviations	Definitions
CBAM	Carbon Border Adjustment Mechanism
CDP	Carbon Disclosure Project
EHS	Environmental Health and Safety Committee
ESG	Environmental, Social, and Governance
ETS	Emissions Trading System
EU-ETS	European Union Emission Trading Scheme
GHG	greenhouse gas
ICP	Internal Carbon Pricing
OPEX	Operating expense
RECs	Renewable Energy Certificates
SBT	Science Based Target
SCC	Social Cost of Carbon
WMO	World Meteorological Organization

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