Intensive Capacity Building in Internal Carbon Pricing and Green Finance for Key Stakeholders of GHG mitigation in Thailand

Step-by-step Practical ICP Guideline, Implementation Plan and Monitoring Plan

(Draft version)

Prepared for

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Step-by-step Practical ICP Guideline, Implementation Plan and Monitoring Plan for GPSC

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List of Abbreviations & Acronyms

Abbreviation & Acronyms	Description
ADB	Asian Development Bank
AF	Adaptation Fund
BAU	Business as usual
CAPEX	Capital expenditure
CFO	Carbon Footprint for Organization
CFP	Carbon Footprint for Products
CSR	Corporate Social Responsibility
DEDE	Department of Alternative Energy Development and Efficiency
EERF	Energy Efficiency Revolving Fund
EF	Environmental Fund
ENCON Fund	Energy Conservation Fund
ESG	Environmental, Social, and Governance
ETS	Emissions Trading Scheme
EXIM	Export-Import Bank of the United States
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GWP	Global Warming Potential
ICP	Internal Carbon Pricing
ICP Guideline	Step-by-step Practical ICP Guideline, Implementation Plan and Monitoring Plan
ICP objective	Objective specific to ICP implementation
IFC	International Finance Corporation
IFF	Infrastructure Fund
I-REC	International Renewable Energy Certificate
IRR	Internal Rate of Return
JBIC	Japan Bank for International Cooperation
JCM	Joint Credit Mechanism

KPI	Key Performance Indicator
MAC	Marginal Abatement Cost
MIGA	Multilateral Investment Guarantee Agency
NDA	National Designated Authority
NPV	Net Present Value
ONEP	Office of Natural Resources and Environmental Policy and Planning
OPEX	Operational expenditure
SOP	Standard Operational Procedures
tCO_2e	Ton of CO_2 equivalent
The Bank	World Bank
TGO	Thailand Greenhouse Gas Management Organization
UNEP-FI	UNEP Finance Initiative
USTDA	United States Trade and Development Agency
VaR	Value at Risk
VCS	Voluntary Certified Standard
VCU	Verified Carbon Unit
WRI	World Resources Institute

Preface

This Step-by-step Practical ICP (Internal Carbon Pricing) Guideline, Implementation Plan and Monitoring Plan ("**ICP guideline**") is developed and funded under the project, "Intensive Capacity Building in Internal Carbon Pricing and Green Finance for Key Stakeholders of GHG Mitigation in Thailand", managed by the World Bank (the "Bank") in partnership with Thailand Greenhouse Gas management Organization ("TGO"), to support the market readiness efforts to attain greenhouse gas (GHG) mitigation targets via private sector engagement.

Objective of this ICP guideline

To provide practical guidance for ICP design and implementation for GPSC. Based on this guideline, GPSC can regularly update and revise implementation plan to ensure that it remains fit for the purpose of GPSC's climate change strategy and targets.

Globally, ICP is a prudent accounting and risk management tool undergoing rapid adoption by any organization looking towards a low-carbon future. It is a powerful tool to help assess climate-related risks and opportunities resulting from the transition to a low-carbon economy. Based on the data from the CDP[1], in 2018 nearly 1,600 companies disclosed that they are currently using, or planning to implement, an internal carbon price within two years. Some companies describe a variety of ways in which the ICP has directly affected their budget allocations or investment decisions, which has resulted in tangible changes.

To design the conceptual framework and methodology for this Guideline, the Consultant team reviewed and brought some of those practical lessons learned into account, together with our direct experiences assisting clients in the UK, Singapore and Thailand on ICP strategy development. In addition, this Guideline was also taken inputs and feedbacks from GPSC through various activities and capacity building exercises from testing ICP case study results during September until November 2020. Therefore, this ICP Guideline was tailored and optimized in the context of the company.

This guideline is divided into 3 main sections:

- **Section 1** Step-by-Step Practical Guideline for ICP implementation
- **Section 2** Implementation Plan & Monitoring Plan for GPSC
- **Section 3** Recommendations for access to Green Finance

The Section 1 illustrates the general 4-step process of a full ICP implementation from designing (Step 1&2), testing (Step 2), fully implementing (Step 3) to monitoring (Step 4) of the ICP approach. The Section 2 is focused on the tailor-made plans of full implementation (Step 3)

[1] https://www.cdp.net/

and continuous monitoring (Step 4) for GPSC. The Section 3 takes ICP further towards green finance opportunities for GPSC. Taken together, this document shall serve as the Guideline for GPSC's continuous ICP implementation in the future.

Definitions

The following definitions apply for the purpose of this document:

Carbon Footprint for Organization (CFO) is the quantity of GHG emissions and removals as a result of an organization's activities, demonstrated in terms of tonne or kilogram of carbon dioxide equivalent. The CFO is recognized as an important tool in quantifying and reporting GHG emissions and removals from an organization's activities and is applicable for both public and private organizations.

Carbon Footprint of Products (CFP) takes into account the quantity of GHG emissions from each production unit throughout the whole life cycle (cradle-to-grave) of a product. Carbon footprint thus calculates the carbon dioxide equivalent (CO2eq) of the GHG emissions releasing from the raw material acquisition, manufacture, use, waste management and final disposal including related transports in all stages

Carbon pricing in general is an economic instrument that captures the external costs of greenhouse gas (GHG) emissions – the costs of emissions that the public pays for in the event of hazards occurred from climate change impacts, such as damage to crops, health care costs from heat waves and droughts, and loss of property from flooding and sea level rise - and ties them to their sources through a price, usually in the form of a price on the carbon dioxide (CO_2) emitted[2].

Climate Risk Premium is an additional return that a company expects to receive from investing in a high GHG emission project which can be perceived as compensation for taking on extra risk in high GHG emission investment.

Climate Stress Test is an exercise to assess how climate-related risks (e.g. transition risk) impact a company under stress scenarios. Based on the results of the stress testing, the company will be able to establish climate resilience measures and strategy that will help to better respond to the threat posed by climate-related risks. Although the use of stress testing to measure climate-related risks is a relatively new development, the stress test is now considered key elements to understand, quantify and forecast the financial impact of climate risk to assess transition risks in different plausible scenarios.

Implicit carbon price is calculated based on how much it costs a company to implement emissions reduction projects, such as renewable energy purchases or energy-efficiency upgrades. An implicit carbon price is calculated retroactively, after a company achieves its

[2] World Bank (e.d.), *What is carbon pricing?* [Online] Retrieved from https://carbonpricingdashboard.worldbank.org/what-carbon-pricing (accessed: 28 October 2020)

desired emissions cuts. Several implicit carbon prices may co-exist within the same company, which can be used as a benchmark for calculating and setting an internal carbon price.

Internal carbon fee is a charge that a company voluntarily imposes on its business units for their emissions. Fee rates can be decided in different ways, depending on the objectives of the given company for introducing such a fee. As applying an internal carbon fee scheme will induce cash flows or monetary transfers within the company, it will influence the bottom line in a way that business decisions can intuitively be steered towards lower emissions choices. Another benefit of applying the internal carbon fee is that it would generate revenue from the collected fees for the company which the company can design to recycle for incentivizing low carbon investment, supporting R&D activities for green products, or purchasing carbon credits to offset its GHG emissions etc.

Internal carbon pricing (ICP) is one of the carbon pricing instruments applied by private sector stakeholders, such as enterprises, financial institutions, educational institutions, etc., to assess and evaluate the potential impacts, including risks and opportunities, of carbon emissions on their businesses and activities. These impacts can stem from different sources, such as mandatory carbon prices in the form of carbon taxes or emissions trading schemes (ETS), as well as changing business environments due to consumers' raising awareness of climate change and/or harsher competition under stricter regulations on GHG emissions in specific industries and jurisdictions.

Internal carbon trading is similar to internal carbon fee, except that the carbon price charged on each business unit is decided by the market mechanism within the company. It is a mechanism that some companies might be interested in piloting to familiarize themselves with carbon credit trading such that they can be more prepared for any potential emissions trading scheme in the future. However, the implementing cost of an internal carbon trading scheme can be much higher than any other forms of ICP (see Table 2 on Page 20 the detailed comparison of all forms of ICP).

Marginal Abatement Cost (MAC) is the cost of reducing GHG emissions. Marginal cost, in general, is an economic concept that measures the incremental cost reducing of an additional unit of GHG emissions. The marginal abatement cost, in general, measures the cost of reducing one more unit of pollution. Although marginal abatement costs can be negative, such as when the low carbon option is cheaper than the business-as-usual or a baseline option, marginal abatement costs often rise steeply as more GHG emissions pollution is reduced.

Marginal Abatement Cost Curve (MAC curve) is a straightforward tool for presenting GHG emissions abatement options relative to a business-as-usual or a baseline. It is a curve that plots out the marginal costs of achieving a cumulative level of emissions abatement which broken into discrete blocks. Each block represents an individual or a set of similar GHG abatement measures. For each block (or GHG mitigation measure), the width indicates the amount of

potential carbon emissions abatement (tCO_2) while the height estimates the marginal cost of the carbon emissions abatement (USD/tCO_2). MAC curve plots the GHG mitigation measures in order from the lowest- to highest-cost technology or measure. Typically, the blocks are ordered such that the lowest cost options, which may represent net cost savings (negative USD/tCO2), are shown first on the left, with subsequent higher cost options proceeding to the right. Therefore, MAC curve can present measures to reduce GHG emissions in the order of their cost-effectiveness.

Shadow pricing is an economic term, which in the Nobel-prized economist Jan Tinbergen's words is defined as "prices indicating the intrinsic or true value of a factor or product in the sense of equilibrium prices"[3]. Shadow carbon pricing therefore refers to the intrinsic value of carbon emissions, which can be hypothetically estimated based on contextual assumptions and expectations. To put it simple, a shadow price of carbon is a hypothetical surcharge on carbon emissions adding to market prices. It is useful for risk management, especially when any regulatory compliance is expected to be imposed in the future. The most common way of adopting ICP in the form of shadow pricing is to incorporate the selected shadow price of carbon into the financial analysis of a project or an asset investment.

Transition risk in climate change is a risk that a business must adapt and transit its business models to a low-carbon economy may affect the business models and profitability. The transition risk generally includes policy and regulatory risk, technology risk and liability risk. Under this guideline, the focus of the transition risk is on potential impact from regulation risk of the carbon pricing instruments that might be implemented in the future.

[3] Chand, S.N. (2008). Shadow Prices. In Chan, S.N., *Public Finance* (vol.2, pp.544). Atlantic Publishing, India

Section 1

Step-by-Step Practical Guideline for Implementation of Internal Carbon Pricing

Section 1 Step-by-Step Practical Guideline for Implementation of Internal Carbon Pricing

Under this section, the Step-by-Step Practical Guideline for Implementation of Internal Carbon Pricing (ICP) is presented. The main purpose is to provide guidance on how to design, implement and monitor a best-practice ICP approach. As GPSC has completed through project consultancy the design phase of its ICP approach, this Section 1 will act as a reference for GPSC whenever it plans to realign or redesign its ICP approach to ensure that it always fit for the purpose of GPSC's climate change strategy and targets.

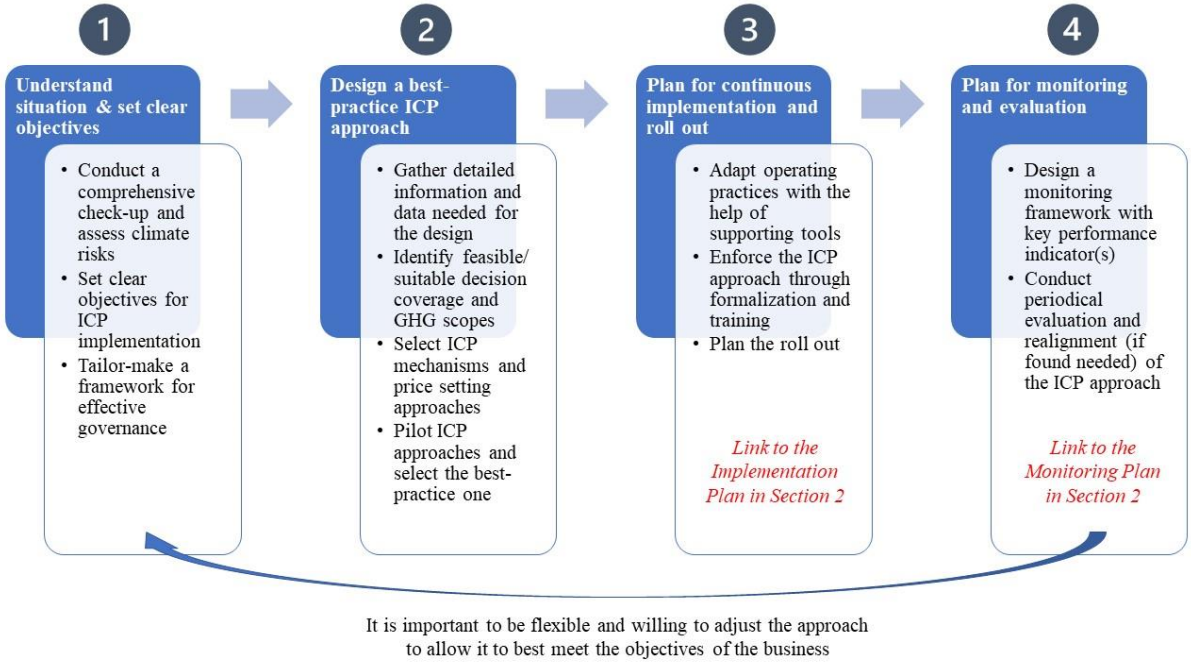


Figure 1 Key steps to a full ICP implementation

In general, a complete ICP implementation cycle can be divided into 4 main steps, and there are sub-steps under each main step (see the summary Figure 1 Key steps to a full ICP implementation above). Step 1 and 2 comprise of preparatory activities such as understanding the situation and climate risks of the company, setting objectives for ICP implementation, designing and piloting ICP approaches, etc. These activities are extremely crucial to the overall success of ICP implementation. Once the best-practice ICP approach is identified from piloting, Step 3 requires the company to elaborate a plan for continuous implementation of the ICP approach (or "implementation plan" in short), which is recommended to take time factor into account by distinguishing short-term strategy from long-term one. The company should

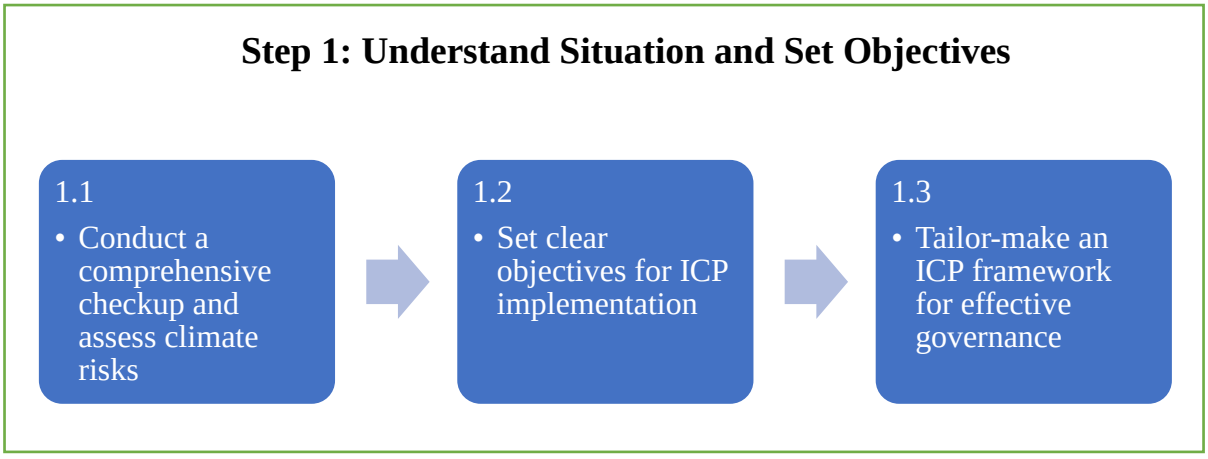
also consider how to formalize ICP implementation, provide staff training and reinforce internal communication. Finally, Step 4 guides the company to plan for monitoring of its ICP implementation (or "monitoring plan" in short), which will facilitate further evaluation and eventually allow the company to make any timely realignment of the ICP approach if found needed.

Step 1: Understand Situation and Set Clear Objectives

Success starts from understanding oneself. As ICP is a carbon pricing mechanism that a company voluntarily use to support its decision making internally, the optimal ICP value depends largely on the company's specific objectives and the context in which it is situated. Technically, the ICP value is highly related to the current level and the expected change of GHG emissions, the actual or potential risk of regulatory compliance on GHG emissions from the government, as well as market expectations on the development of low-carbon technologies and structural transitions, etc. As a result, the optimal ICP value and implementation strategy should vary from one company to another. That is why understanding the current situation as well as the expected development of one's own business and industry is crucial to help the company set a reasonable benchmark and plan for clear objectives for ICP implementation.

Moreover, as the whole process of ICP implementation will take a relatively long time and will require a high level of collaboration across business units within the company, it is also important to tailor-make an implementation framework to ensure effective governance.

In summary, this first step of ICP implementation can be further broken down into three sub-steps as follows:



1.1.1 Conduct a comprehensive checkup and assess climate risks

Who

- Task force for ICP implementation across all business units (ICP leading unit); or
- Climate change working group; or
- A unit within the company (usually the sustainability team)

Why

This first step is the basis and key to a successful ICP implementation. A comprehensive checkup of the company helps to frame the context in which ICP instruments will be adopted. ICP can usually be linked to the company's sustainability and/or ESG framework, strategies, and objectives (especially if the company has any climate-related targets). In some cases, it can contribute to the company's overall vision, mission, and goals. In some other cases, it is the civil society's expectation on the business world taking its climate responsibility that urges companies to implement ICP.

As ICP can be applied to a variety of aspects relating to the business, including new capital investments, existing operations and even the whole value chain, a full examination of the GHG emissions profile and financial analysis of the current portfolio and project pipeline is also helpful to identify suitable entry point(s) for ICP implementation. Moreover, as ICP can act as a risk management instrument specific to climate-related risks, it is essential to identify and assess climate risks at this initial stage to facilitate a fit-for-purpose design of the ICP approach.

How

First of all, to conduct a comprehensive check-up, several aspects to be covered for the review and analysis, including but not limited to the following items:

- Overall vision, mission, and organizational goals of the company
- Sustainability objectives and strategies (preferable climate-related), if any
- Geographic and sectoral coverage of the company's operations, as well as any country/region-specific, or sector-specific concern (e.g. Potential regulatory compliance or market prospects) that may be realized in the future.
- Market analysis (with positioning of the company in the value chain) and business plans for the next five years, if any
- Result of the materiality assessment from the sustainability reports in the past
- Priority (or importance) of climate-related risks to the company
- Financial and operational performance of GPSC each business unit in the past five years

- Detailed profile of the projects in the investment pipeline, including evaluation results of risk and return profile, estimates on potential GHG emissions, if any (preferably covering scope 1, 2 and 3), etc.
- GHG emissions profile of GPSC each business unit, if any (preferably covering scope 1, 2 and 3)
- Marginal abatement cost database, if any.

This check-up shall serve to the purpose of following identification and assessment of the climate risks specifically to be addressed by the ICP approach.

There are a variety of climate risks. In terms of ICP applications, the most relevant climate risks surround carbon emissions for a transition risk. Therefore, the climate risks discussed here specifically imply carbon pricing-related risks. Based on the framework for assessing and managing carbon (asset) risk (see Figure 2 below) developed by the World Resources Institute (WRI) and UNEP Finance Initiative (UNEP-FI)[4], the carbon risk is defined as "**risk of financial loss to an operator of a physical asset due to non-physical climate change related factors**". To operators like GPSC, which are not involved in financial intermediary activities, carbon risk assessment should be focused on the items indicated in the graph below by the boxes bounded by red solid lines. It is also suggested that policy and legal factors are prioritized among the risks, as these have the highest relevance to ICP implementation. By conducting a stress test and valuation of carbon risk on the existing assets, the Value at risk (VaR) can be identified, contributing to designing the suitable ICP approach.

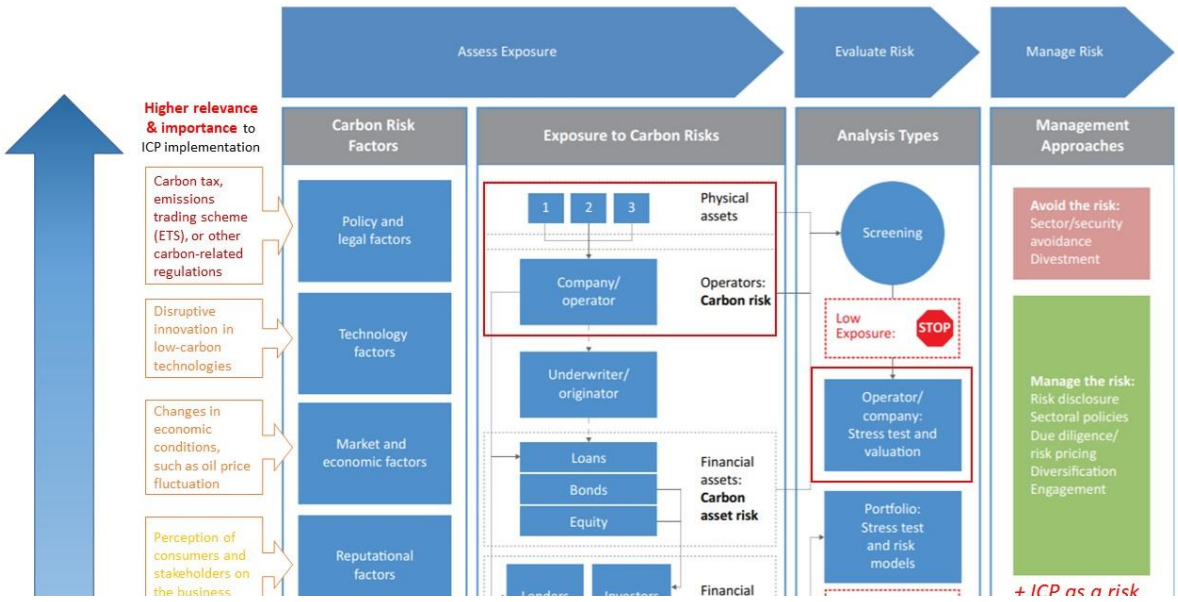


FIGURE 2 FRAMEWORK FOR ASSESSING CARBON RISK
Resource: WRI & UNEP-FI (e.d.), adapted by the Consultant team

[4] WRI & UNEP-FI (e.d.). *Carbon asset risk: discussion framework*. Prepared under the WRI and UNEP-FI Portfolio Carbon Initiative. Available at https://www.unepfi.org/fileadmin/documents/carbon_asset_risk.pdf. (accessed on 28, October 2020)

1.1.2 Set clear objectives for ICP implementation

Who

C-suite executives (or senior management) and the ICP leading unit

Why

A successful ICP implementation will have significant and profound impact on the company, and it takes determination, commitment, and consensus across all departments of the company. Therefore, clear objective-setting is the basis of all such that everyone in the company understands why they should implement ICP, and to where ICP will lead the company. This is also the stage for getting buy-in from senior management and executives. With their support and engagement in objective setting, people will see the company's strong determination and commitments to implementing ICP.

How

The ICP leading unit should present its analysis from the checkup of GPSC identify the entry points in which ICP may play a role to support the company in achieving its broader goals, mission, and vision.

In most cases, ICP objectives can be built upon one or a combination of the main goals as follows:

1. **Demonstrate climate leadership**: this is mostly the case when company clients or end-customers esteem the importance of climate responsibility and commitments, such as the well below 2℃ goal under the Paris Agreement. It might also be the case when the company intends to build or change its culture and behaviors, sometimes also involving that of the company's value chain partners, towards more climate-friendly ones. The carbon price will then be set based on the GHG emissions reduction target(s) of the company
2. **Build resilience against climate-related risk**: this is mostly the case when the company has a high GHG emissions profile, which might lead to stricter regulatory compliance in the future, or when the company assets exposed to any potential hazard related to climate. The carbon price will then be set to the expected levels of regulatory compliance or of risk occurrence.
3. **Capitalise on the low carbon transition**: this is when the company sees new business opportunities or potential benefits to its own operations from low-carbon investments, such as renewables and energy efficiency improvement. Such opportunities might exist internally or externally, and sometimes in the market that the company is currently in or in a new market that the company may enter. The carbon price might then be set based on the marginal abatement cost (MAC) which is estimated from hurdle rates and other investment criteria of the company to trigger low carbon investment.

These goals can be taken altogether at once to establish a comprehensive climate strategy such as the one shown in the Figure 3 below. Specific steps to designing the best-practice approach to ICP implementation will be further detailed (see Annex 1).

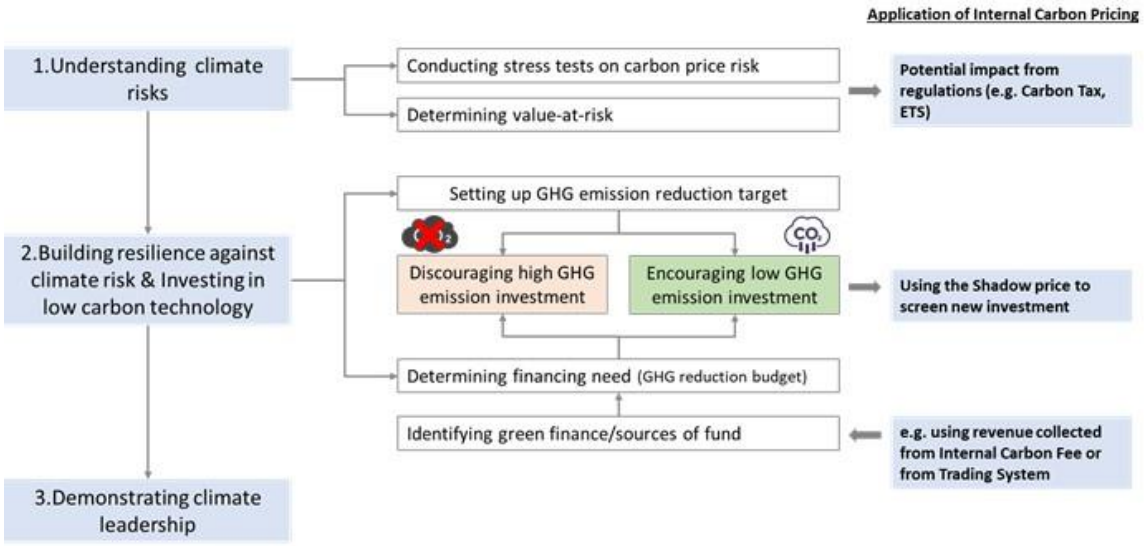


FIGURE 3 ESTABLISHMENT OF A COMPREHENSIVE CLIMATE STRATEGY
Source: The Creagy Company (2020)

No matter if the company chooses to focus on one particular goal or to conduct an integrated goal setting, the goal(s) should be further broken down into detailed objectives specific to ICP implementation (hereinafter referred to as "ICP objectives").

Some companies set mitigation targets or have plans to follow the national mitigation target such as a reduction in GHG emissions by 20-25% from projected BAU levels by 2030. Some would like to use ICP as a risk mitigation tool in its capital investment and operations. Also, some other companies might consider ICP as an educational tool to raise awareness of climate change and improve climate-related capacity among its staff.

These are only some examples of ICP objectives. It is likely that the company has more than one main goal and several ICP objectives. It is important to make sure that the objectives do not contradict each other, and that they are in line with the broader vision, mission, and goals of the company.

1.1.3 Tailor-make a framework for effective governance

Who

ICP leading unit and staff members of relevant business units

Why

ICP is a multifaceted, cross-departmental tool. It goes beyond any regular business unit within the company. Therefore, it is crucial to design and establish a framework that covers all relevant parties and that fits into the company's culture so that the process of ICP implementation can be effectively governed and supported by key stakeholders.

How

First of all, the ICP leading unit should identify the units and people that should be involved in the process, potentially with some prioritization if necessary. Setting up a working group committee or an ICP task force that regularly meets and reviews the progress of ICP implementation is helpful to ensure that communication across all relevant parties is smooth and seamless. Alternatively, other coordination mechanisms for inter-departmental communication should be considered.

Secondly, it is also necessary to review the data management system that the company currently has. It is important to check whether the company collects data for scope 1, 2 and 3 GHG emissions. In most cases, only scope 1 and 2 emissions are covered. The company may consider starting to collect data for scope 3 GHG emissions if it plans to take more ambitious action. It is also worth evaluating if the data management system needs to be unified or upgraded in order to improve the data quality or that effort needed for data collection and sorting can be efficiently reduced.

The design of an effective framework for governance is a self-improving process that should be reviewed, adjusted, or realigned whenever found necessary during the entire process of ICP implementation.

Step 2: Design a best-practice ICP approach

This step composes of identifying and piloting potential ICP approach(es), and eventually concluding the best-practice one. A so-called 4D framework (see Figure 4 below) provides an instructive context to help ICP practitioners identify the suitable set of ICP parameters for the company.

Typically, the 4D dimensions include **Height (Carbon pricing level)**, **Width (GHG emissions coverage), Depth (Business influence),** and **Time (Development journey).** A combination of these parameters forms the ICP approach that will be applied. It might be useful to identify more than one potential combination and conclude the best-practice one through piloting.

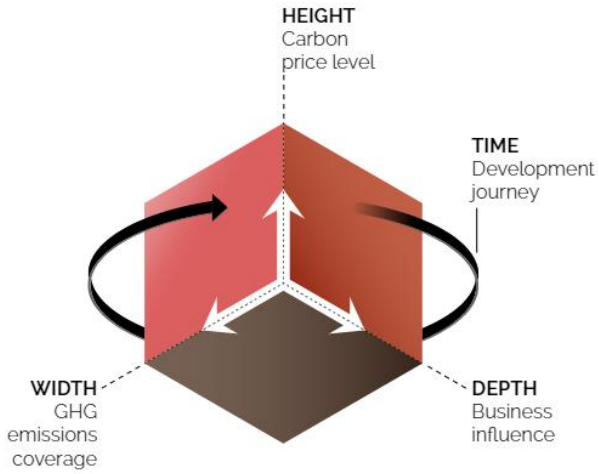
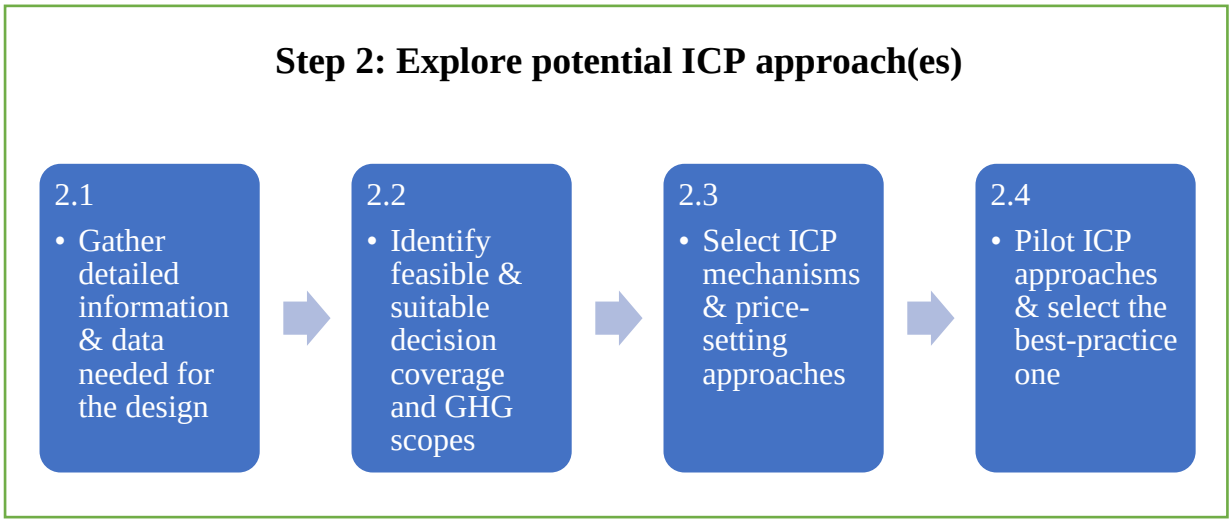


FIGURE 4 4D FRAMEWORK OF ICP
Source: Ecofys & Generation Foundation (2017)

This step is further broken down into sub-steps as follows:



1.2.1 Gather detailed information and data needed for the design

Who

ICP leading unit and staff members of relevant business units

Why

Developing an ICP approach with real impact and potential trigger change must be taken into account the detailed and comprehensive information and data, so that the designed approach can best address the actual needs and interests of the company.

How

The basic information and data needed for designing the ICP approach include but is not limited to the following items:

- The GHG emissions profile of the value chain, disaggregated by business units (GHG emissions scope 1, scope 2 and scope 3).
- Financial results of the company and each business units from the past three to five years and projection of financial performance in the coming years.
- The drivers and actors that are responsible or influent GHG emissions in the value chain.
- The type of business decisions that influence this GHG profile and the departments and staff members making and influencing these decisions.
- Existing initiatives and approaches that influence value chain GHG emissions.

Firstly, the ICP leading unit should identify and analyze to identify 'hotspots' of GHG emission sources in each element of the value chain. Thailand Greenhouse Gas Management Organization (TGO) has launched several carbon labelling programs, such as Carbon Footprint for Organization (CFO) and Carbon Footprint of Products (CFP). These programs and mechanisms serve as a good starting point for the company to establish a comprehensive carbon footprint database, which helps the company to create its own GHG inventory.

Secondly, it is important to have a detailed understanding of the drivers and actors responsible for the company's GHG emissions. In principle, ICP implementation is supposed to **encourage low-carbon and energy efficient operations and investments**, while **discouraging energy-consuming and high-emission activities & investments**. Internally, potential entry points should be identified for ICP to drive changes in the decision-making process. Externally along the value chain, if the size of the company's indirect emissions (or scope-3 emissions) is important, it is suggested that the company could try to understand how its value chain partners manage their GHG emissions and to which extent it has influence over their emissions.

Finally, understanding the scope and influence of any existing initiatives and approaches, such as the CFO and CFP mentioned above over the value chain of the company, it is also helpful to decide whether ICP should exclude those footprints or integrate different efforts into one.

1.2.2 Identify feasible/suitable decision coverage and GHG scopes (Width)

Who

ICP leading unit

Why

The width dimension helps to scope the coverage of decision-making and GHG emissions to be influenced by the ICP approach. This is based on a detailed understanding of the origin of GHG emissions in the value chain, as well as the actors and drivers that can be influenced through ICP implementation both now and in the future.

How

ICP can be applied to different areas of decision making, such as capital investments, existing operations, supply chain management, procurement, R&D, etc., as well as different GHG scopes (scope 1, 2 or 3). The combination of decision and GHG scope coverage (width) will play a role in which the depth (business influence) of ICP will be imposed to your company.

This step is closely linked to the analysis of information and data collected from the previous step. Usually, the company will apply ICP applications around the most important scope(s) of its GHG emissions because that is where ICP can be most effective to drive changes within the company. In most cases, companies are able to collect data more completely on scope 1 and 2 emissions, while scope 3 emissions are relatively less explored. However, more and more companies now try to work on scope 3 emissions and for some industries, it is even necessary to do so due to its nature of limited scope 1 and 2 emissions. This limitation of data availability and the characteristic of the company's emissions profile should be taken into account now as well as planned into the future.

Regarding decision coverage, the most common case is to apply ICP in capital investment decisions, followed by operational decisions. This is because applying to capital investment decisions is in general relatively simple to start and can avoid interrupting existing business operation decisions to gain more buy-in from ICP applications. For each type of decisions, it can be further broken down into sub-areas, such as new investment in equipment that reduces GHG emissions, traditional investment that emits GHG emissions, or improvement in procedural efficiency that helps to reduce GHG emissions, etc. It is not necessary and highly unlikely to cover all areas at once as this might lead to huge pressure and impact on the company's overall operations and financial performance. Instead, it could be preferable to

prioritize the areas based on the information and data available, as well as the ICP objectives set forth. Examples of decision coverage can be found in Table 1.

TABLE 1 EXAMPLES OF DECISION COVERAGES

Decision coverage	Applicable conditions
Capital expenditure (CAPEX) decisions	This is the most applied coverage. Companies can use ICP to evaluate investment projects on several factors relating to GHG emissions, including regulatory risk on GHG emissions, cost savings potential due to reduction in GHG emissions, and commercial viability in new markets, etc. This can easily be conducted by applying a shadow price to the carbon footprint in financial analysis such that it improves the business case for low-carbon investments.
Procurement decisions	This is usually applied when the ICP approach aims to affect the scope-3 GHG emissions along the value chain of the company. ICP can be used to assess supplier contracts on climate-related cost pass-through risks and the cost savings potential of purchasing goods and services with a lower carbon footprint. By applying a shadow price to the carbon footprint of purchased goods and services, suppliers will be pushed towards more low-carbon operations and/or the company will shift procurement towards low-carbon suppliers.
Operational (OPEX) decisions	Companies can use ICP to reveal hidden climate-related costs and opportunities by applying a shadow price to the carbon footprint of their assets, or to directly drive changes in operational decisions by charging an internal carbon fee on business units for their carbon footprint. While shadow pricing in OPEX decisions is relatively rare, applying ICP in the form of an internal carbon fee is quite common. Because the latter is more powerful in the way that business units would fully integrate the value of GHG emissions in the process of optimizing their financial performance, and the revenues from fee collection can be further used for various ends, such as supporting low-carbon investments or CSR activities relating to climate change.
R&D decisions	Companies can use ICP to evaluate R&D proposals on the risks of climate-related regulatory costs, the cost savings potential and their commercial viability in a low-carbon future. A shadow price on the expected carbon footprint of new products and services can drive

Decision coverage	Applicable conditions
	R&D decisions or allocate R&D budgets towards low-carbon innovation.

Source: Adapted from Ecofys & Generation Foundation (2017)

1.2.3 Select ICP mechanism(es) and price-setting approach(es) (Height)

Who

ICP leading unit

Why

Height of the ICP approach (price level) is usually the main concern of many companies, as it is the most obvious dimension of all. There are a variety of ways for setting an internal carbon price, as well as different mechanisms for integrating the price into the company's decision-making for driving changes. Ideally, a best practice ICP approach is one that can eventually change day-to-day business decisions to mitigate climate change related risks, seize the opportunities of the low-carbon transition, and/or drive down GHG emissions. Therefore, the aim is to find the mechanism and price-setting approach that will be sufficient to stimulate changes in our business decisions, eventually contributing to achieving ICP objectives.

How

To identify the suitable mechanism of change and price-setting approach, it is worth spending some time studying the case studies from other peer companies. It is important to consider that reasonable carbon pricing will not be identical across different companies, and certainly not be identical across different sectors and different countries. Therefore, the reference case studies should be as similar to GPSC as possible. Examples such as other Thai companies that have implemented ICP or other power generation businesses in the region will be a good starting point.

In practice, there are two common mechanisms for integrating ICP into business decisions, including **shadow pricing** and **internal carbon fee.** Meanwhile, there are other two less common mechanisms**: implicit carbon pricing** and **internal trading system.** A comparison of pros and cons of these mechanisms is shown in Table 2.

TABLE 2 PROS AND CONS OF ICP MECHANISMS

	Shadow pricing	Implicit carbon pricing	Internal carbon fee	Internal trading system
Function	Hypothetical surcharge on carbon emissions, in line with predicted future costs.	Price reflects spend on reducing emissions (e.g., investment in the past in RE & EE projects)	Charge imposed on internal business units based on emissions	Allocate emissions credits which can be traded internally between business units
Potential decision coverage	- Capex - Opex (rare) - Procurement - R & D	- Capex - Opex	- Opex	- Opex
Pros	- Easy to implement - Potential legislation and regulatory compliance can be factored into decision-making - Useful for risk management	- Reflects action taken - Helps understand existing costs	- Collected fund can be recycled for green investments and/or offsets - Influences the bottom line in a way that business decisions can be directly steered towards lower emissions choices	- Allows the market mechanism to identify most efficient reduction - Create a direct financial incentive to make low-carbon decisions - Help prepare for the potential ETS
Cons	- Hypothetical - No actual financial flows or monetary transfers - Stronger enforcement may be needed to ensure its influence over business decisions	- Does not always directly drive change	- Imposes additional costs on business units - Price level often too low	- Complex to administer - Relatively high implementation cost - Risk of over-supply of credits

Source: Carbon Trust and Creagy, 2020

For suitable price setting, the main principle is that the price level should be able to provide a meaningful incentive to drive changes and to achieve the company's ICP objectives.

First of all, carbon prices may take different forms, and companies should decide between the choices as follows:

1. **Uniform price** VS. **differentiated price**: carbon price can be identical across all business units, or varies by region, by business unit, by type of decisions, etc.
2. **Static price** VS. **evolving price**: carbon price can remain at the same level throughout time, or vary across time, depending on the circumstances under which the decision is made or the time horizon of the decision (e.g. gradually increasing over 10 years).

There is no absolute answer to which choice is best for the company. However, it is often suggested to start with a uniform and static price, as this is simpler and more straightforward to build consensus across the company. The set price can then be evolved and differentiated once ICP implementation has gained its foothold in the company's decision-making.

As for the price-setting approach, different factors should be taken into account, such as the ICP objectives, the decision coverage, any specifics of the company, and the resources and time that the company may contribute to setting the carbon price. However, there are generally three types of price-setting approaches as follows, which can be taken independently but best be taken into account in an integrated way.

1. **Benchmarking against the existing carbon prices**, which can be the ICP values adopted by peer companies and/or external carbon tax rates (e.g. Singapore's carbon tax) or average prices of mandatory emissions trading schemes (e.g. EU ETS). In Thailand's case, none of the mandatory carbon pricing schemes is yet imposed.
2. **Internal consultation across business units**, which allows the company to arrive at a commonly agreed price**.** This approach requires inputs from all concerned business units to assess different price levels and their impacts. Business decisions in the past can be the reference to current price-setting with an assessment of how different price levels would have affected its bottom line. However, there is less certainty on whether the price is high enough to drive changes and to achieve ICP objectives.
3. **Evidence-based technical analyses**, which requires the company to collect enough information and data for pricing simulation, as well as identified measures for achieving certain low-carbon targets. This approach requires significant effort, typically with a detailed assessment of the cost of potential measures along the company's entire carbon footprint to meet its targets. It provides more certainty that the company will achieve its objectives. The analyses can be conducted by different modelling approaches, mainly depending on the ICP objectives set forth in the beginning, and it is recommended that the unit responsible for risk and financial assessment should be

engaged in the modelling process to make sure that all relevant risks are integrated into the model. This method can link to the ICP piloting described in the next sub-step.

1.2.4 Pilot ICP approach(es) and conclude the best-practice one

Who

Senior management (for pilot selection and conclusion), ICP leading unit and relevant staff members (for conduct piloting)

Why

Testing the designed ICP approaches through a selection of pilot projects is essentially helpful to observe whether the approaches fit with the company's regular operations and the applied circumstances, as well as whether they are able to deliver the expected outcomes that answer to the ICP objectives set forth in the beginning. Testing is a crucial step as the decision-makers (i.e. board members or C-suite executives) generally prefer seeing the approaches working prior to approving a full rollout.

How

The selection of pilot projects is important to a successful pilot testing, and it is subject to the scope and mechanisms chosen in the previous step. For example, to test shadow pricing in new capex decision for scope 1 and 2 emissions, the pilot projects should then accordingly be new capex investments in the pipeline with sufficient information on the estimated scope 1 and 2 emissions; meanwhile, to test the internal carbon fee in OPEX decision for scope 2 emissions, the pilot case can then be a selection of business units within the company that are more exposed to the pricing scope (i.e. having higher scope 2 emissions).

Eventually, the ICP leading unit should be able to draw some results from different pilot cases. It should bring the results to the senior management for further evaluating and concluding the best practice ICP approach. As the pilot cases might cover different approaches, the concluded ICP values and the impacts of these approaches on the company will much unlikely be the same. In principle, the best practice ICP approach should be able to best respond to as many as ICP objectives as possible, which are supposed to have been set forth in the very beginning of this exercise. It is of interest to recall the 4D framework in the determination of the best practice ICP approach, including the Height (carbon price), Width (GHG emissions coverage), Depth (business decision), and Time (development journey). And this is the moment to add Time factor to the design of the ICP approach.

Some examples of how the different combinations of ICP parameters can develop over time are illustrated in Figure 5 below.

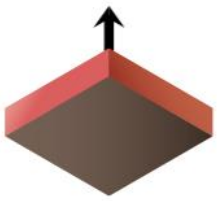
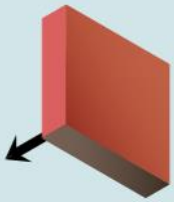
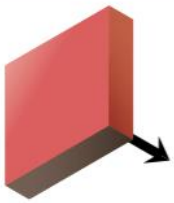
DIFFERENT ICP SHAPES	ILLUSTRATIVE EXAMPLE OF HOW THE ICP APPROACH CAN DEVELOP OVER TIME
Height: Low price **Width:** Large coverage **Depth:** Strong influence 	A company could start with a low price to minimise the impact on its competitive position or enable departments to familiarize themselves with ICP. The low financial impact on each department may lead to higher acceptability within the company—an important pre-requisite for success. As ICP becomes more accepted in the company, the price could gradually increase to enhance its impact on business decisions.
Height: High price **Width:** Small coverage **Depth:** Strong influence 	A company could initially apply a high price to only a small part of the business, for instance, investment decisions in a particular country or business area. Possible reasons to do so could include limiting the initial impact on the business while getting used to ICP, lack of data available for the other GHG emissions, or limited expectations of climate regulation to be implemented in some jurisdictions in which the company operates. When the above circumstances change, the company could decide to expand the coverage of ICP to have a larger impact on the company's business strategy.
Height: High price **Width:** Large coverage **Depth:** Weak influence 	A company could decide to test how a high price would affect its whole value chain, either as part of the scenario analysis as recommended by the FSB-TCFD or a voluntary initiative in the company. The results could be used to inform the company's overall strategy, without these calculations affecting specific decisions. As low-carbon scenarios become more likely or the company becomes more familiar with ICP, it can increase the influence of ICP by making it a mandatory factor in business decisions.

FIGURE 5 EXAMPLES OF HOW THE ICP APPROACH CAN DEVELOP OVER TIME
Source: Ecofys & Generation Foundation (2017)

In general, some tradeoffs will be needed to find a conditional balance between different price levels, emissions coverages and business decisions that are effective enough to drive changes without threatening the bottom line of the company. Meanwhile, the time factor should be taken into account as well. Some ICP approaches might be too early for adoption to GPSC the moment due to their overwhelming impact on the company's bottom line or due to the overall circumstances in which the company's business is situated. However, introducing ICP with a less impactful approach in the early stage, and then over time, those initially unfeasible approaches might become feasible to the company.

Box 1: An example application of shadow price of Carbon on CAPEX decisions

The most common ICP approach is to apply shadow pricing to new CAPEX investments to inform decisions about new investments. When applying shadow pricing, there is no real carbon cost or carbon revenue to the project, however, this application allows a financial analyst to conduct additional scenario analyses by factoring in carbon cost or revenue. This would help the investment decision making becomes more comprehensive and thoughtful.

This example shows an approach of using shadow pricing to screen new investment projects by dividing investment into two groups: High GHG emissions and Low/reduced GHG emissions. For high GHG emission projects, the shadow price will be applied as the cost of carbon into the financial analysis to discourage the investment. While for GHG reduction projects, the shadow price will be applied as the shadow carbon revenue to encourage the investment. Therefore, this example shows the application of shadow pricing to reflect the cost of carbon emissions in an investment assessment such that the projects with a high emissions profile will be discouraged while other projects with a low or reduced emissions profile will be encouraged.

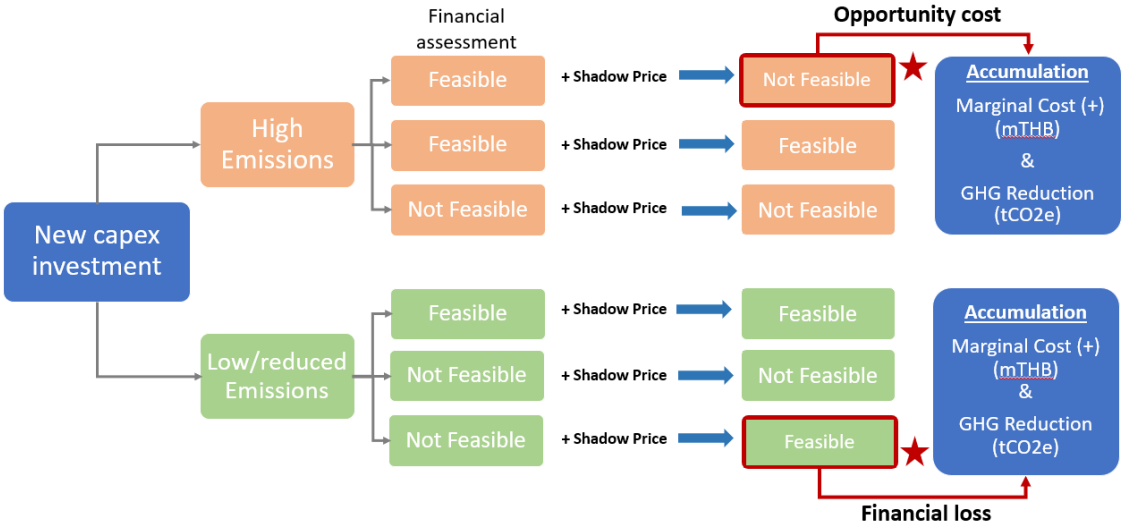


FIGURE 6 CONCEPT OF SHADOW PRICING
Source: Creagy (2020)

In a statistical sense, that is how different values of an independent variable (i.e. carbon price levels) affect a specific dependent variable (i.e. net present value: NPV & internal rate of return: IRR) under a given set of assumptions. When the shadow price is not applied, a new capex investment is assessed by a typical financial analysis, where the result might either be feasible (IRR > hurdle rate) or not feasible (IRR < hurdle rate). However, when the price of carbon is considered through shadow pricing, a financially feasible investment with a high emissions profile might become no longer attractive (new IRR is lower), while a financially unfeasible investment with a low or reduced emissions profile might be turned into an attractive investment target (new IRR is higher).

Box 2: An example application of internal carbon fee collection to raise revenue for funding lower carbon investment in the company

Internal carbon fee is another popular ICP approach applied globally. Internal carbon fee is a charge that a company voluntarily imposes on its business units for their emissions. While shadow pricing does not create actual financial flows or monetary transfers, applying an internal carbon fee scheme will induce cash flows or monetary transfers within the company, it will therefore influence the bottom line in a way that business decisions can intuitively be steered towards lower emissions choices.

This example shows the application of internal carbon fee to generate revenue from the collected fees which the company can use for funding/ incentivizing low carbon investment, supporting R&D activities for green products, or purchasing carbon credits to offset its GHG emissions etc. The figure below shows the concept of this approach. Instead of using the revenue from carbon fee collection for other non-climate purposes, it is more recommended to reinvest it in mitigation measures.

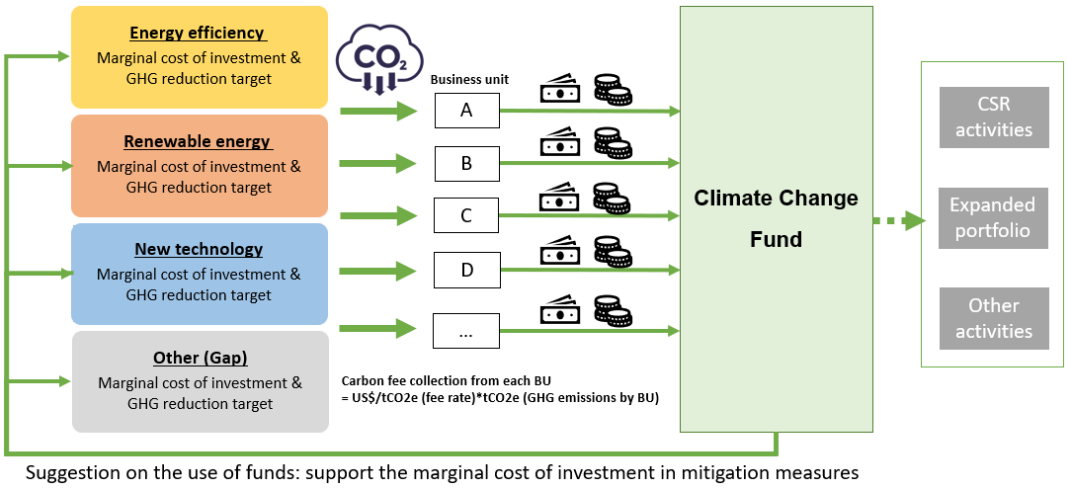


FIGURE 7 CONCEPT OF AN INTERNAL CARBON FEE SCHEME

Source: Creagy (2020)

Under this approach, each business units (BUs) must have GHG footprints available. In the absence of complete datasets, the piloting scope will have to be more selective, focusing on the units with a higher propensity to emit GHGs. Or else, assumptions can also be made based on experience to allocate emissions to likely responsible BUs. A simulation of financial impact on BUs from an internal carbon fee scheme will help to not only understand the feasibility of such a scheme but also estimate the potential size of funds that can be collected from the scheme for any other use.

Box 3: How to prepare for an internal carbon trading scheme

Internal carbon trading scheme is desirable as it could help companies to familiarize themselves with carbon trading and better prepare for any potential ETS scheme. However, setting up a carbon trading scheme can be much more complicated than applying shadow pricing or an internal carbon fee. Officially known, only a couple of companies have introduced an internal carbon trading scheme, including BP and the Royal Dutch/Shell Group. This box outlines the key steps to setting up a carbon trading scheme (PMR and ICAP, 2016).

Pre-implementation

Step 1. Design the scope: it involves the decisions of a) which business units to cover, b) which greenhouse gases to cover, as well as 3) which units to regulate. Although broader coverage is desirable as it increases the range of low-cost mitigation options, it may in turn impose greater burdens on small and diffuse emissions sources. Therefore, the benefits of broader coverage must be balanced against any additional administrative effort and transaction costs.

Step 2. Set the cap: The carbon trading cap sets a limit on the number of allowances issued over a specified time period which then constrains the total amount of emissions produced by the regulated entities. In principle, the cap should be aligned with the company's overall mitigation target. Trade-offs between emissions reduction ambition and system costs should be managed, aligning cap ambition with target ambition, and assigning mitigation responsibility across capped and uncapped sectors.

Step 3. Distribute allowances: in general, allowances can be distributed through free allocation, auctioning, or some combination of the two, as well as award allowances for removals. However, free allocation based on business units' historical emissions or based on an industry-specific benchmark is perhaps most suitable for a company.

Step 4. Consider the use of offsets: the company should decide whether "offsets" — credits for emissions reductions in uncovered sources and sectors— are allowed to be used by covered business units to meet compliance obligations under the cap. For a given cap, accepting offsets will lower prices, if there is eligible low-cost abatement potential available outside the system. Monitoring, reporting and verification (MRV) is also challenging as the quality of MRV of offsets needs to match that of the internal carbon credits to ensure environmental equivalence of offsets and allowances.

Step 5. Decide on temporal flexibility: a carbon trading scheme can provide some flexibility for complied units as to when they wish to reduce emissions. However, this flexibility in timing must be balanced against the certainty of achieving reductions.

(Continued from the previous page)

Step 6. Address price predictability and cost containment: in a carbon trading scheme, time-varying market prices provide the signals that will allow participants to achieve a given quantity of emissions at least cost. In some cases, carbon prices could be kept at a low level while in some other cases, carbon prices could be increased, depending on the balance of supply and demand for allowances. Some design options might be favorable to reduce such a price volatility, such as adjustment of the quantity of allowances or constraints on the price level.

Step 7. Ensure compliance and oversight: a carbon trading scheme needs a rigorous approach to enforcement of participants' obligations and to oversight of the system. It can be useful to start implementing effective systems for MRV of GHG emissions early in the process of an internal carbon trading scheme development to support later compliance assessment. An initial stand-alone period of MRV or a pilot phase can enable capacity building before implementing a full-scale internal carbon trading scheme.

Step 8. Engage stakeholders, communicate and build capacities: stakeholder engagement, communication and capacity building are key to a successful carbon trading scheme. This corresponds to Step 3 – roll out the ICP approach – in the next sub-section.

Step 9. Consider linking: the company may consider if the allowances can be linked to other mitigation programs such as CFR, CFO or T-VER in which the company has participated. Linking broadens flexibility as to where emissions reductions can occur, and so takes advantage of a broader array of abatement opportunities, thereby lowering the aggregate costs of meeting emissions targets.

Full implementation

Step 10. Implement, evaluate, and improve: this corresponds to Step 3 and 4 – monitor and evaluate the ICP approach – in the next sub-sections. The company should develop an implementation and monitoring mechanism to ensure that the carbon trading scheme will last in the long run and be able to respond to the ever-changing circumstances.

[5] Partnership for Market Readiness (PMR) and International Carbon Action Partnership (ICAP). 2016. Emissions Trading in Practice: a Handbook on Design and Implementation. World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO

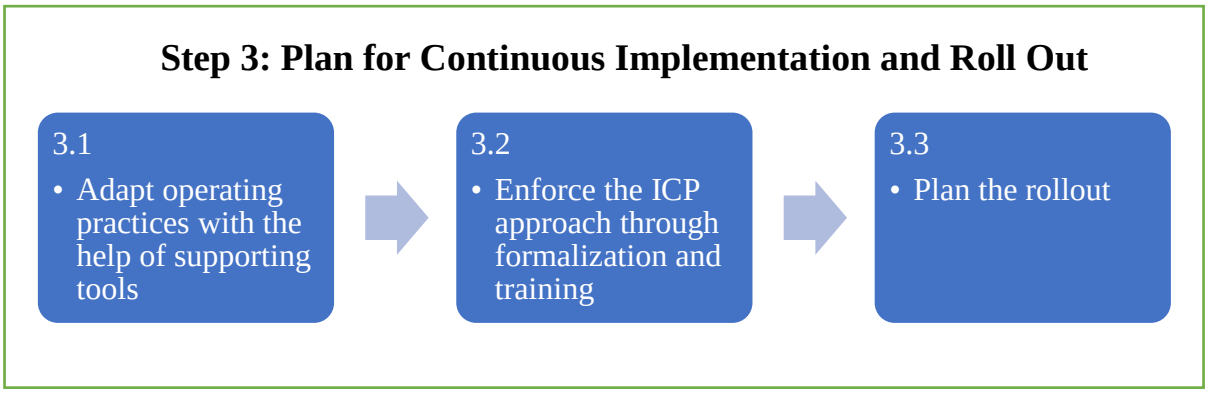
Step 3: Plan for Continuous Implementation and Roll out

Having concluded the best-practice ICP approach, this step is to plan for an official rollout and continuous implementation in the future. Lessons learnt from ICP piloting at the previous step will be valuable to this step such that the rollout of the ICP approach will be smoother with the least resistance and/or objections. More importantly, the pilots can serve as the showcase to the senior management and the board, such that full implementation of the ICP approach can gain support and approval from the board.

Having gained approval from the board, the company should consider enforcing the ICP approach through formalization and regular training. In this way, people will have a formal procedure to follow and that people have enough capacity to implement it. This will also help to make the rollout of ICP implementation more eye-catching and serious.

In terms of continuous implementation, to make ICP a long-term instrument that facilitates the company's sustainable development, a well-designed implementation plan which aligns ICP implementation with other major strategies of the company, as well as a formal integration of ICP-relevant guidelines and plans into the existing operational procedures, policies or directives will be key to success.

This step can be further broken down into 3 sub-steps as follows:



1.3.1 Adapt operating practices with the help of supporting tools

Who

ICP leading unit and relevant staff members

Why

A successful implementation of ICP will often require some changes in operating practices and/or procedures to ensure that key data and information are collected, managed, as well as that ICP can be smoothly integrated into the related decision-making and/or operations. To this end, various supporting tools might help the concerned parties to better manage their data collection and compilation, or to facilitate their capacity of ICP-integrated decision making and communication. These tools can be identified throughout the piloting phase when any operational difficulty in applying ICP is found. With useful adaptation in operating practices put in place with the help of supporting tools before the roll out, people will be more confident in carrying out ICP implementation activities.

How

Adaptation for a more complete greenhouse gas inventory and data management

The most common challenge in ICP implementation is the data availability of detailed GHG emissions at the business unit and/or activity level. There exist some **carbon footprint calculation tools,** which generally contain a large database of GHG emission factors associated with specific activities, technologies, and measures. If a more complex ICP approach (e.g. dynamic and multiple prices, wider coverage of decision-making) is to be applied, a more advanced carbon footprint calculation tool will be needed for a more precise and informative scenario analysis. Moreover, if the company has only covered a limited scope of GHG emissions (i.e. scope 1 and/or 2) in its inventory, it might consider starting to work with its supply chain partners to collect data on scope-3 emissions if it plans to expand its scope of ICP applications in the future.

In the meantime, as the coverage of GHG emissions data expands, introduction of appropriate IT software and/or hardware (such as separate electric meters and big-data analytics tools) is recommended to ensure that data is collected and managed in an efficient and effective way.

Adaptation for a better integration of ICP values into financial decision-making

In most cases, applying ICP will imply some **procedural adjustments to the process of financial assessment and decision-making**, especially if the company decides to apply a shadow price in its CAPEX decisions. It is not always required to introduce new financial calculation tools, but at least in the company's existing financial models, additional commands or programming will be needed to reflect ICP value(s) in the modelling.

Adaptation for smoother coordination and communication within the company

As ICP implementation will be a new concept for most of the employees in the company, another important tool to ensure a smoother coordination across business units is a **clear and easy-to-adopt guidance material** on ICP implementation to facilitate and standardize the process across the company. This step-by-step Guideline for ICP implementation serves exactly to this purpose. Furthermore, this material can help to strengthen internal communication by informing employees about the ICP approach and its applications. However, the company might find it even more helpful to produce a **communication plan** with application of some specific tools, such as infographics, blog posts, newsletters, and multimedia channels, to regularly disseminate and update the progress of ICP implementation among the employees. Find the table below some general requirements for developing an efficient communication plan.

TABLE 3 GENERAL REQUIREMENTS FOR DEVELOPING AN EFFICIENT COMMUNICATION PLAN

	ICP Leading Units	Management	Company-Wide
Main Topic(s)	• Current status • Problems-solutions	• Updates on achievement vs. target • Current status • Challenges	• Recap on the objectives of the ICP • Updates on achievement vs. target • Current status
Frequency	Quarterly	At management meetings	Bi-annually
Target	**Required**: Heads and responsible personnel of relevant units	Management	All staff
Channel	**Preferred**: Face to face meeting	Virtual meeting or as appropriate	Newsletter, internet feeds

1.3.2 Enforce the ICP approach through formalization and training

Who

C-suite executives (or senior management) and ICP leading unit

Why

Formalization of the ICP approach signifies that the process of ICP implementation should be well documented as a formal policy or directive, or at least should be integrated into the current standard operating procedures (SOP) for relevant activities (such as risk assessment of new investments, GHG data collection and reporting, etc.). Formalization will give ICP an official status within GPSC will help to ensure that ICP will be enforced with standardized procedures across different business units. In the meantime, training will help to ensure that the employees are fully equipped with the essential knowledge and capacity of carrying out the key steps involved in the process of ICP implementation (such as GHG data collection, management, and reporting, etc.).

How

The ICP leading unit should have a good understanding of all the relevant documentation and procedures within the company that might be the potential entry in which the practice of ICP implementation can be inserted. A step-by-step set of Guideline on who/why/how to use ICP like this Guideline is useful to make sure that the implementation follows standardized procedures. However, the ICP leading unit should work with the senior management in embedding such Guideline in any directive or other formal papers such that ICP will be entitled to an official status. Moreover, the ICP approach should also be integrated into the company's existing operating documents, such as risk management policy or financial management manual, wherever found necessary.

In addition to the "hard" approach of formalization, staff training is a "soft" approach that helps to ensure that all relevant employees well understand the Guideline and are capable of carrying out the key steps involved in ICP implementation and the following monitoring, potentially with the help of supporting tools mentioned earlier. The training could be held via webinars and in-person and should also train the representatives on how the ICP approach is beneficial for their business and how it should be implemented in daily decision-making processes. This will also serve to reinforce internal communication.

1.3.3 Plan the rollout

Who

C-suite executives (or senior management) and ICP leading unit

Why

A well-elaborated implementation plan is crucial to the success of continuous ICP implementation. As mentioned earlier, some tradeoffs and time consideration might be needed in concluding the best practice ICP approach. These factors should then be designed into the implementation plan. Moreover, careful timing and strategic communication of a full rollout can lead to greater acceptance internally, lower the risk of delays, and reach more people internally to make them aware of the introduction of the ICP approach.

How

Following the previous steps, an implementation plan should be formulated, and rolled out in a formal and continuous way. This plan should lay out the finalized ICP approach (in near term, medium term and/or long term, wherever applicable) and detailed procedures for implementation as well as the role and responsibility of each concerned party. All these elements should be clearly defined and ideally integrated into other existing and relevant operational procedures within the company.

Once the implementation plan is elaborated, the company should consider the best timing for an official rollout. Several factors like how (effective communication), when (proper scheduling), and who (the Board and testers) to roll out the implementation plan will be key to success. The figure below lays out the key considerations and their rationale.

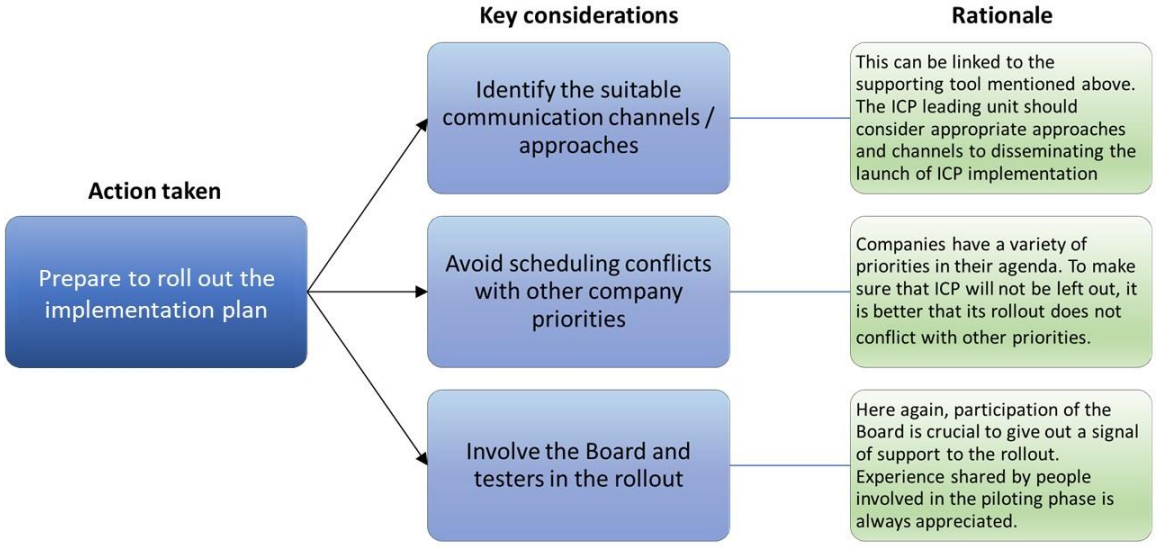


FIGURE 8 KEY CONSIDERATIONS FOR PLANNING THE ROLLOUT
Source: Adapted from Ecofys & Generation Foundation (2017)

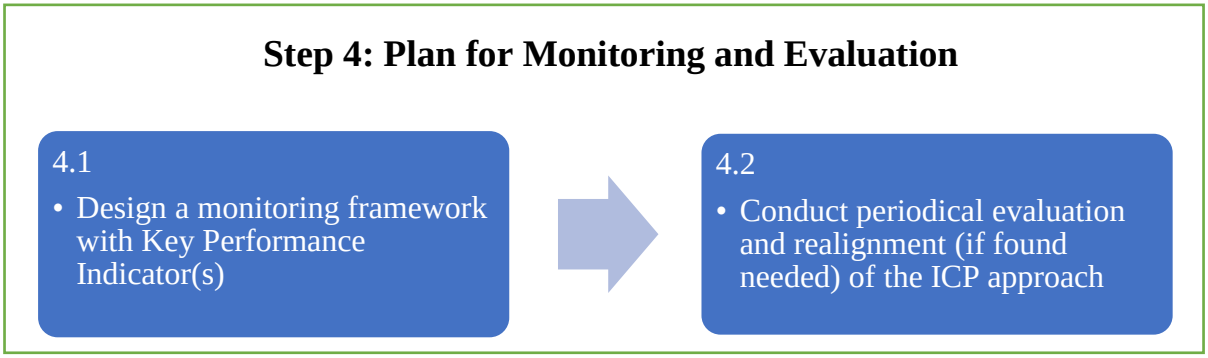
Step 4: Plan for Monitoring and Evaluation

Having ICP implemented, this step is to elaborate a monitoring plan which establishes a mechanism for monitoring the progress of ICP implementation, as well as for evaluating the performance of ICP as a tool to affect business decisions. This document can help to track and assess the results of the ICP interventions throughout the implementation process, such that the company will fully understand its influence on the business. It is a living document that should be referred to and possibly updated as need be.

It is important to develop the monitoring plan before actual implementation is taken place. This plan will help the concerned staff to be aware of the data that should be collected, the indicators that will be tracked, the approach that the monitored data will be analysed, evaluated and eventually disseminated either internally or externally.

Having monitored ICP implementation, a periodical evaluation will help the company to examine whether the ICP approach remains useful to the company in the way that it is expected since the beginning, as well as whether it remains effective and efficient if any circumstance (e.g. macroeconomic conditions, industrial prospects, supply chain, market preference, etc.) has been different from the time when the ICP approach was designed. Realignment of the ICP approach should be conducted as much as possible in a timely manner whenever found needed. Taken together, this step should lead to a carefully designed monitoring plan that people can follow for periodical monitoring and evaluation of the ICP approach.

To elaborate a monitoring plan, this step can be further broken down into sub-steps as follows:



1.4.1 Design a monitoring mechanism with Key Performance Indicators (KPIs)

Who

C-suite executives (or senior management) and ICP leading unit

Why

To ensure that the ICP approach is being used as intended within the company, as well as to continuously improve or realign the designed approach in response to the dynamics of the business environment, establishing a monitoring mechanism with specific indicators for measuring the performance is strongly advisable.

How

There are different ways of monitoring the performance of a given activity within the company. To keep the monitoring mechanism objective, simple and straightforward to relevant stakeholders, setting key performance indicators (KPIs), which is a measurable approach for monitoring, is a common practice in the business world. To ensure that the monitoring mechanism can be effective, the selection of KPIs is important, and the selected KPIs should be closely relevant to the objectives set forth for ICP implementation.

The "Key" here means that the indicators should be key to the given company in terms of ICP implementation. Therefore, KPIs are unique to the company, as well as unique to the ICP objectives and approach developed by the given company throughout the previous steps. Moreover, KPIs can be separated into two types: process indicators and outcome indicators. Process indicators track the progress of the ICP rollout so as to answer the question, "Are activities being implemented as planned?" Outcome indicators track how successful the implementation has been at achieving the objectives, say, to answer the question, "Have this ICP implementation made a difference?" The table below shows some examples of process and outcome indicators:

TABLE 4 EXAMPLES OF INDICATOR SETTING

Process Indicators	Outcome Indicators
P1. **Development of GHG abatement cost analysis**	O1. Estimated reduction in GHG emissions made by the projects applying ICP
P2. **Integration of the ICP value in the company's financial model**	O2. Number of projects applying ICP
P3. **Number of trainings to relevant units**	O3. Number of investment decisions changed due to ICP

Process Indicators	Outcome Indicators
P4. **Level of understanding of relevant staff on ICP implementation**	O4. Variance in financial indicators (e.g. IRR, NPV, etc.) before and after ICP implementation
P5. **Variance in administrative and/or operating costs**	O5. Size of the investment related to ICP implementation
P6. **Average time taken for making a business decision with ICP**	O6. Net profit/loss of total investment related to ICP implementation

Having selected KPIs, it is then necessary to design the suitable approach for monitoring these indicators; that is, **who** is responsible for monitoring the indicators, **how** they should monitor them and at what frequency, **who** should be informed of the value of the indicators, and **who** should check these values. Some common practices include:

- **Appoint representatives or form a cross-unit monitoring group**: these people may come from the ICP leading unit, or from other relevant business units. They are responsible for collecting (or monitoring the collection of) relevant data based on the indicators set forth. They should also conduct a regular reporting on the evolution of the indicators to the ICP leading unit and concerned management.
- **Develop monitoring tools**: there should be a standardized tracking sheet, a shared platform or information portal where people can keep record of their data needed for the purpose of monitoring in an organized and transparent way. It is advisable to integrate the monitoring tools as much as possible into the other supporting tools (i.e. carbon footprint calculation tools and adjusted financial models) mentioned in Step 3.
- **Setting simple and clear procedures**: In the design of the monitoring procedures, these questions should be taken into account and properly addressed:
    - How and when the data should be collected
    - Who should collect and/or compile the data
    - Who should report the monitoring results to whom? How often (monthly, quarterly, biannual, etc.)?

A monitoring plan developed by the Consultant as a proposed monitoring mechanism is included in Section 2.2 of this Guideline, which is subjected to change depending on the company's actual needs and dynamic circumstances.

1.4.2 Conduct periodical evaluation and realignment of the ICP approach

Who

C-suite executives (or senior management) and ICP leading unit

Why

As the business world is every-changing, so are climate change and the relevant policies and regulations. A periodical evaluation of the interim results of ICP implementation is important to ensure that the designed ICP approach remains fit for purpose and sufficient to drive changes to meet the objectives set forth. In this way, establishing an ICP approach remains to be a dynamic and iterative process. Eventually, evaluation result can also be used as an input to dissemination and communication materials to allow a broader audience to understand the achievement of the company in ICP implementation.

How

First of all, the ICP leading unit should decide how and when to conduct the periodical evaluation. Some companies do not necessarily conduct the evaluation on a regular basis, but rather launch the process if specific circumstances trigger the need for an evaluation. For example, if the carbon tax is imposed at a rate higher than the ICP value that the company currently adopts. It is, however, recommended that the evaluation takes place on an annual basis to ensure that the ICP approach can respond to the ever-changing environment. There are a variety of evaluation tools such as objective tree analysis and logical framework, etc. The company may choose whichever approach with which the employees are familiar. The most important is that the monitoring mechanism is thoughtfully designed in a way that facilitates the evaluation.

It is a great opportunity through the evaluation to gather feedback from all business units involved in the process of implementation. The ICP leading unit may consider the suitable approach, such as an anonymous survey, consultation meetings, interviews, to doing so. Some examples of evaluation questions can be found below.

TABLE 5 EXAMPLES OF EVALUATION QUESTIONS

Subjects	Questions
Relevance to the objective(s)	○ How does the ICP approach satisfy its objective(s)? ○ Compared to other market-based instruments, has the ICP approach been more capable of achieving the company's climate change objective(s)? ○ If the KPIs show that the results are not satisfactory in achieving the objective(s), how can we improve the ICP approach?
Price level (height)	○ Is the current ICP value sufficient to meet the objective(s)? ○ Are there any expected events (e.g. new regulations, market evolution) that might trigger the need for adjusting the price level?
GHG scope and coverage of decisions (width)	○ Are the current GHG scope(s) and coverage of decision(s) involved in the ICP approach sufficient to meet the company's objectives or to address GHG emissions hotspots in the company's value chain? ○ If not, how can we adjust the scope and coverage to make the approach more effective?
The depth of impact on decision-making	○ How has the ICP approach affected the company's decision-making? Is it able to drive the expected changes in decision-making? ○ Is the company ready to embed the ICP approach deeper into more types of its business decisions, especially along its value chain (e.g. supply chain management, procurement, etc.)?
Timeline of the ICP evolution	○ According to the implementation plan, does the ICP approach align with the planned timeline and is there need for realignment to reflect the current circumstances in the business environment?
Administrative burden	○ What is the administrative burden for the involved departments or employees and how does that weigh against the potential benefits of ICP? ○ What can be done to reduce the administrative burden? ○ Are there any other instruments that could reach the same goals but lead to less administrative burden compared to ICP?
Alignment with other company policies	○ Are there any conflicts between the ICP approach and other company policies? ○ How to ensure the consistency of the ICP approach with other company policies and priorities?

Source: Adapted from Ecofys & Generation Foundation (2017)

Upon completion of the evaluation, the conclusion shall be made to decide whether any realignment of the ICP approach is needed to ensure that it remains pertinent and effective to the company's objectives, and that is remains capable of addressing the challenges and risks relating to climate change that the company will continue to face.

Furthermore, the company can also plan for a formal reporting and dissemination of the evaluation result, both internally and externally. It will be best and most effective if the process of evaluation, reporting and dissemination is well in place from the beginning and becomes routine as part of the ICP implementation activities. As such, meetings and periodic reviews will be more likely to be as productive as everyone looks forward to. See the table below how evaluation, reporting and dissemination of ICP implementation results can be organized.

TABLE 6 STRATEGY FOR ICP EVALUATION, REPORTING AND DISSEMINATION

Purpose	Targeted Groups	Method	Frequency	Notes
For ICP evaluation	ICP leading unit and relevant management	Meetings	Quarterly or bi-annually	Result can be communicated internally via newsletter or bulletin board
For external reporting and dissemination	Outsiders	Printed or digital publications	Annually	Result can be integrated into annual Sustainability Reports

Section 2

Implementation Plan & Monitoring Plan for GPSC

Section 2 Implementation Plan & Monitoring Plan for GPSC

Background

Global Power Synergy Public Company Limited ("GPSC") is one of the largest power producers in Thailand. As of end 2019, its business portfolio is composed of 1) power generation, which is respectively generated from natural gas (3,399MW), coal power (1,064MW), solar power (101MW), hydro power (449 MW), waster-to-energy and biomass (13MW); 2) chilled water (15,400RT); 3) Steam (2,698 tons/hour); 4) industrial water (7,372 m3/hour).See **Figure 9**

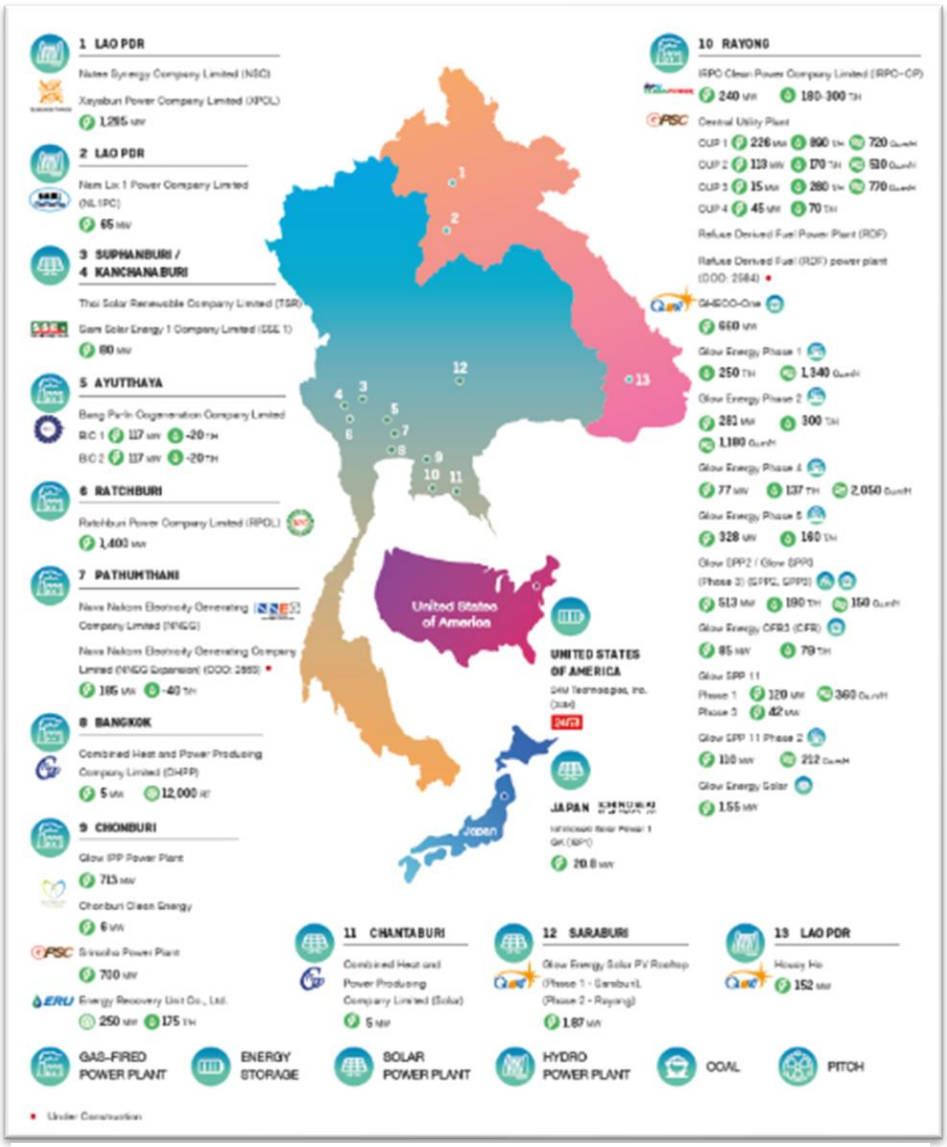


FIGURE 9 BUSINESS OVERVIEW OF GPSC
(Source: Integrated Sustainability Report 2019, GPSC)

GPSC and its invested companies are located in Thailand and abroad, selling power and steam to several industrial customers and government agencies, including Electricity Generating

Authority of Thailand (EGAT), Provincial Electricity Authority (PEA), Metropolitan Electricity Authority (MEA), ELECTRICITE DU LAOS (EDL), and Tohoku Electric Power Co., Inc.., etc.

Sustainability targets and strategies

With a vision to become a global leading innovative and sustainable power company, GPSC adopts three business strategies (**3S): S**ynergy and integration, **S**elective growth (including renewable-power plant development), and **S**-curve (for new business opportunities), based on **3D** principles: **D**ecentralize, **D**ecarbonize and **D**igitalize.

The company has embraced six main goals of the UN's Sustainable Development Goals (SDGs) as guidelines for the company's sustainable development management, of which SDG 7 (clean energy) and SDG 13 (climate action) are included. According to its sustainability report 2019, high priority is given to the themes such as clean energy future and climate resilience, corporate governance, risk management and compliance (GRC), and evolving the Business Model, which can be closely related to ICP applications. See Figure 10 the company's materiality matrix 2019.

Figure 10 GPSC's Materiality matrix 2019
(Source: Integrated Sustainability Report 2019, GPSC)

With the move towards clean energy, renewable energy has played a significant role in the GPSC's operations. GPSC has committed to developing technologies, seeking new opportunities in energy investment, increasing the ratio of clean energy use in power

generation, and designing measurements for dealing with risks and effects of climate changes, to create long-term stability in energy.

GPSC is committed to proactive climate change management by aligning management strategies with the company's corporate goals and mission as follows:

1) Implement sustainable resource utilization based on the eco-efficiency principle by **enhancing the efficiency of electricity and steam production process and adopting additional GHGs emission reduction measures.**
2) Identify research and **development opportunities in electricity and steam production with renewable energy** that is safe and environmentally friendly.
3) **Raise awareness and encourage participation GHGs reduction** by having environmentally friendly operations and building engagement of both internal and external stakeholders in a sustainable manner.

Implementation plan and monitoring plan

This implementation plan was developed by the Consultant considering the ICP case studies and analysis and our experiences assisting clients in Thailand, UK and Singapore on ICP strategy development.

It is important to note that the plan was developed in November 2020 based on existing available data, global and Thailand's domestic climate policy, existing company strategy, and low carbon technology which would be changed in the future. Fighting climate change is a long-term game and therefore **the implementation plan should be reviewed and updated annually** to reflect an up-to-date climate context of the company as well as global climate situation and low carbon technology. Therefore, the key objective of this implementation plan is not only the plan itself, but also or even more importantly a good practice and example to design, write and update the implementation plan in the future which requires deep understanding both carbon economics and company operations. The Consultant team designed this implementation plan by focusing on enhancing and guiding on ICP implementation in practice.

Key questions to be considered when developing or updating the ICP implementation plan:

- What would be the financial impact to GPSC if the government introduces the carbon tax to Thailand?
- What should GPSC do to prepare for potential regulatory compliance from the government?
- How can GPSC use the internal carbon pricing (ICP) to drive green(er) portfolio investment (e.g. energy efficiency and renewable energy)?
- What are an estimated investment cost and marginal cost of GHG emission reductions?

- How should GPSC apply and integrate ICP strategy into climate change strategy & day-to-day operation?

Under this section, the implementation plan and monitoring plan of ICP applications for GPSC is developed as a guide for GPSC to start implementing ICP from 2021 onwards which comprises of 6 components:

1. ICP Implementation concept and strategy
2. Policy, procedures, process, and methodology to apply ICP
3. Communication plan
4. Implementation team
5. Work plan
6. Monitoring plan

2.1 ICP Implementation concept and strategy

From GPSC's Sustainability targets and strategies, GPSC expects to apply ICP to meet the following objectives:

1. To increase internal capacity and learn to apply internal carbon pricing.
2. To reduce GHG emissions.
3. To increase renewable energy.

Based on the results of ICP analysis from several case studies (See Annex[6]), the ICP implementation plan was designed into 3 phases. The consultant suggested GPSC should seriously take action to Phases 1 and 2, while Phase 3 is to be reconsider by the end of Phase 2.

TABLE 7 GPSC'S ICP IMPLEMENTATION STRATEGY

	Near-Future Term (2021-2022)	Longer term (2023-2030)	Ultimate Goal (2031-2050)
ICP Objectives	To increase internal capacity and learn to apply internal carbon pricing.	To Reduce Greenhouse Gas Emission. / To Increase renewable energy.	To achieve Net Zero carbon emissions
Coverage Scope of GHG Emissions	Scope 1 / Scope 2	Scope 1 / Scope 2 / Scope 3	Scope 1 / Scope 2 / Scope 3
Decision Making Areas	Investment Decisions	Investment Decisions / Operation Decisions	Investment Decisions / Operation Decisions
ICP Approach	Implicit Price / Shadow Price	Shadow Price / Internal Carbon Fee/Internal trading system	Shadow Price / Internal Carbon Fee/Internal trading system
ICP Value	US$15/tCO2e	Shadow Price = US$15/tCO2e and gradually increasing Internal Carbon Fee = US$1.56/tCO2e	Internal Carbon Fee = US$59/tCO2e

Short-term implementation strategy (2021-2022)

The near-future term (2021-2022) aims to build on the knowledge and understandings of GPSC through learning-by-doing approach. At this very beginning stage, it is suggested that the shadow price approach should be applied to the decision on new investment only. As of the fact that application of this ICP concept is not entirely new (in practice), but there might be some unexpected implications on the company's existing activities. Therefore, to learn of these implications, it is least complicated to apply it to only new decisions. GHG Scope 1 and Scope 2 are the reduction target since GPSC has total control on both.

[6] During September – November 2020, GPSC, TGO and Creagy (Consultant) worked together to design and apply several ICP approaches to design an appropriate ICP strategy and pricing for GPSC to support its climate strategy development. The methodology and results of case studies is shown in the Annex. GPSC could consider revisiting the best approaches that best fit with its business and objectives

Besides that, in this phase GPSC should be applied implicit carbon price in any GHG reduction project that GPSC decided to invest without profit (e.g. CSR project) which to raise awareness on existing abatement cost of GHG reductions that GPSC has been supporting.

TABLE 8 STRATEGY FOR THE NEAR-FUTURE TERM (2021-2022)

Objective 1	**To raise awareness of the existing abatement costs of GHG mitigation measures that GPSC has taken**
ICP approach	Implicit Carbon Price
Project type	Any GHG reduction project that GPSC decided to invest without profit (e.g. CSR project)
Scale	all scales
GHG type	CO_2 / CH_4 / N_20 / HFC / PFC / SF_6 / NF_3
Scope	Scope 1 / Scope 2
Timeline:	1 Jan 2021 – 31 Dec 2022 (Evaluate the result on an annual basis)
Key person	Climate taskforce*
Activity:	• Tracking CAPEX projects by collecting data relating to their financial performance and any increase/reduction in GHG emissions. • Evaluate the results through the following indicators: the number of projects applying ICP, potential GHG reduction, amount of total investment, and net profit/loss of projects. • Evaluate the abatement costs of GHG mitigation measures.
Objective 2	**To learn and prepare readiness of applying ICP**
ICP approach	Shadow Price
Project type	• GHG reduction project
Scale	all scales
GHG type	CO_2 / CH_4 / N_20 / HFC / PFC / SF_6 / NF_3
Scope	Scope 1 / Scope 2
ICP Price	US$15/tCO2e (starting carbon price)
Timeline:	1 Jan 2021 – 31 Dec 2022 (Evaluate the result on an annual basis)
Key person	Climate taskforce* and Investment taskforce
Activity:	• Tracking CAPEX projects by collect data relating to their financial performance and any increase/reduction in GHG emissions. • Evaluate result after applying shadow price. - Number of projects applying ICP (Project) - Number of projects that changed investment decision (Project) - Project IRR and NPV before applying the shadow price (%, mTHB) - Project IRR and NPV after applying the shadow price (%, mTHB) - Potential GHG reduction (tCO2e/yr) - Potential GHG avoidance (tCO2e/yr) - Amount of total investment (mTHB) - Net profit/loss (mTHB)

*Climate taskforce should be consisting of at least these functions: sustainability management, strategic planning, accounting, financing, and operating unit.

Overall, ICP implementation results and lesson learned from this phase will be used as an input to strengthen the ICP implementation in the next phase. It is expected that during this phase, GPSC will be able to:

- Start collaborating and working across business units and relevant departments to implement ICP.
- Test whether the shadow price approach and the initial carbon price work as intended and evaluate how it fits with GPSC circumstances and situation.
- Address new issues and concerns before implementation in the next long-term phase.
- Update and revise supporting tools (e.g. carbon footprint calculation tools, financial models, implementation plan, climate risk premium, document templates, etc.) if needed based on feedback.
- Develop a strong pipeline of low carbon investment projects with details of marginal abatement cost.
- Learn how to monitor and evaluate ICP results periodically so that it remains fit for purpose.

Long-term implementation strategy (2023-2030)

The longer term (2023-2030) is to build upon the starting phase. This phase aims to build resilience and reduce GHG emissions to meet the 2030 target, for which the company commits to reduce GHG emissions from the BAU level by 2030 (base year = 2018).

To achieve the target, GPSC could do several things:

- revise the shadow price level to strengthen the outcome of financial decision making
- extrapolate its ICP approaches to be more ambitious and expand the decision area to cover some existing operations
- introduce the internal carbon fee to raise extra budget for the GHG reduction purpose, while the emission scopes could remain unchanged.

TABLE 9 STRATEGY FOR THE LONGER TERM (2023-2030)

Objective 1	**To reduce GHG emissions and increase renewable energy.**
ICP approach 1	Shadow Price
Project type	• GHG reduction project
Scale	all scale project
GHG type	CO_2 / CH_4 / N_20 / HFC / PFC / SF_6 / NF_3
Scope	Scope 1 / Scope 2
ICP Price	Starting at US$15/tCO2e
Timeline:	1 Jan 2023 – 31 Dec 2030 (Evaluate the result on an annual basis)
Key person	Climate taskforce* and Investment taskforce

Activity:	• Tracking CAPEX projects by collect data relating to their financial performance and any increase/reduction in GHG emissions. • *Evaluate result after applying shadow price.* - Number of projects applying ICP (Project) - Number of projects that changed investment decision (Project) - Project IRR and NPV before applying the shadow price (%, mTHB) - Project IRR and NPV after applying the shadow price (%, mTHB) - Potential GHG reduction (tCO2e/yr) - Potential GHG avoidance (tCO2e/yr) - Amount of total investment (mTHB) - Net profit/loss (mTHB)
ICP approach 2	Internal Carbon Fee/Internal trading system
Project type	Existing business units
Scale	all scale project
GHG type	CO_2 / CH_4 / N_20 / HFC / PFC / SF_6 / NF_3
Scope	Scope 1 / Scope 2
ICP Price	Starting US$1.56/tCO2e (internal carbon fee)
Timeline:	1 Jan 2023 – 31 Dec 2030 (Evaluate result every year)
Key person	Climate taskforce*
Activity:	• Tracking CAPEX projects in term of potential GHG reduction and amount of total investment in low carbon technologies. • Tracking GHG emissions of business unit • Evaluate result when using internal carbon fee/internal trading system - Potential GHG emission (tCO2e/yr) - Potential GHG reduction (tCO2e/yr) - Amount of total investment in low carbon technology (mTHB)

*Climate taskforce should be consisting of at least these functions: sustainability management, strategic planning, accounting, financing, and operating unit.

All in all, general roadmap covering the period of 2021-2030, which has been divide into two phases, is depicted in **FIGURE 11**. the implementation of each phase is detailed in the following parts.

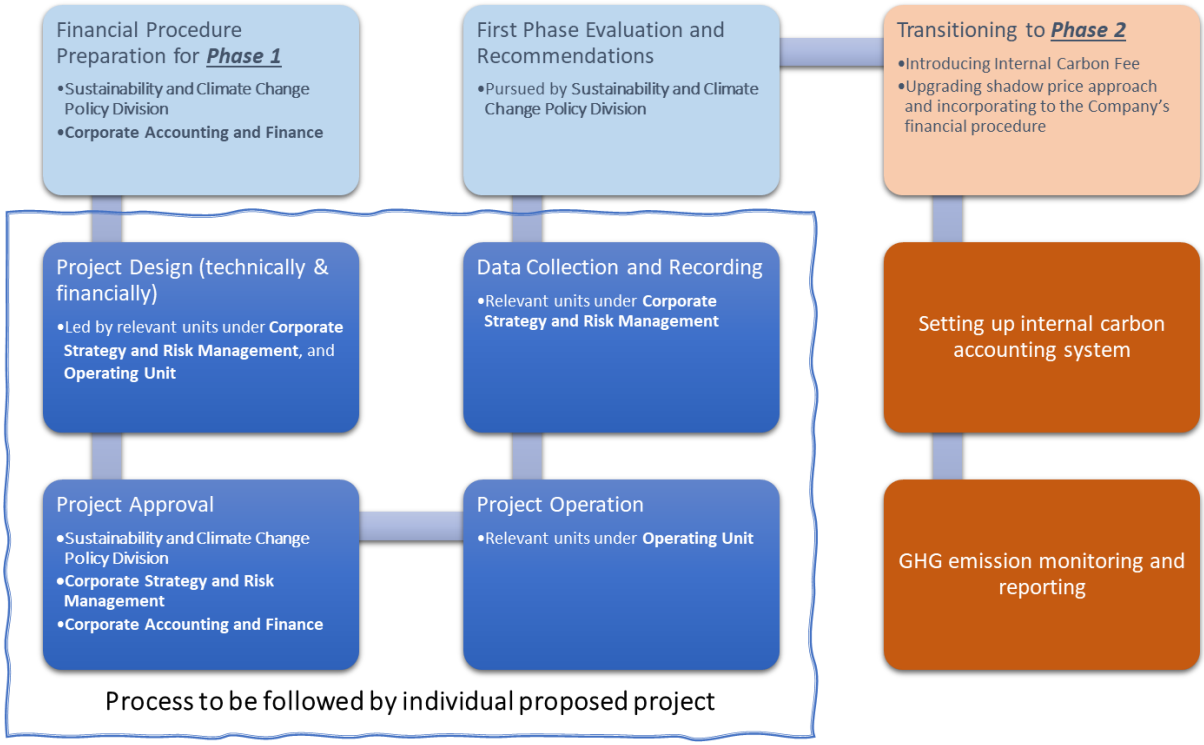


FIGURE 11 GPSC'S ICP ROADMAP DURING 2021-2030

Achieving GPSC Ultimate Goal (2031-2050)

In order to achieve the ultimate goal, GPSC aims to ambitiously increase its target to meet net zero carbon emissions by 2050. To do so, GPSC could consider several things:

- revise the shadow price level to strengthen the outcome of financial decision making
- extrapolate its ICP approaches to be more ambitious and expand the decision area to cover all existing operations and all 3 GHG scopes.
- revise the internal carbon fee by repeat the same processes in Phase 2 to raise extra budget for the GHG reduction purpose, while the emission scopes could cover 3 GHG scopes.

However, the plan of this phase shall be detailed based on the assessment of the company's status at the end of Phase 2 (by 2030).

2.2 Policy, procedures, process, and methodology to apply ICP

As stated earlier in Section 2, the Consultant has divided the recommendations for ICP implementation into 2 phases. Although this implementation plan will detail specifically the first/near-term plan over the period of 2021-2022, namely "Shadow price for investment

decision on capital expenditure", it also provides conceptual steps and broader view of the longer-term implementation for guiding purpose.

Thus, the detail information on policy, procedures, process, and methodology to apply ICP of each phase is further explained below.

POLICY, PROCEDURES, PROCESS, AND METHODOLOGY TO APPLY ICP DURING 2021-2022

Generally, this early phase will apply the "shadow price" approach in order to support GPSC's investment decisions on new Capital Expenditures (CAPEX) which would cover on GHG emissions scope 1 and scope 2. Based on the case studies and information provided under this Project, the **shadow price provided at US$15/tCO$_2$e is recommended for its learning purpose**, as well as for preparing GPSC for the potential regulatory compliance. The monitored and recorded results from the applications of this ICP will be a solid foundation for GPSC to build upon for its longer-term implementation.

The application of this initial ICP value of US$15/tCO$_2$e aims at supporting GPSC's investment decisions on new CAPEX, covering GHG emissions scope 1 and scope 2. The new projects are divided into Projects with GHG reduction potentials, e.g., floating solar, wind projects

The application steps of each type are further explained below.

2.2.1 Application of ICP to Type 1: Projects with GHG reduction potentials

Step 1: Estimating the amount of GHGs

In addition to the essential components for financial analysis, the saving from GHG reductions is to be considered to the financial model. This step is used to determine appropriate estimated amount of GHGs reduced over the course of project operation. Thus, it is important to understand the technical process of the project so as to most accurately determine the types and amount of GHGs directly reduced (GHG scope 1), electricity usage (scope 2), as well as the correspond emission factors. These emissions will be translated into the common GHG term, so-called "carbon dioxide equivalent" (CO_2e), and will be applied as a green initiative used to assess the cost of project investment with GHG reduction potentials.

Step 2: Establishing the base case investment analysis

In this step, a basic project financial feasibility is required. For each single project in the pipeline, the financial assessment of the base case scenario (not taken the climate risk into account) will have to be conducted. Common project financial indicators—i.e. Net Present Value (NPV), Internal Rate of Return (IRR) and Payback Period—, together with the financial model will have to be recorded. General financial information needed for the base case financial assessment include:

- Annual free cash flow of the project
- Project lifetime

- Project WACC (weighted average cost of capital)

Step 3: Assessing the investment analysis with carbon price

The financial assessment in Step 3 will basically incorporate the carbon price into the base case analysis in Step 2. By applying the ICP mechanism to calculate the benefits from green initiatives, annual GHG reductions multiplied by the pre-determined shadow price (US$15/tCO$_2$e). The benefits from the green initiative are to be included to the project's free cash flow. The carbon reduction projects become more profitability, consequently the project's NPV and IRR increase, while the payback period shortens. Furthermore, the sensitivity analysis on different levels of shadow prices is also to be conducted.

Hence, the results of project's IRR of both base case and the case with carbon price will be determined against hurdle rate. The IRR which is higher than the hurdle rate determines the viability of that particular project.

Step 4: Providing summary and recommendations for investments

A summary table of the assessment will show the financial indicators (i.e. NPV, IRR and Payback) of all cases, automatically generated by using the enclosed **Tool for Investment Assessment**, including the base case and other cases with various rates of carbon prices. Apart from the unambiguous investment decision of each project by determining the project IRR that is greater than hurdle rate, GPSC should also consider the attractiveness of the project as compared to other carbon reduction projects in the pipeline.

Step 5: Setting project indicators monitoring, reporting and evaluation procedures

The evaluation report on ICP application to GHG reduction projects should cover the project's capital investment, its lifetime, WACC, NPV, IRR (both base case and cases with carbon prices) and annual GHG reductions. Key indicators to be monitored shall include, but not limited to, the followings:

- Number of new projects applied the ICP mechanism
- Number of new projects that the ICP application alters the investment decision
- Project NPV that the ICP application alters the investment decision
- Additional profits of the project that the ICP application alters the investment decision
- Annual accumulated GHG emission reductions of all new projects applied the ICP mechanism
- Annual accumulated GHG emission reductions of all new projects that the ICP application alters the investment decision
- Average increase of IRR from all new projects that the ICP application alters the investment decision

POLICY, PROCEDURES, PROCESS, AND METHODOLOGY TO APPLY ICP DURING 2023-2030

With a solid ground from the experiences using ICP mechanism in the earlier years, the application of shadow price will become familiar to GPSC. The monitored data will be a good starting point in order to re-evaluate the more, or even most, appropriate shadow price to be applied after the year 2022. In this longer-term phase, the objective of ICP implementation become more solid. GPSC is clearly aims to achieve its carbon reduction by 2030. The Consultant has laid a longer-term plan for GPSC to strengthen its ICP implementation using a set of two approaches. One is the continued usage of "shadow price" to encourage and/or discourage the new projects (as explained in above sub-section. The other is the "introduction of internal carbon fee" as a tool to channel internal budgeting to stimulate GHG reduction potentials to meet the target in a set timeframe.

Application of Shadow Pricing

The Consultant recommend that GPSC gives priority to the actual results from the application of US$15/tCO2e over the first phase to determine the new price. Once the new shadow is settled, the steps on project investment assessment of two project types as outlined in Sections 2.2.1 can be still used. Although the case studies used to come up with this value might not be consider a decent sample set to represent GPSC's project pipeline, the value could be one among others that GPSC would have to consider re-evaluating the shadow price, as well as the climate risk premium. However, the improvement of this continuation is not only to the level of price, but also the coverage this approach is to be applied. It is suggested that GPSC may consider extending the coverage of the shadow price to its existing operations (i.e. Operating Expenditures (OPEX)) as well, while the GHG scope could remain unchanged.

Introduction of Internal Carbon Fee

Internal carbon fee is a charge that a company voluntarily imposes on its business units for their emissions. Based on the case studies in this Project, the internal carbon fee is to be applied to all power plants which would promisingly raise a certain budget internally required to achieve the emission reduction target in 2030 is at US$1.56/$tCO_2e$. It should be noted that the internal carbon fee approach is somewhat complicated for the case of GPSC's power plant operations as a networking system. Certain actions will be required to prepare GPSC's internal BUs since a clear distinct of GHGs and financial data of each plant/business unit is needed in order to reasonably apply this approach to a selected set of participating units.

The implementation of internal carbon fee approach is simply an imitation of carbon tax, but the payment and circulation of fee collection, management and use would only occur internally. The fee implication will concern only the GHG scope 1 and scope 2. Necessary steps of this approach are delineated below.

Step 1: Internal carbon accounting system

Carbon accounting is a process by which the company quantify their GHG emissions so that they may understand their climate impact and set goals to limit their emissions. For GPSC case, the carbon account will have to be systematically set up at business unit (BU) level, and at least to each BU in group which would be participating in the scheme.

The carbon account may simply set and manage in the similar way to bank account, but the asset lied upon the account is the amount of GHGs (in universal unit: CO_2e). the head office may take responsibility (being a bank) to oversee the status and transaction of GHG among this group.

Step 2: GHG emission monitoring and reporting

Over the course of the scheme implementation, the GHG emissions from each BU's operations will have to be strictly monitored and reported. Since each type of GHGs has a different global warming potential (GWP) and persists for a different length of time in the atmosphere. Standardized carbon unit has been introduced considering ONE kilogram (kg) of carbon dioxide (CO_2) to produce a warming potential value of 1, scientifically, 1 kg of other GHGs contribute multiples effects to the warming potential. For example, releasing 1 kg of nitrous oxide (N_2O) into the atmosphere is about equivalent to releasing 298 kg of CO_2. Similar to N_2O, other GHGs contribute to different level of GWP. As such, to complete the reporting the monitoring data GPSC will have to continue monitoring it carbon footprint of all participating BUs. Key monitoring data include, but not limited to, the followings:

- Types of fuels used
- Amount of fuels used
- Process activities in the BU
- Types of GHGs produced from each process
- Amount of each GHG type and of each process
- Electricity usage
- Electricity emission factor

The Consultant trust that the existing practice on monitoring the carbon footprint is sufficient and fit for the purpose of this internal carbon fee exercise.

Step 3: Fee collection and carbon account management

the carbon fee collection can by conducted annually by the headquarter. The total amount is simply the multiplication of GHG emissions and the set carbon fee (US$12.6/$tCO_2e$) from each BU. The carbon account should also be recorded. This accounting system could potentially be a steppingstone towards a more advanced (internal) scheme in the future.

2.3 Communication plan

A communication plan enables GPSC to effectively deliver information regarding the company's specific ICP plan across all business units, as well as central supporting functions. The plan will identify the messages needed to promote, to different targeted groups and on which channel(s).

The communication plan is designed over the course of the ICP implementation period, mainly, for three groups as indicated in the table below.

TABLE 10 GENERAL REQUIREMENTS FOR ICP COMMUNICATION PLAN

	ICP Implementation Units	Management	Company-Wide
Main Topic(s)	• Outreaching, introduction and dissemination of ICP programme • Current status • Problems-solutions	• Updates on achievement vs. target • Current status • Challenges	• Recap on the objectives of the ICP • Updates on achievement vs. target • Current status • Challenges
Frequency	Quarterly	At management meetings	Biannually
Target	**Required**: Heads and responsible personnel of relevant units	Management	All staff
Channel	**Preferred**: Face to face meeting	Virtual meeting or as appropriate	Newsletter, internet feeds

However, it should be noted that each communication activity may cover different topics for information and issues for discussion depending on the stage of communication and specific problem occurring at that point. Last but not least, a video presentation on the ICP concept and how it would complement the company's visions is recommended for not only internal use but also as an outreach to public.

2.4 Implementation team

Key functions of ICP implementation within GPSC are identified. Specific responsibility, schedule and procedural steps for the ICP implementation to each particular teams/units, in correspondence to the implementation flow, are officially cascaded and summarized in the table below:

TABLE 11 TASKS AND FUNCTIONS OF TASK OWNERS

Task	Task Owner	Roles and Responsibilities	Actions Required
Financial Procedure Preparation	**Sustainability and Climate Change Policy Division (Key Responsible Unit)**	To supervise the configuration of ICP using shadow price approach	Integration of ICP value and its application to the company's financial consideration procedure
Project Design (technically & financially)	Relevant units under: • **Corporate Strategy** • **Operating Unit**	To identify potential GHG reduction project and ICP targets	Low GHG project proposal development for submission
	• Safety, Occupational Health & Environment Management Department	To provide supports on project design and target setting	Technical and financial supports as required
Project Approval	• **Sustainability and Climate Change Policy Division** • **Corporate Strategy and Risk Management** • **Corporate Accounting and Finance**	To assess the low GHG project proposals and proposed ICP targets	Proposal assessment: providing feedbacks for further improvement and/or approval of both project design and target setting
Project Operation	Relevant units under **Operating Unit**	To ensure smooth operation of the selected projects	Project operation: normal operation, reporting of any challenges and soring for solutions
Data Collection and Recording	Relevant units under **Corporate Strategy and Risk Management**	To monitor and keep track of the project implementation	Records of monitoring data, evaluation the project performance against ICP targets

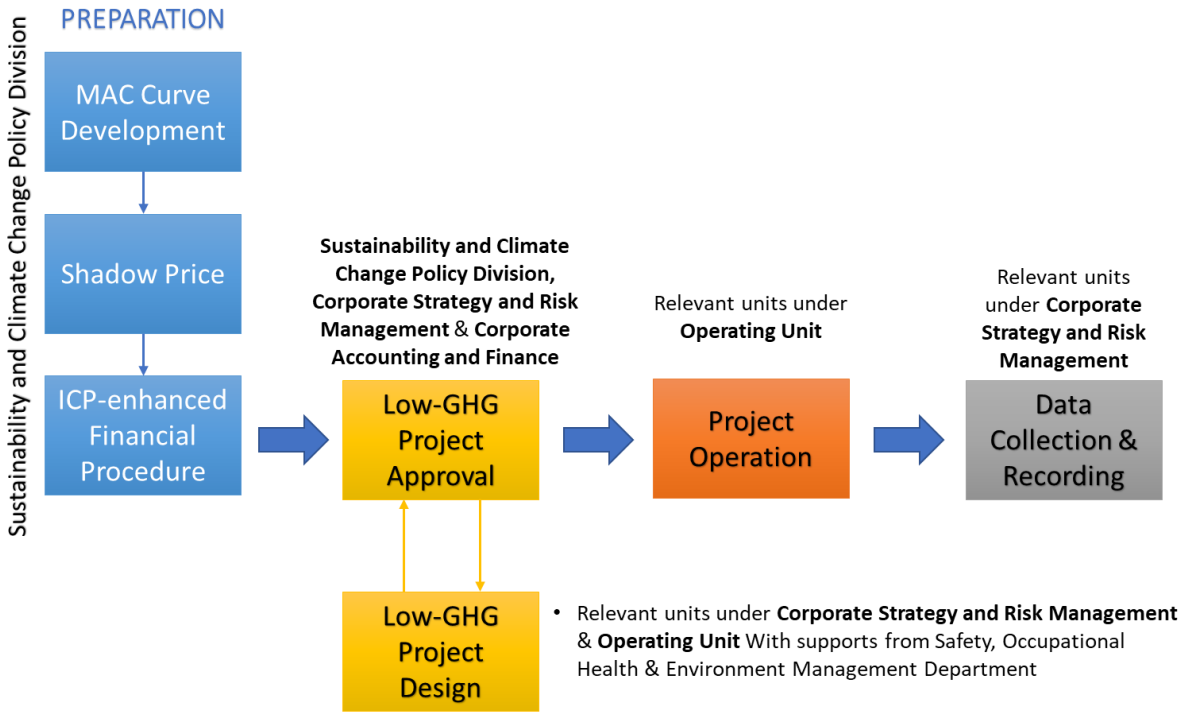


FIGURE 12 GPSC'S ICP IMPLEMENTATION FLOW AND RESPONSIBLE UNITS FOR THE IMPLEMENTATION OF "SHADOW PRICE FOR INVESTMENT DECISION"

2.5 Work Plan

Following the roles and responsibilities (Table 11) in correspondence with the implementation process flow shown in Figure 12, developing the detailed implementation action sheet (Table 12) could help tracking and reminding on which actions should be performed at and/or completed at a certain period in time. This sheet may contain actions required, task description, task owner, due date and status indicator (e.g. in-progress, behind schedule, complete). Below table 12 illustrated an initial version which GPSC could further developed to reflect the most precise information matched with GPSC's relevant policy and planning.

Preparation of ICP-enhanced investment procedure

In order to materialize the ICP implementation plan, especially the application of shadow price or the climate risk premium to new CAPEX decision making process, GPSC is highly recommended to ensure the corporate's financial decision procedure is officially adopted and ready to be used at the very beginning of this phase. It is seen that this financial procedure preparation may take more or less the following steps:

- Establishment of MAC curve
- Defining carbon value/climate risk premium
- Integration the carbon value/climate risk premium into relevant company's procedures

GPSC should flag this preparation at the top priority since it will have to be in place prior to any new CAPEX consideration. Although the length of time to gather abatement measures information, to assess the appropriate level of carbon price/ risk premium and to fully adopt these values may be uncertain. The design of carbon-related projects is encouraged, and the proposals can be developed in parallel to this procedure development.

Approval of project proposals

For the approval process, a signal regarding the timeframe should be given. However, to avoid any confusion that may arise due to this new ICP concept to the company, as we ll as to lessen additional burden to internal BUs, it is recommended that the new CAPEX decision process itself should remain unchanged regardless of the application of shadow pricing mechanism.

TABLE 12 IMPLEMENTATION PLAN OF "SHADOW PRICE FOR INVESTMENT DECISION" BY ACTIONS

#	Action	Task Owner	Timing*	Notes	Status
0	**Preparation of financial consideration procedure**	**Sustainability and Climate Change Policy Division (Key Responsible Unit)**	**Months 1-3**	**One-time action (unless revision required)**	**In-progress / Behind schedule / Complete**
0-1	Establishment of MAC curve		Months 1-2		In-progress / Behind schedule / Complete
0-2	Defining carbon value/climate risk premium		Month 3		In-progress / Behind schedule / Complete
0-3	Integration the carbon value/climate risk premium into relevant company's procedures		Month 3		In-progress / Behind schedule / Complete
1	**Project proposal development**	**Relevant business unit(s)**	**-**	**-**	**N/A**
1-1	Technical design		-	-	N/A
1-2	Financial feasibility analysis		-	-	N/A
2	**Approval process**	**Sustainability and Climate Change Policy Division, Corporate Strategy and Risk Management and Corporate Accounting & Finance**	**Within 3 months**	**All approved projects within 31 Dec 2022 are subject to this ICP-enhance financial procedure.**	N/A
3	**Project Operation**	Relevant units under **Operating Unit**	**Continuously**	**-**	N/A
4	**Data Collection and Recording**	Relevant units under **Corporate Strategy and Risk Management**	**Continuously**	**-**	N/A

* Suggested by the Consultant, subject to GPSC's internal policy and procedure.

2.6 Monitoring plan

A monitoring plan is a document that helps to track and assess the results of the ICP interventions throughout the implementation program. It is a living document that should be referred to and possibly updated as need be. The monitoring plan includes documents that have been created during the planning process, which should at least include the followings:

- Logical framework
- Implementation plan
- Communication plan
- Implementation team, including roles and responsibilities
- List of monitoring indicators
- monitoring logbook and templates

It is important to develop monitoring plan before the actual implementation taken place. This plan will help program staff decide how to collect data and track indicators, how monitoring data will be analysed, and how the results of data collection will be disseminated both internally and externally. Steps of monitoring plan development is depicted in the figure below.

FIGURE 13 MONITORING PLAN DEVELOPMENT

Referring to GPSC's logical framework on ICP establishment, the objectives have been clearly defined. It is also necessary to develop intermediate outputs and objectives for the program to help track successful steps on the way to the overall program goal.

GPSC's key objectives for the adoption of ICP approach in the near-future term are for the company **to learn the concept, applications, benefits, etc. of ICP**. In addition, GPSC shall have to consider intermediate objectives which may include the understanding of **its financial resilience to climate change exposure** and **applications of ICP concept to the overall company's financial, as well as sustainability performances**.

GPSC shall monitoring and collect data under the ICP implementation regularly for reporting on a quarterly basis. For data comparability and reliability throughout the timeline, standardized data collection tools and templates is developed for the usage and all staff involved should be consistently trained on the standard procedures. Databases and a system for

filing source documents will be developed and managed by the assigned personnel under the Corporate Strategy for collating, analyzing and securely storing information.

2.6.1 List of Monitoring Indicators

Once the ICP goals and objectives are defined, it is time to define indicators for tracking progress towards achieving those goals. The indicators should be a mix of those that measure process, or what is being done, and those that measure outcomes.

Process indicators track the progress of the ICP rollout so as to answer the question, "Are activities being implemented as planned?" Outcome indicators track how successful the implementation has been at achieving the objectives, say, to answer the question, "Have this ICP implementation made a difference?" The below table concludes process and outcome indicators of this rollout:

TABLE 13 PROCESS AND OUTCOME INDICATORS OF THE ICP IMPLEMENTATION OF "SHADOW PRICE FOR INVESTMENT DECISION"

Process Indicators	Outcome Indicators
P1. **Development of MAC curve**	O1. Number of projects that investment decision changed
P2. **Integration of ICP value in the company's investment decision procedure**	O2. Project IRR and NPV before applying the shadow price
P3. **Applied ICP value (from shadow price approach)**	O3. Project IRR and NPV after applying the shadow price
P4. **Number of new projects applying ICP**	O4. Average increase of IRR from all new projects that the ICP application alters the investment decision
P5. **Annual accumulated GHG emission reductions of all new projects applied the ICP mechanism**	O5. Annual accumulated GHG emission reductions of all new projects that the ICP application alters the investment decision
P6. **Number of trainings to relevant units**	O6. Amount of accumulated total investment
	O7. Net profit/loss

2.6.2 Description of Monitoring Indicators

Process Indicators

Indicator P1. Development of MAC curve serves as the origin of shadow price to be directly applied to the project investment analysis as an addition cost or revenue to the free cashflow and/or to establish the climate change premium which in turn used to adjust the hurdle rate. The development of MAC curve is expected to be done once at the beginning of this near future phase. Unless it is necessary to refine key information/assumption, this MAC curve can be pertained over the course of this 2-year phase.

Indicator P2. Integration of ICP value in the company's investment decision procedure is the ultimate product of the company financial procedure enhancement by integrating the shadow price and/or climate risk premium. Again this action is expected only once at the beginning of this phase. Unless there is any revision of the MAC curve, this integration would be performed only once.

Indicator P3. Applied ICP value (from shadow price approach) is another product based on the analysis using MAC curve. The applied ICP value in this case has to be recorded in a form of "shadow price" and/or "climate risk premium". These values are deemed to be developed once and continually applied over the course of this 2-year phase, unless it is necessary to be revisited.

Indicator P4. Number of new projects applying ICP counts all new projects being considered using this new climate-induced WACC. This number indicates the actual in-pursuit projects as compared to the project in the pipeline; thus, reflect the rate, sequence and timeline of project materialisation against the company planning. In due course, monitoring this indicator will help on the planning process in the future.

Indicator P5. Annual accumulated GHG emission reductions of all new projects applied the ICP mechanism is built upon the estimates number of reduction potentials from all proposed projects. This accumulated number will increase over time whenever there is additional new project proposals submitted for approval. This number shows the entirety of GHG reduction potentials which could be used to evaluate against net CAPEX to compare with the actual average abatement cost from those projects being approved.

Indicator P6. Number of trainings to relevant units is deemed important in terms of capacity building. The trainings should be designed o be fit with the targeted groups and specific needed. Not only the number of trainings, but all material used, training contents, evaluation and feedbacks should also be recorded so that the follow-on actions and subsequent one can be appropriately designed based on these records.

Outcome Indicators

Indicator O1. Number of projects that investment decision changed shows the actual number of projects that pass the new climate-induced investment approval process. This indicator illustrates the success ratio of new project proposals which would be realised. It also reflects the company's level of contributions towards its transitional phase to low carbon business and a baseline to build upon in the coming ICP phase.

Indicator O2. Project IRR and NPV before applying the shadow price are the indicators applicable in the case where the investment decision making applied shadow price directly to its financial feasibility. These values will be used to determined **Indicator O4** (Average increase of IRR).

Indicator O3. Project IRR and NPV after applying the shadow price, similar to Ind**icator O2**, are the indicators applicable in the case where the investment decision making applied shadow price directly to its financial feasibility. These values will be used to determined Indicator O4 (Average increase of IRR).

Indicator O4. Average increase of IRR from all new projects that the ICP application alters the investment decision is determined based on **Indicators O2** and **O3**. The average increaser in project IRR signal the level of climate risk towards GPSC business. Monitoring this over time should draw a trend of climate change effecting its business in the near future.

Indicator O5. Annual accumulated GHG emission reductions of all new projects that the ICP application alters the investment decision is built upon the estimates number of reduction potentials from only projects that pass the new financial decision assessment. This accumulated number will increase over time whenever there is additional new project to be implemented. This number can be used, in conjunction with **Indicator O6** (Amount of total investment), to determine the actual abatement cost per unit of GHG reductions.

Indicator O6. Amount of accumulated total investment is also increase over time whenever there is an additional project approved and would be implemented. This indicator together with **Indicator O5** (Annual GHG emission reductions) is necessary to establish the actual abatement cost per unit of GHG reductions.

Indicator O7. Net profit/loss as a result of new project hurdle rate (climate risk adjusted) being applied to the investment decision making must be strictly monitored. This opportunity loss will serve as an indication to the level of additional budget the company requires in order to maintain its business position and competitiveness so that the company could plan for this additional budget resources either internally or externally.

2.6.3 Monitoring Procedure and Reporting Template

After creating monitoring indicators, it is time to decide on methods for gathering data and how often various data will be recorded to track indicators. Since the majority of the indicators can be collected internally, the necessity is to decide how often it will be collected. Some data will be continuously gathered by internal staff (such as the number of trainings). If other types of data depend on outside sources are required, collection frequencies and responsibilities should be clearly defined. The table and figure below can be printed out and all staff working on this ICP program can refer to it so that everyone knows what data is needed, when and by whom.

TABLE 14 GENERAL REQUIREMENTS FOR ICP IMPLEMENTATION PLAN

Indicator	Data Source(s)	Timing	Responsible Units
PROCESS INDICATORS			
P1. Development of MAC curve	GHG Marginal abatement Cost Database	M2	Sustainability and Climate Change Policy Division
P2. Integration of ICP value in the company's investment decision procedure	Approved company's financial management manual	M3	Corporate Accounting & Finance
P3. Applied ICP value (from shadow price approach)	Internal ICP valuation	M3	Sustainability and Climate Change Policy Division
P4. Number of new projects applying ICP	Report on new CAPEX investment decision	Quarterly	Relevant units under Corporate Strategy and Risk management
P5. Annual accumulated GHG emission reductions of all new projects applied the ICP mechanism	Calculated based on project proposals	Quarterly	Relevant units under Corporate Strategy and Risk management
P6. Number of trainings to relevant units	Training attendance sheets	Biannually	Corporate HR
OUTCOME INDICATORS			
O1. Number of projects that investment decision changed	Report on new CAPEX investment decision	M3	Relevant units under Corporate Strategy and Risk management
O2. Project IRR and NPV before applying the shadow price	Project financial feasibility study	Quarterly	Relevant units under Corporate Strategy and Risk management
O3. Project IRR and NPV after applying the shadow price	Project financial feasibility study	Quarterly	Relevant units under Corporate Strategy and Risk management

Indicator	Data Source(s)	Timing	Responsible Units
O4. Average increase of IRR from all new projects that the ICP application alters the investment decision	Calculated	Quarterly	Relevant units under Corporate Strategy and Risk management
O5. Annual accumulated GHG emission reductions of all new projects that the ICP application alters the investment decision	Calculated based on project proposals	Quarterly	Relevant units under Corporate Strategy and Risk management
O6. Amount of accumulated total investment	• Calculated based on project proposals • Actual investment	Quarterly	Corporate Accounting & Finance
O7. Net profit/loss	• Calculated based on project proposals • Actual cashflow	Quarterly	Corporate Accounting & Finance

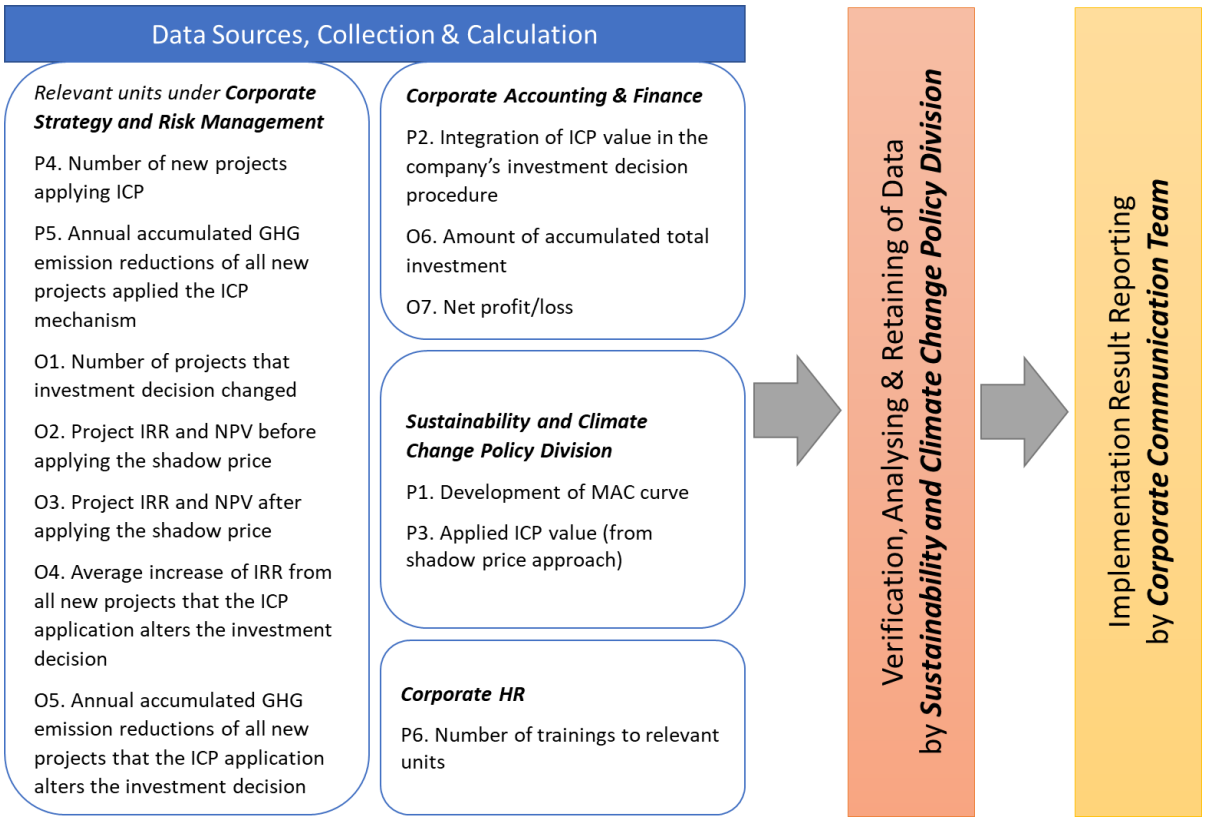


FIGURE 14 DATA FLOW AND PROCESSING DIAGRAM

Once all of the data have been collected, they will have to be compiled and analysed. The progress and/or results will be established for internal review and external reporting. What data will be tracked, analysed and how the results will be presented are explained and summarised in the table below.

TABLE 15 DATA REPORTING TEMPLATE

Indicator	Baseline	Q1/Y1	Q2/Y1	Q3/Y1	Q4/Y1	Q1/Y2	Q2/Y2	Q3/Y2	Q4/Y2	Cumulative	Target	% of Target Achieved
PROCESS INDICATORS												
P1. Development of MAC curve												
P2. Integration of ICP value in the company's investment decision procedure												
P3. Applied ICP value (from shadow price approach)												
P4. Number of new projects applying ICP												
P5. Annual accumulated GHG emission reductions of all new projects applied the ICP mechanism												

Indicator	Baseline	Q1/Y1	Q2/Y1	Q3/Y1	Q4/Y1	Q1/Y2	Q2/Y2	Q3/Y2	Q4/Y2	Cumulative	Target	% of Target Achieved
P6. Number of trainings to relevant units	None	1	1	1	1					4	8	50%
OUTCOME INDICATORS												
O1. Number of projects that investment decision changed	None	-	-	0.05	-						0.5	10%
O2. Project IRR and NPV before applying the shadow price												
O3. Project IRR and NPV after applying the shadow price												
O4. Average increase of IRR from all new projects that the ICP application alters the investment decision												
O5. Annual accumulated												

Indicator	Baseline	Q1/Y1	Q2/Y1	Q3/Y1	Q4/Y1	Q1/Y2	Q2/Y2	Q3/Y2	Q4/Y2	Cumulative	Target	% of Target Achieved
GHG emission reductions of all new projects that the ICP application alters the investment decision												
O6. Amount of accumulated total investment												
O7. Net profit/loss												

Remark: Figures and/or texts in Blue provided in the table are only random examples.

Section 3
Recommendations for Green Finance

Section 3 Recommendations for Green Finance

Between August and November 2020, GPSC worked with the Consultant team to pilot ICP approaches through the process shown in Figure 15. While it is recommended that the company introducing an internal carbon fee scheme to accumulate a climate fund for mitigation measures, it is not the only feasible solution. There are many other sources of funds dedicated to climate action (i.e. green finance), to which the company may resort to.

A variety of green finance instruments allow the company to have more financial levers or to be able to reduce its investment risk, and thus have a higher chance to meet the mitigation targets. As a result, this section will provide an overview of green finance available in Thailand.

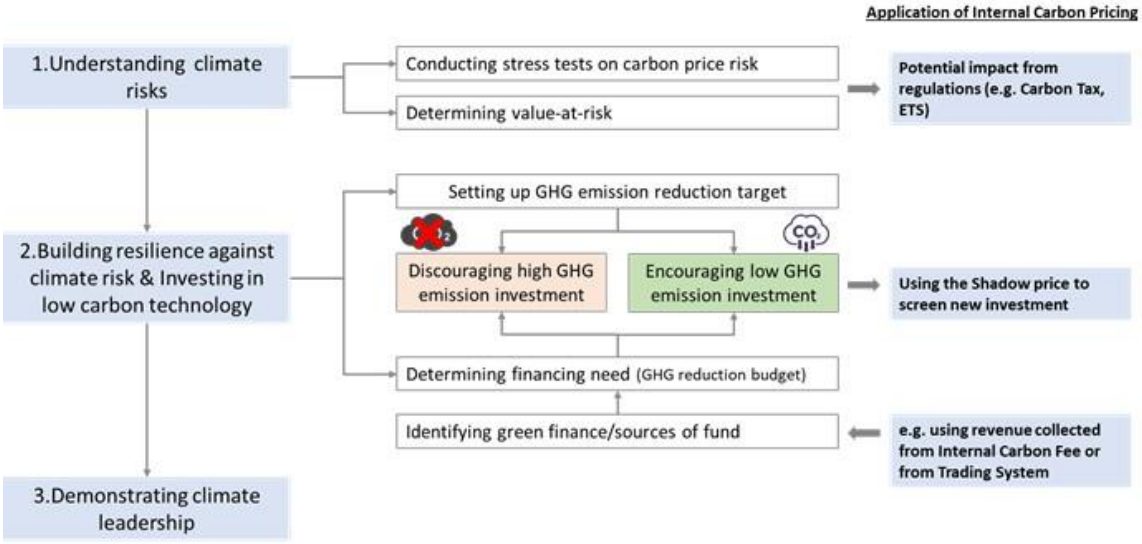


FIGURE 15 CLIMATE CHANGE STRATEGY DEVELOPMENT USING ICP

3.1 Background

Green finance, or climate finance, refers to local, national or transnational financing—drawn from public, private and alternative sources of financing—that seeks to support mitigation and adaptation actions that will address climate change. The figure shows a snapshot of the characteristics of climate finance. After identifying the volume of green finance needed, GPSC may consider resorting to any specific source of funds for an or a combination of instruments that best suit the need of the company.

The main difference between green finance and traditional finance is the consideration of climate benefits into the financing terms, which allows green finance to cover at least part of the marginal cost of a green investment or to reduce the incremental risk associated with the climate change. Green finance can come in different forms. In addition to the standard investment instruments such as debt and equity financing, GPSC might in some cases seek for de-risking and catalytic instruments, such as guarantees, insurance and result-based financing, etc. which are also made available by certain funding providers. The introduction of funding sources below will be separated into three main categories, including public, private, and international sources of funds, in Thailand.

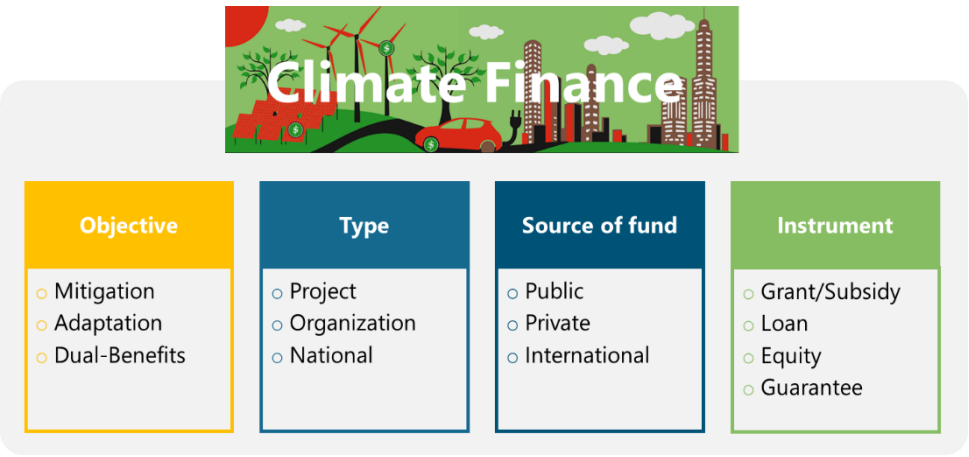


FIGURE 16 CHARACTERISTICS OF CLIMATE FINANCE

3.2 Public sources of green finance

Several extra-budgetary funds were established by the Thai government to support climate action in Thailand. The figure below gives an overview of the domestic public funds for green finance in Thailand.

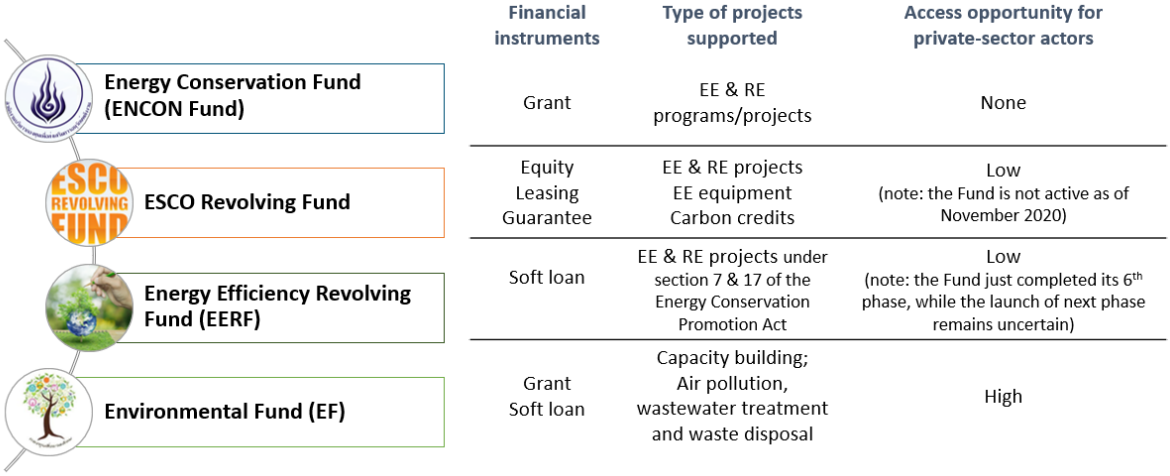


FIGURE 17 OVERVIEW OF PUBLIC SOURCES OF GREEN FINANCE

Among them all, one of the largest and the most active climate-related funds is **Energy Conservation Fund (ENCON Fund)**, which has an accumulated budget of around 24 billion THB (or approximately 770 million USD). The investment portfolio of the ENCON fund is composed of three components, including energy efficiency (EE), renewable energy (RE), and strategic management, among which EE accounts for the largest share (72%, nearly 37.56 billion THB or 1.1 million USD). In each fiscal year, the ENCON Fund will announce the specific program(s) for which it will provide finance in the form of grant. However, private-sector actors do not have direct access to the ENCON Fund. The mechanism is that the ENCON Fund provides grant support for public entities to further finance climate measures taken by private-sector actors.

TABLE 16 SCOPE OF FUNDING AND ELIGIBLE CRITERIA OF ENCON FUND

Topic	Details
Eligible Applicant	Under Section 26 of the Energy Conservation Promotion Act, eligible applicant includes those **government agency, state enterprise, educational institution, and non- profit organization** which has a status of legal entity as specified by Thai or international laws with activities directly related to energy conservation or protection, and environmental issues of energy conservation. Also, such

Topic	Details
	organizations shall not aim for any political or commercial profit from the implementation of the fund. Therefore, it is important to note that ***private sector entity or SMEs do not have direct access to receive support from the Encon Fund***. However, the Encon fund has provided funding to other public entities, funds, programs where private sector entity or SMEs can access to those channels afterward.
Eligible sector / scope / project	1. The Energy Strategy which comprises of: I. Energy Efficiency Enhancement Plan II. Renewable Energy Plan III. Strategic Management Plan 2. The 20 years National Strategy 3. The Energy for All Strategy (ไทยนิยม ยั่งยืน)
Evaluation Criteria	All proposals submitted to request funding supports from the Encon Fund will be evaluated against the five criteria set by Proposal and Budget evaluation Sub-Committee: 1. Relevant 2. Effectiveness 3. Efficiency 4. Impact 5. Sustainability The proposals must demonstrate to meet minimum scores to receive funding.
Type of supports/funding	1. Grant for expenses related to research study and R&D. 2. Grant for expenses related to administrative and project management. 3. Grant for subsidy or compensate interests to project owners for providing investment subsidy or soft loan programs to participating entities. 4. Grant for expenses related to capacity building of stakeholders in energy conservation and alternative energy. 5. Grant for expenses related to the problem solving from the implementation of energy conservation and alternative energy.
Submission of Proposal	The steps for requesting funds will be operated electronically. Thus, applicants are required to submit an application to the Encon Fund Management Office and ensure the accuracy of the request before sending documents electronically. The date of sending documents electronically is considered a date of submission. The applicants shall print out the electronic document receipt that has been sent to be kept as evidence of the submission. The application can be submitted at https://project.enconfund.go.th/
Example of key funding programs/projects	• Energy Efficiency Revolving Fund (EERF) • ESCO revolving fund • Investment subsidy for energy efficiency retrofit program (80/20 and 70/30) • Investment subsidy for solar dome • Investment subsidy for solar dome • Investment subsidy for solar PV rooftop • Matching fund for energy efficiency in public hospitals

Topic	Details
	• Grant for biogas community projects

Funded by the ENCON Fund, the two important climate-related funds that directly provide funding support for private-sector actors are **ESCO Revolving Fund** and **Energy Efficiency Revolving Fund (EERF)**.

The **ESCO Revolving Fund** was administered by the Department of Alternative Energy Development and Efficiency (DEDE), dedicated to supporting investment in EE and RE projects in the form of equity, leasing, or credit guarantees. However, after four phases of implementation, DEDE seems to have halted the operation of ESCO Revolving Fund since 2017. It is not clear as of the time of writing if this Fund will open to applications again.

TABLE 17 SCOPE OF FUNDING AND ELIGIBLE CRITERIA OF ESCO REVOLVING FUND

Topic	Details
Eligible Applicant to the Fund	Potential entrepreneurs from industrial sectors or Energy Service Companies (ESCO) with potential energy efficiency or renewable energy projects resulting in reducing energy consumption, increasing energy efficiency, fuel switching, or renewable energy businesses.
Eligible Criteria	ESCO Revolving Fund is divided the investment services into 6 type as follows; 1. **Equity Investment:** make an equity investment in EE or RE projects. ***Criteria:*** *Equity investment in 10%-50% of total equity but limited to 50 mTHB, 5-7 years of investment period, and shared sell-back to the entrepreneur after end of agreement.* 2. **ESCO Venture Capital:** The Fund will venture with ESCO to raise capital for investments in energy saving projects of the ESCO. ***Criteria:*** *30% of registered capital but limited to 50 mTHB, 5-7 years of investment period, and shared sell-back to the entrepreneur after end of agreement.* 3. **Equipment Leasing:** Provide ling term leasing service in purchasing equipment and allow the entrepreneurs to repayment with low interest. ***Criteria:*** *100% of equipment cost but limited to 10 mTHB, 5-7 years of investment period, and 4% Flat rate of interest rate.* 4. **Carbon Credit Facility:** Facilitate project owners in developing CDM documents and building them to ensure that they can benefit from selling the carbon credits. 5. **Credit Guarantee Facility**: Assist the entrepreneurs in access the long-term loan from bank by providing credit guarantee.

Topic	Details
	6. **Technical Assistance**: Provide financial support for technical assistance such as energy audit, feasibility study. ***Criteria:*** *Limited to 100,000 THB and reimbursed to the Fund.*
Submission of Proposal	The target group/eligible applicant can apply to the Fund manager directly. Then, the Fund manager propose the project to the Investment committee who is committee form DEDE for approving the project. After that, the Fund manager sign the contract with the applicant and provide the investment contribution.

The Energy Efficiency Revolving Fund (EERF) was also administered by the DEDE, has just completed its sixth phase of implementation. The EERF provides soft loans[7] through domestic banks for EE and RE projects, specified under the section 7 and 17 of the Energy Conservation Promotion Act B.E. 2535, carried out by designated factories and buildings. However, whether the EERF will continue its another round of call for proposals remains uncertain as of the time of writing.

TABLE 18 SCOPE OF FUNDING AND ELIGIBLE CRITERIA OF THE ENERGY EFFICIENCY REVOLVING FUND (EERF)

Topic	Details
Eligible Applicant to the Fund	Potential applicant is the designated factory and new building type that under the section 7 and 17 of Energy Conservation Promotion Act B.E. 2535, respectively. In addition to the designated factor, the ESCO company is also eligible to access to the EERF's soft loan.
Form of Supports	The supports from EERF in the form of soft loan are provided by participants domestic banks who will evaluate and provide loans to the applicants. The application must also be approved by EERF's committee to be eligible for the soft loan. Key terms and condition of the soft loan are follows: Size of loan: Limited to 50 mTHB per project Interest rate: Limited to 3.5% per year Payment terms: Limited to 5 years Type of project: Energy efficiency and Renewable energy

[7] Key terms and condition of the soft loan are follows: Size of loan: Limited to 50 million THB (approximately 1.6 million USD) per project; interest rate: limited to 3.5% per year; repayment period: limited to 5 years.

Topic	Details
Submission of Proposal	The eligible applicant can submit the application to the participating banks. After the loan evaluation process by the bank, if approved, the bank will propose the proposals to EERF's committee for approving of the soft loan. After that, the banks sign the loan contract with the applicant and provide the financial support.

Another important climate-related fund is the **Environmental Fund (EF).** It has been used to support, in the form of subsidies and soft loans, both public and private-sector actors to improve the management of air pollution, wastewater treatment and waste disposal, which is different from the other funds focusing on EE and RE projects. Eligible applicants are required to submit a proposal to the Office of Natural Resources and Environmental Policy and Planning (ONEP) for further evaluation. Once approved, proceeds will be handled through the Krungthai Bank.

TABLE 19 SCOPE OF FUNDING AND ELIGIBLE CRITERIA OF ENVIRONMENTAL FUND (EF)

Topic	Details
Eligible Applicant to the Fund	In accordance to financial supporting framework under Section 23 (4) of the Act and with approval from the National Environment Board, **eligible applicants include government agencies, local administrative organizations, state enterprises, private sectors, environmental organizations, and individuals or agencies.**
Eligible sector/scope/project	**Subsidies and loans –** under the section 23, funds can be: 1) According to Section 23(1) given to government or local government to invest/carry out total wastewater or total waste disposal systems including procurement of land, materials, equipment, tools and necessary equipment for the system management *Credit limit not more than 50 - 90 percent of the project budget With the local administrative organization supporting not less than 10% and not more than 50% of the project budget* 2) given to local government or state enterprises to borrow and invest in the air pollution and waste water treatment systems, including any other equipment for use in the governmental affairs only. *Interest rate : 2.25 percent per annum by using the resolution of the Local Administrative Organization Council as collateral* 3) given to private sector to borrow and invest in the air pollution and waste water treatment systems, including any other equipment for use in its own activities or in the case of applicants having license to engage in the business services of air treatment or waste disposal. *Interest rate : 2 percent per year in case of using the guarantee letter Or transfer claims in deposit accounts, 3 percent per year in case of using other securities as collateral* 4) used as grant or subsidies to carry out the promotion and conservation of environmental quality's activities

Topic	Details
	5) used as fund management's cost
Submission of Proposal	Follow the eligible project as mention above that is following this; NO. 1) the local government put the project to the province action plan and propose to ONEP. NO. 3) the eligible applicant submits the application to the Krungthai banks. NO. 4) the eligible applicants are required to prepare a proposal. Then, shall be submitted to ONEP. The eligible applicants are required to prepare a proposal, in agreement with the activities under Section 23 of Promotion and Conservation of National Environmental Quality *Act*, 1992 which includes various activities in pollution management and the promotion of natural resource and environmental conservation. Next, proposal and supporting documents prepared shall be submitted to the Office of Natural Resources and Environmental Policy and Planning.

3.3 Private sources of funds

Green finance offered by private funding providers is much more diverse and flexible. Several commercial banks in Thailand have one or more **Green Loan Schemes** dedicated to different types of green projects. The terms and conditions are usually preferential than traditional loans, but borrowers are required to demonstrate their credit worthiness as traditional debt financing requirements. Some schemes have a particular focus small and medium enterprises. Examples of green loan products are shown in table below.

TABLE 20 LIST OF EXISTING GREEN LOAN PROGRAMS AVAILABLE IN THAILAND

Financial institutions	Special loan product(s)	Key Features	Eligible criteria
Kasikorn Bank (KBank)	K-Energy Saving Guarantee program[8]	Credit limit up to 100% of the total project investment, inclusive of consultation fees and operations by expert companies. Special Interest Rate below MLR (Bank's funding or Gov't Soft loan when available)	Business with cost of energy (fuel, electricity) more than 500,000 THB/month.Energy efficiency project with guaranteed energy savings by approved ESCO.
	K-Solar Rooftop Financing Program	Credit limit up to 100% of the total project investment. 8 years maximum loan term. Special Interest Rate below MLR (Bank's funding or Gov't Soft loan when available)	Solar PV Rooftop installation for self-consumption or with electricity purchase contract from government agencies. Employ high quality and standard equipment to ensure expected outcome and durability.
Siam Commercial Bank (SCB)	SCB's SME Go Green[9]	- Credit limit up to 150% of the collateral value. - Installment periods of up to 7 years. - grace period for principal payment in the first year - Maximum fee capped at 1.5%.	Business with at least 4 years with the following projects: • Energy Efficiency Improvement • Clean transportation Fleet • Pollution Treatment Equipment • Female Entrepreneur in SME Segment

8 K-Energy Saving Guarantee Program, https://www.kasikornbank.com/en/business/sme/loan/special-loan/Pages/k-energy-saving-guarantee-program.aspx

9 SCB's SME Go Green, https://scbsme.scb.co.th/products-detail/sme-green-financing

Financial institutions	Special loan product(s)	Key Features	Eligible criteria
Bangkok bank	Bualuang Green Loan[10]	High credit limit starting from 1 million baht with unlimited credit ceiling, and special interest rates of MLR per annum or lower. Exemption for credit management fees	Business that invests in energy-saving measures, optimizing energy consumption or producing environmentally friendly products: • energy-saving projects and activities • alternative/renewable energy • green label products • waste management (turning waste into energy) • bio-products (replacing chemical products)

Meanwhile, **Green Bond** is an emerging type of green finance in Thailand. Like green loan, green bond is a debt financing instrument to raise money for businesses to invest in green projects. However, lenders of the bond are not necessary to be the banks, they could be any investor who are interested to invest in the bond. Another difference is the transaction size in which the green bond issuance size is big, typically larger than 1 billion THB, and therefore, the green bond is not a financing option for SME.

Overall, green bond is any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible green projects and which are aligned with the four core components of the Green Bond Principles (GBP). The Green Bond Principles (GBP) was issued by International Capital Market Association (ICMA), are voluntary process guidelines that recommend transparency and disclosure and promote integrity in the development of the Green Bond market by clarifying the approach for issuance of a Green Bond.

Although there is no guarantee that the green bond issuer can benefit from a lower rate of interest or coupon, the issuer of the green bond might be able to attract investors who want deals with high environmental and climate impact. This means the green bond is likely to attract more investors if it is rated in the same category as the typical bond.

10 Bualuang Green Loan, https://www.bangkokbank.com/en/Business-Banking/Finance-My-Business/Loans-for-SMEs/Specific-Business-Loans/Bualuang-Green-Loan

A limited number of companies and banks have raised their funds for green investment through bond issuance. The bottleneck exists in the fact that green bond issuance usually takes a long time on average 4-6 months, while a typical bond issuance process may take around 2-3 months. This is because the green bond issuance requires to hire an external reviewer to validate its quality against the green bond principle, pushing up the cost of finances. Therefore, the size of green bonds typically exceeds 1 billion THB (about 32 million USD). See below some examples of green bonds in Thailand. For more information of bond issuance, please further review the bond issuance manual [11] developed by The Thai Bond Market Association (ThaiBMA). It is recommended to contact Thai BMA for assisting on green bond issuance.

FIGURE 18 EXAMPLES OF GREEN BONDS IN THAILAND

Another potential financing approach is **Infrastructure Fund (IFF)** which is a financial instrument for raising capital designed to raise fund to finance infrastructure projects. Type of infrastructure assets to invest in which is railway transportation, electricity generation, waterworks, roads/express ways/concession way, airports/ airfields, deep sea ports, telecommunication, or infrastructure for information technology and communication, alternative energy, water management system and irrigation system, natural disaster prevention system, waste management system, and multi-infrastructure project.

In most cases, infrastructure funds are designed to re-finance existing infrastructure projects to ensure and lower risks for interested investors. Therefore, it might not suit with businesses that want to raise fund without existing operational projects.

11 http://www.thaibma.or.th/pdf/publication/BondIssuace2015.pdf

Basically, the infrastructure fund is another type of mutual fund established to mobilize funds from public and institutional investors. The advantage of the infrastructure fund comparing to private equity fund is that investors will have higher liquidity to exit the investment because of the availability of the secondary market. However, an infrastructure fund requires a minimum issued size of 2 billion THB (approximately 64 million USD). Another key benefit of fundraising through an infrastructure fund is the tax incentive. Investors will be exempted from individual income tax for their dividends received in the first ten years of investment. See Table 21 Examples of climate related IFF. For to set up the IFF, it is recommended to contact the Securities and Exchange Commission of Thailand (SEC) for more information and support.

TABLE 21 EXAMPLES OF INFRASTRUCTURE FUNDS IN THAILAND

Name of the fund	Invested assets	Fund size at IPO
Thailand Future Fund	Chalong Rat Expressway and Burapha Withi Expressway	Upto 45.7 billion THB (≈ 1.465 billion USD)
Super Energy Infrastructure Fund	Solar power plant	Upto to 5.15 billion THB (≈ 165 million USD)
Buriram Sugar Group Power Plant Infrastructure Fund	Biomass power plant	Upto 3.85 billion THB (≈ 123.44 million USD)
Amata B. Grimm Power Plant Infrastructure Fund	Power plant	Upto 6.6 billion THB (≈ 211.6 million USD)

Finally, there are several voluntary crediting mechanisms that provides additional incentive for companies to certify their mitigation efforts and climate action related credits.

The most famous includes the **Joint Credit Mechanism (JCM)**. JCM is a system, established by the Japanese government since 2011, to cooperate with developing countries for reducing greenhouse gas emissions, in which the result of reduction is assessed as contribution by both partner countries and Japan. To be eligible for the JCM, a project must contribute to a reduction or removal in GHG emissions, including carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF6) and/or nitrogen trifluoride (NF3). The Joint Credits (JCs) are issued based on quantified amount of GHG emission reductions or removals achieved by the contribution of project participants in the implementation of GHG emission reductions or removals project activities under the JCM. As of mid-2020, Japan has held consultations and established the JCM with 17 developing countries, including Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Viet Nam,

Lao PDR, Indonesia, Costa Rica, Palau, Cambodia, Mexico, Saudi Arabia, Chile, Myanmar, Thailand and the Philippines. The partnership of Thailand-Japan was established since November 2015. Example of JCM projects in Thailand are:

- Introduction of 30MW Rooftop Solar Power System to Large Supermarkets.
- Power Generation by Waste Heat Recovery in Cement Industry.
- Introduction of 3.4MW Rooftop Solar Power System to Air-conditioning Parts Factories.
- Energy Saving for Semiconductor Factory with High Efficiency Centrifugal Chiller and Compressor.
- Installation of High Efficiency Air Conditioning System and Chillers in Semiconductor Factory.
- Reducing GHG emission at Textile Factory of Luckytex (Thailand) Public Company Limited by Upgrading to Air-saving Loom.
- Introduction of Solar PV Systems on Rooftops of Factory and Office Building.

The **International Renewable Energy Certificate (i-REC)** which issues tradable credits based on renewable power generation. A renewable energy certificate, or generally named as Energy Attribute Certificate (EAC), is the official documentation to prove renewable energy consumption. Each EAC represents proof that 1 MWh of renewable energy has been produced and added to the grid. Currently, there exist primarily 3 EAC standards for renewable claims, including the Guarantees of Origin (GO) in Europe, the Renewable Energy Certificate (REC) in the North America, and the International Renewable Energy Certificate (I-REC) in the rest of the world, especially in Asia, Africa, Middle East and Latin America.

Companies might be interested in I-RECs for different reasons. According to the observation of the non-profit organization Energy Web[12], multinational corporations tend to buy regionally sourced RECs matched to their demand from existing and new facilities in the region. Many are also looking for ways to better enable and track sustainability commitments down through their supply chains, whose operations are often based in Thailand and neighboring countries. And some are interested to accelerate clean energy access, including residential rooftop solar (which is not usually part of the menu of options for corporate renewables procurement).

On the supply side, the generation of I-RECs allows electricity generators to receive additional revenue for their production, and therefore the financial terms of a renewable energy project may become better when the electricity generating facility is registered with the I-REC

[12] Energy Web (2019). PTT and Energy Web Foundation Launch Blockchain-based Renewables Platform for Thailand, ASEAN, Japan. https://www.energyweb.org/2019/09/11/ptt-and-energy-web-foundation-launch-blockchain-based-renewables-platform-for-thailand-asean-japan/

Standard. In 2018, some 1.2 billion EACs were traded globally. Yet RECs in the United States and GOs in Europe accounted for the overwhelming majority of global EAC market activity. The ASEAN region only had about 5 million MWh of certified I-RECs, which represents less than one-half of one percent of global EAC markets. In Thailand specifically, renewable energy provided in 2018 about 28 million MWh of clean electricity, yet only 0.16 million I-RECs (MWh) were issued.

The **Voluntary Certified Standard (VCS)** which also issues tradable credits for a variety of mitigation projects. VCS is one of the well-known independent carbon crediting mechanisms in the world. It is administered by the non-profit organization Verra, founded in 2005. The VCS program was initiated by several key carbon market actors, including the Climate Group, the International Emissions Trading Association, the World Business Council for Sustainable Development, and the World Economic Forum. Since its establishment, VCS has grown into the most active voluntary carbon crediting mechanism in the world. According to the Bank[13], the initial purpose of the VCS program was to certify and credit voluntary emission reduction projects. While the main use of Verified Carbon Units (VCUs), the type of credits issued by VCS, is still predominantly for voluntary offsetting, over 17 million VCUs from VCS projects have been used for compliance under the Colombia carbon tax. Other compliance systems, including South Africa's carbon tax and CORSIA, have also sanctioned the use of VCUs.

The bottleneck is that the application and verification process for carbon credits issuance can sometimes be costly and time-consuming, and the market price of carbon credits is volatile due to varying demand and supply. According to the Ecosystem Market place, buyers/supporters of climate action credits prefer to support projects that demonstrate benefits beyond emission reductions, but their willingness to pay a premium is limited. This is reflected in the fact that the biggest jump in volume was for offsets that achieved dual certification under both the VCS, which certifies greenhouse-gas impacts, and the CCB standards, which certify positive social and biodiversity impacts. Transacted volume of VCS+CCB-certified offsets increased 325%, from 7.7 MtCO2e in 2016 to 32.7 MtCO2e in 2018. The rise in VCS+CCB certified offsets lifted total VCS volume 88.6%, from 33.4 MtCO2e in 2016 to 63.0 MtCO2e in 2018, allowing VCS's overall market share to stand at 73%: 38% for VCS+CCB and 35% for VCS alone. Meanwhile, the second highest volume standard, Gold Standard, had only a market share of 15%. Despite the strong volume, the price of VCS+CCB offsets fell from $3.90 in 2016 to $2.49 in 2018, while the price of offsets certified under VCS alone increased from $2.30 to $2.71. The golden time of voluntary carbon credits appeared to be in 2008, when the average

13 International Bank for Reconstruction and Development / The World Bank (2020). *State and Trends of Carbon Pricing 2020*. Accessed on July 22, 2020 at https://openknowledge.worldbank.org/bitstream/handle/10986/33809/9781464815867.pdf?sequence=4&isAllowed=y.

market price stood at $7.34. After ten years, the average market price was less than half at $3.01 in 2018.

3.4 International sources of funds

At the global level, three UNFCCC-related funds are dedicated to climate action, including Green Climate Fund (GCF), Global Environmental Facility (GEF), and Adaptation Fund (AF). Among them all, GCF is the largest fund, providing most diverse financial instruments (grant, loan, guarantee, and equity). However, accessing these funding sources must go through an accredited entity and a meticulous process of assessment and evaluation, and there is no GCF-accredited entity in Thailand yet as of the time of writing. The chance that private companies can get financial support from these international funds remains to be observed. The Consultant team suggests that GPSC could follow any updates from the Office of Natural Resources and Environmental Policy and Planning (ONEP) as it is the National Designated Authority (NDA) of GCF in Thailand.

In addition to UNFCCC-related funds, there are other international sources of funds from regional and international development banks (e.g. IFC, ADB, JBIC, etc) and agencies (e.g. USTDA, MIGA, bilateral export-import credit agencies, etc). More details of available green finance products and instruments can be found in the reference in the next session.

3.5 Summary and references of Green Financing Sources

In summary, based on GPSC's credit profile and character of typical climate action related projects (i.e. mostly renewable energy project and energy efficiency project), the table below summarizes the feasible green finance options for the GPSC.

TABLE 22 FEASIBLE GREEN FINANCE OPTIONS FOR THE GPSC

Type of climate action projects	Feasible green finance options
Energy efficiency related project	• Investment subsidy program from DEDE • Energy Efficiency Revolving fund (EERF) • Corporate green loan from commercial banks • Crediting mechanisms (e.g. JCM, iREC, VCS, etc) • Credit guarantee products
Solar-rooftop for self-consumption project	• Investment subsidy program from DEDE • Energy Efficiency Revolving fund (EERF) • Corporate green loan from commercial banks • Crediting mechanisms (e.g. JCM, iREC, VCS, etc) • Credit guarantee products
Utility scale grid-connected renewable energy project (i.e. Selling electricity to the grid)	• Soft loan from international development banks (e.g. IFC, ADB) • Loan/Credit guarantee products from bilateral exim banks or international agencies (e.g. MIGA, US-Exim) • Crediting mechanisms (e.g. JCM, iREC, VCS, etc) • Green bond • Infrastructure fund

TABLE 23 REFERENCES OF GREEN FINANCING SOURCES

Green Financing Sources	References
Energy Conservation Fund (ENCON Fund)	https://project.enconfund.go.th
ESCO Revolving Fund	http://www.efe.or.th/escofund.php?task=9
Energy Efficiency Revolving Fund (EERF)	https://krungthai.com/th/corporate/ktb-business-loan/163/321
Environmental Fund (EF)	http://envfund.onep.go.th/home/viewsAll/1

Green Financing Sources	References
K–Energy Saving Guarantee program	https://www.kasikornbank.com/en/business/sme/loan/special-loan/Pages/k-energy-saving-guarantee-program.aspx
K–Solar Rooftop Financing Program	https://www.kasikornbank.com/en/business/sme/loan/special-loan/Pages/k-energy-saving-guarantee-program-solar-rooftop.aspx
SCB's SME Go Green	https://scbsme.scb.co.th/products-detail/sme-green-financing
Bualuang Green Loan	https://www.bangkokbank.com/en/Business-Banking/Finance-My-Business/Loans-for-SMEs/Bualuang-Green-Loan
Green Bond issuance	https://capital.sec.or.th/webapp/nrs/data/7874ae11.pdf
Joint Credit Mechanism (JCM)	http://ghgreduction.tgo.or.th/jcm.html
International Renewable Energy Certificates (i-REC)	https://www.irecstandard.org/
Green Climate Fund (GCF)	https://www.greenclimate.fund/
Global Environmental Facility (GEF)	https://www.thegef.org/
International Finance Corporation (IFC)	https://www.ifc.org
Asian Development Bank (ADB)	https://www.adb.org/what-we-do/private-sector-financing/main
The Japan Bank for International Cooperation (JBIC)	https://www.jbic.go.jp/en/
Multilateral Investment Guarantee Agency (MIGA)	https://www.miga.org/products
United States Trade and Development Agency (USTDA)	https://ustda.gov/work/
The Export-Import Bank of the United States (EXIM)	https://www.exim.gov/

Annex

Annex I: Methodology for setting up ICP

As ICP is still a relatively new concept to most industrial and private sector stakeholders in Thailand, the Consultant team has designed this methodology by focusing on three main building block steps 1) to build understanding and fundamental knowledge of carbon pricing and climate risks, 2) to develop a strategy to build resilience against climate risk and identify low carbon investment, and 3) to demonstrate leadership towards a low-emissions pathway and climate actions. These three main steps in the below flowchart is developed a systematic framework for building capacity of each pilot plant. At each step, the ICP is introduced as a tool to support the pilot companies to achieve specific goals and climate change strategy development. The three steps are explained respectively in the following sessions.

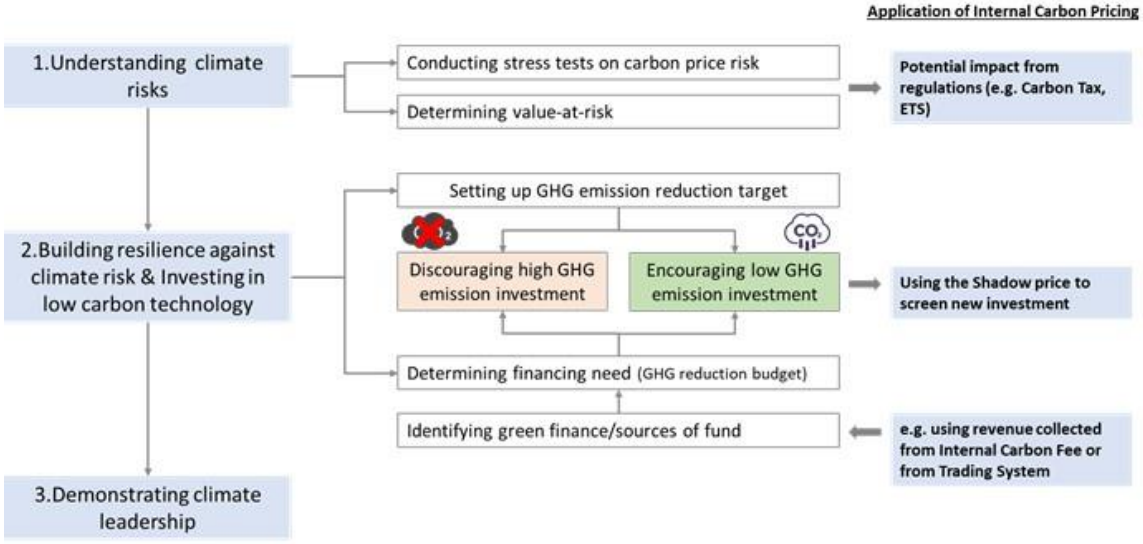


FIGURE 19 CLIMATE CHANGE STRATEGY DEVELOPMENT USING ICP

Step#1 Understanding carbon pricing risks (Outside-In approach)

There are a variety of climate risks, as well as a variety of approaches to climate risk assessment. In terms of ICP applications, the most relevant climate risks surround carbon emissions as an external cost or potential future liability. Therefore, the climate risks discussed here specifically imply to carbon pricing risk (or transition risk), not physical risk, from climate change.

Based on the framework for assessing carbon pricing risk and assessing and managing carbon asset risk developed by the World Resources Institute (WRI) and UNEP Finance Initiative (UNEP-FI)[14], the carbon pricing risk or carbon risk to a company is defined as "risk of financial loss to an operator of a physical asset due to non-physical climate change related factors. These factors can be categorized into four groups, including 1) policy and legal factors, 2) technology

[14] WRI & UNEP-FI (e.d.). *Carbon asset risk: discussion framework*. Prepared under the WRI and UNEP-FI Portfolio Carbon Initiative. Available at https://www.unepfi.org/fileadmin/documents/carbon_asset_risk.pdf. (accessed on 28, October 2020)

factors, 3) market and economic factors, and 4) reputational factors, with policy, technology and market being the predominant factors to a company's carbon risks. In evaluation of the exposure to such carbon risks, scenario analysis and stress testing are suggested to assess how risk factors might have an impact on the company's financial health. The Consultant team took some of the essentials in this framework to tailor-make a simplified approach for the pilot companies.

To identify the most significant of the carbon risk factors to the pilot companies, the Consultant team had in-depth discussion through several rounds of virtual and physical meetings, with each pilot company during the course of assignment. Some pilot companies conducted a general climate risk assessment and reported the results in the annual sustainability reports. In summary, it is found that, in terms of climate risks, the pilot companies are generally concerned about how an external carbon pricing (i.e. carbon tax or ETS) could affect their business and financial performance, namely the transition or regulatory & compliance risk.

The Consultant team has designed the activities under this step to enhance their understanding in carbon pricing risks by focusing on building few external carbon pricing scenarios to stress test the companies' profitability and determine value-at-risk. This ICP approach can be called an "Outside-In" which allows companies to place a monetary value on emitting a ton of carbon, even when none of their operations are currently subject to external carbon-pricing policies and related regulations.

To make it simple and straightforward for capacity building purpose, the Consultant team conducted a stress test using various carbon tax rates on the companies' earnings before interest, taxes, depreciation, and amortization (EBITDA) as the main indicator. The EBITDA metric is considered a more reliable indicator of a company's operational efficiency and financial soundness as it enables people to focus on a company's baseline profitability without capital expenses factored into the assessment. EBITDA can also be replaced by other financial indicators, subject to an interest of a particular company in conducting this risk assessment.

The ultimate aim of this step is to determine Value-at-Risk (VaR) from potential regulations on carbon emissions. Each company would learn what would be an impact to their profitability when every ton of GHG emissions was taxed. It should be noted that due to the data availability and restricted access to detailed information of the pilot companies, the Consultant team can't conduct a detailed carbon risk assessment at each business units/product/service level of the company, but rather a company-wide level.

With this exercise, each pilot company would learn and understand to what extend their profitability are exposed to carbon pricing risk by applying internal carbon pricing with Outside-In Approach. For next step, to take actions to reduce their carbon risk exposure, the pilot companies can move to Step#2 and Step#3 below.

Step#2 Building resilience against climate risks and increasing low carbon investment (Inside-Out Approach)

Having understood the company-specific carbon pricing risks from the impact of climate-change policies on the company's strategy and returns, the company could take next steps in building resilience against climate risks and increasing low carbon investment to lower their exposure to carbon pricing risks. The main concept of this step is to build capacity of the pilot companies by using ICP to inform decisions about capital investments especially when projects directly affect GHG emissions, energy efficiency, renewable energy or changes in the portfolio of energy sources.

The Consultant team found that most pilot companies have already set their own GHG reduction targets. For those that have not yet set such targets, they also showed their intention of doing so in the near future or their willingness to contribute to Thailand's NDC mitigation target at 20 percent GHG emissions reduction from the BAU level by 2030. Key question is how to apply the ICP as a tool to support the companies' future investment decisions so that they can achieve their GHG emission reduction targets. This approach can be called "Inside-Out', by setting their own internal carbon price(s) to make a contribution to the world, even when none of their operations are subject to external carbon-pricing policies and related regulations.

In this steps, not only ICP is designed as a tool to support the pilot companies to achieve GHG emission reduction targets but also used as a tool to facilitate discussions and collaboration among business units to refine companies' climate change and investment strategy; since ICP translates an emission unit into a monetary value that get everyone attention. The Consultant has worked with the pilot companies to layout a concept to achieve the GHG emission reduction targets by 2030. The basic principle is to discourage high GHG emissions investment and operations, while encouraging low carbon investment and energy efficiency improvement by factoring a Shadow Price into new project investment decision. As some low carbon investments need a support in particular for incremental cost or risk premium required to make the investment of climate action viable, ICP could also be used as a tool to estimate additional financial needs for funding marginal cost of GHG emission reductions for the pilot companies.

In practice, this step#2 in itself is the PDCA process (Plan, Do, Check and Act) which will cycle many rounds until the company reach its targeted climate objective(s). The figure below shows how this step fits into the full cycle of ICP implementation[15]. The Consultant team then worked with the pilot company to define & select case studies for piloting in exploration of suitable internal carbon price(s) to meet the targeted climate objectives.

[15] Ecofys, The Generation Foundation and CDP, *How-to guide to corporate internal carbon pricing – Four dimensions to best practice approaches*, December 2017. Prepared under the Carbon Pricing Unlocked partnership between the Generation Foundation and Ecofys in collaboration with CDP. Available at https://guidehouse.com/-/media/www/site/downloads/energy/2018/cpu2017howtoguidetointernalcarbonpricingfinal.pdf (accessed on 28, October, 2020)

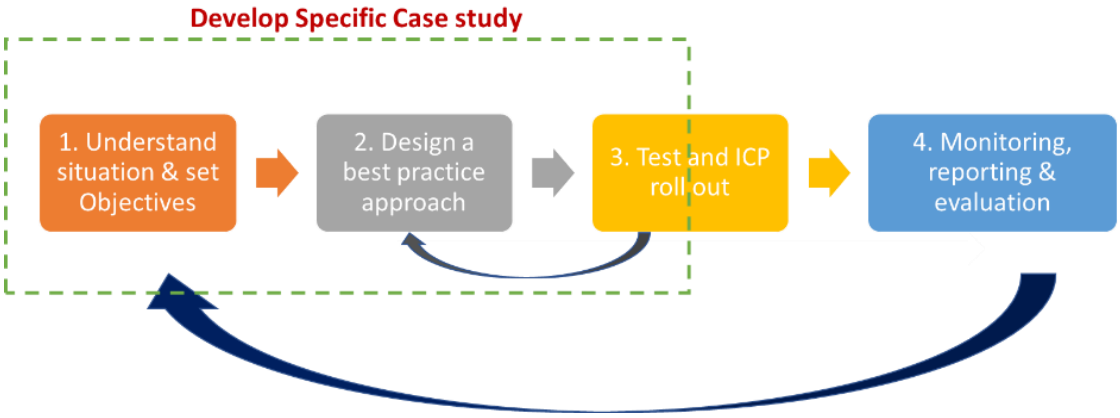


FIGURE 20 A FULL CYCLE OF ICP IMPLEMENTATION

In addition, this step is part of an establishment of ICP implementation strategy 2021-2030, where the internal carbon price could be set to start with an aim to reach one objective and then be evolved to reach higher/other objectives (see step#3 Demonstrating climate leadership). The exercise of case studies is therefore designed to build a common understanding of ICP applications, to gain wider acceptance among the involved stakeholders, and to improve capacity of the pilot companies to use ICP to as a supporting tool to their climate strategy development.

Step#3 Demonstrating climate leadership

Having familiarize themselves with ICP implementation after certain years, the pilot companies will be able to demonstrate their leadership by setting more ambitious target(s) and by expanding their decision coverage of ICP implementation to exert a further influence on their mitigation efforts. Examples include setting targets based on more robust scientific evidence, or affecting not only scope-1 and scope-2 emissions but also scope-3 emissions. These measures, however, will require them to establish a workflow cycle as shown in the Figure 19 below in the long run, while preparing themselves with better data management and higher capacity to calibrate their ICP approach. A set of step-by-step practical Guideline, an implementation plan and a monitoring plan will be developed at the end of this case study activity for each pilot company to go beyond piloting with a larger-scale, continuously improved ICP implementation.

ICP values can be retrieved in various ways, depending on several factors such as the purpose of ICP implementation, underlying assumptions, limitations in terms of data availability and resource (time, manpower, cost, etc.) sufficiency, etc. As ICP is still an unfamiliar field to most stakeholders in Thai industries, the Consultant team regards this project primarily as a learning process for the pilot companies. The principles embedded in the methodology are therefore **simplicity** and **comprehensibility**, such that the pilot companies will have stronger willingness to carry on ICP implementation in the future.

Based on the conceptual framework, the Consultant has conducted the test and analysis of initial ICP values for six pilot plants in three approaches[16]:

1. *Approach#1* is to apply a shadow price for stress testing climate risks on profitability.
2. *Approach#2* is to apply a shadow price for supporting capital expenditure decisions.
3. *Approach#3* is to apply an internal carbon fee for supporting operational expenditure decisions.

Detailed description methodology of the proposed approaches is provided below:

[16] These approaches were further developed by the Consultant team based on initial ideas from Ecofys, The Generation Foundation and CDP, How-to guide to corporate internal carbon pricing – Four dimensions to best practice approaches, December 2017.

Approach#1: Stress testing of climate risk on profitability by shadow pricing

The purpose of this stage is to understand how climate risk (i.e. introduction of a carbon tax) will affect the profitability of pilot companies. The analyzed timeframe is from 2021 to 2030, with a carbon tax presumably to be introduced in 2025. The Consultant team applied the concept of sensitivity analysis to a financial model to determine the impact of carbon taxes at different levels[17] on the profitability of the company. The two main scenarios of the carbon tax for stress testing the carbon pricing risk are:

- Scenario 1: a carbon tax (static price) at US$5/tCO$_2$e from 2025 – 2030; and
- Scenario 2: a carbon tax (evolving price) starts at US$5/tCO$_2$e in 2025 and gradually raises to US$30/tCO$_2$e in 2030. See below.

Year	Carbon Tax Rate (USD/tCO$_2$e)
2025	5
2026	10
2027	15
2028	20
2029	25
2030	30

The indicator of profitability applied is EBITDA, based on the reason explained in the previous section. In a statistical sense, that is how different values of an independent variable (i.e. carbon price levels) affect a specific dependent variable (i.e. EBITDA) under a given set of assumptions.

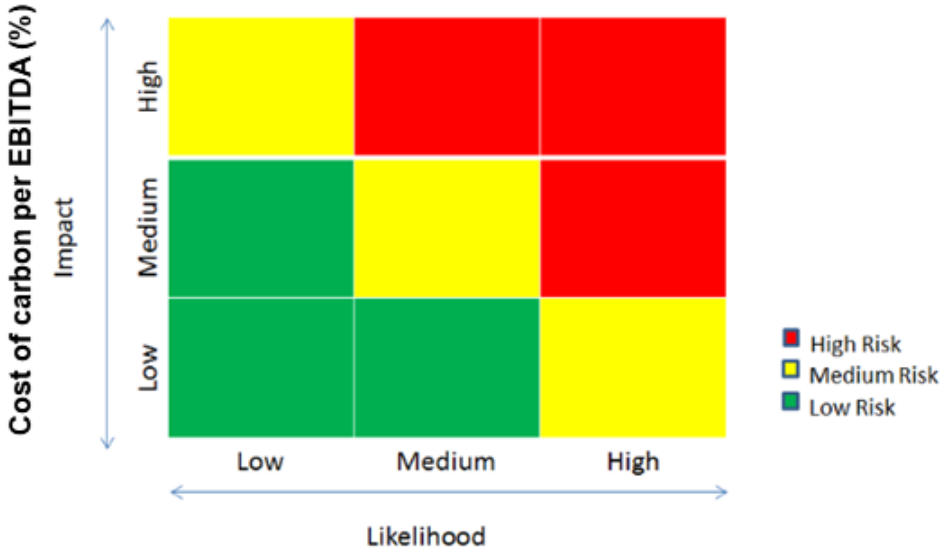
[17] It is important to note that Thailand has not implemented either a carbon tax, a cap-and-trade scheme, nor any other mandatory scheme to cut GHG emissions from private sector yet. In practice, external carbon pricing level can be substantial and range across a wide variety of sectors, asset classes, and countries, depends on policy decisions. The Consultant reviewed existing carbon pricing schemes around the world (e.g. carbon tax in Singapore at 5 USD/tCO$_2$e, etc). Also, it is estimated that the implied carbon price needed to limit global warming to below two degree Celsius range from 15-360 USD/tCO$_2$e in 2030 and from 45-1,000 USD/tCO$_2$e in 2050 (Stiglitz et al., 2017). The consultant took into account these inputs to develop the carbon tax scenarios for this stage. Having noted that the main objective of this step is not to come up with predictions about future carbon prices for Thailand case but to build an awareness and understanding for pilot companies of their exposure to carbon pricing risk based on their carbon footprints at various carbon pricing levels.

For the companies that have done their own projections on profitability and GHG emissions until 2030, the Consultant team conducted the test based on their projections. For the companies that have not had such data available, the Consultant team conducted the projection based on their expected growth in profitability and GHG emissions. The projected EBITDA at any given time t is calculated by the formula below.

$$Projected\ EBITDA_t = EBITDA_{t-1} \times (1 + \alpha_{EBITDA}) - \delta \times GHG_{t-1} \times (1 + \beta_{GHG}),$$

Where α signifies the growth rate of EBITDA, β signifies the growth rate of GHG emissions, and δ signifies the rate of carbon tax.

Based on consultation with pilot companies, the Consultant developed criteria to categorize the company's exposure to carbon pricing risk as follows:



- Cost of carbon comparing to EBITDA:
  - High impact > 10%
  - Medium impact 5-10%
  - Low impact <5%

- Likelihood of being regulated to pay for carbon cost in Thailand:
  - High likelihood > 50%
  - Medium likelihood 10-50%
  - Low likelihood <10%

By taking this exercise, the pilot company would be able learn and understand to what extend their profitability are exposed to carbon pricing risk (i.e. High Risk, Medium Risk and Low Risk). The company can then take this as an input for setting up/reflecting their climate action strategy to build resilience, increase low carbon investment, or demonstrate climate leadership.

Approach#2: shadow pricing in capital expenditure (CAPEX) decisions

To apply a shadow pricing to support CAPEX investment decisions, the Consultant team applied the concept of sensitivity analysis of shadow carbon prices to determine the financial impact on the profitability of a given project.

In a statistical sense, that is how different values of an independent variable (i.e. carbon price levels) affect a specific dependent variable (i.e. net present value: NPV & internal rate of return: IRR) under a given set of assumptions.

The analysis was conducted at the project level through a selection of pilot cases which have the following information:

- Expected GHG emissions at a periodic basis (i.e. annually in all pilot projects included in this report) throughout the lifespan of a project
- Projected cash flows at a periodic basis (i.e. annually in all pilot projects included in this report) throughout the lifespan of a project.
- Investment approval criteria should be identified (i.e. hurdle rate, weighted average cost of capital [WACC)], risk premium, etc).
- High importance in terms of GHG emissions or emissions reduction.
- High relevance to the objectives of ICP implementation set forth.
- Preferably a mix of project types (e.g. those that increase GHG emissions versus those that reduce GHG emissions, or those that improves energy efficiency versus those that invest in renewable installations, etc.).

To perform sensitivity analysis of shadow prices, steps were taken as follows:

1. Define the base case scenario of the CAPEX investment case, including re-checking the NPV and IRR of the base case.
2. Re-Calculate the output variable (i.e. NPV and IRR) by applying various shadow prices (i.e. different carbon price levels), leaving all other assumptions unchanged.
3. Determine the average marginal abatement cost of the project which is the shadow carbon price at the level making investment decision of the base case changes.

The formula for integrating the shadow price of carbon into new NPV calculation is shown below:

$$NPV = -\ Fixed\ cost_0 + \sum_{t=1}^{n} \frac{Net\ cash\ flow_t - (Carbon\ Price \times GHG\ emissions)}{(1+Discount\ rate)^t},$$

where SPC stands for the "Shadow Price of Carbon", and GHG emissions will be negative for projects that reduce emissions, which thus create a green incentive.

Box 1: static price or dynamic price

As one of the design principles of the methodology is simplicity aiming to build fundamental knowledge and capacity of participating companies, the Consultant team chose to hold the carbon price static throughout the lifespan of a project. It is certainly useful to conduct the analysis with carbon prices increasing over time, since the High-Level Commission on Carbon Prices concluded in 2017 that the explicit carbon-price level consistent with achieving the Paris temperature target is at least US$40–80/t$CO_2$e by 2020 and US$50–100/tCO_2e by 2030, provided a supportive policy environment is in place[18]. Prices of the existing carbon taxes and ETS schemes generally have not reached such a high level, and therefore it is commonly expected that carbon prices will continue rising over time.

However, a dynamic carbon pricing over time will make the model much more complicated and a lot more assumptions have to be made around the expected dynamics of carbon prices, given that Thailand has not yet put in place an external carbon pricing mechanism. The Consultant team thinks that it would be more suitable at this stage to consider only static carbon pricing for the sake of simplicity and comprehensibility.

[18] IBRD/WB (2017). Report of the High-Level Commission on Carbon Prices. Executive summary available at https://www.carbonpricingleadership.org/report-of-the-highlevel-commission-on-carbon-prices.

Approach#3: internal carbon fee in operational expenditure (OPEX) decisions

For the analysis of **internal carbon fee in OPEX decisions**, the Consultant team first calculated the gross additional budget needed for achieving the company's mitigation target, then divided the company's carbon footprints.

The concept is that from the previous approach by applying the shadow price to new capital expenditure, for GHG emission reduction projects, it would be resulting in setting up a maximum marginal abatement cost that the company would absorb. This data can determine the maximum budget that the company needed to fund the marginal cost of GHG reductions. In practice when the company starts collecting financial and technical data from the projects, it would be able to estimate an average marginal abatement cost for the project pipeline, which can be used to calculate the additional budget for funding low carbon investment more accurate.

Then, to internally raise revenue to fund this additional budget, the company could set up an internal carbon fee which it can raise fund by collecting carbon fee from any business units across the company.

The formulas for estimating the rate of internal carbon fee can be shown below.

(1) $Emissions\ reduction\ gap\ between\ the\ BAU\ and\ the\ targeted\ level\ (Gap) = GHG\ emissions\ at\ the\ projected\ BAU\ level\ \times (1 - reduction\ target\ in\ \%)$

(2) $additional\ budget\ for\ supporting\ low\ carbon\ investment = Gap \times Avereage\ Marginal\ Abatement\ Cost$[19] *(derived from the 2nd stage)*

(3) $Rate\ of\ internal\ carbon\ fee = \frac{Additional\ budget}{average\ carbon\ footprint}$

The implication of this approach is that the any marginal abatement cost will be fully covered by the revenue from the internal carbon fee scheme. The advantage of doing so is that the company can be financially autonomous to fill the investment gap for achieving its mitigation target.

At this stage, the main objective of this exercise is not to determine a proper internal carbon fee to implement, but to build capacity of pilot companies so that they can grasp the essence of internal carbon pricing easily.

Annex II: Results of Case Study from GPSC

ICP objectives and approaches for case study

By applying ICP, GPSC aims to achieve its mitigation target as well as to prepare itself for any potential regulatory compliance. Meanwhile, it also expects that its decision making can be enhanced by taking ICP into account.

This Guideline was also taken inputs and feedbacks from GPSC through various activities and capacity building exercises from testing ICP case study results during September until November 2020 as follows.

In September 2020, the Consultant organized the pre-kick off and kick off meetings with GPSC. The Consultant created a brief introductory paper of the assignment (including the objectives, potential benefits and workplan of the case study) and a checklist of information/data to be collected for ICP calculation and analysis. During the meetings, the Consultant discussed with the management for a better understanding of GPSC's interests in applying ICP. The objectives and scope of ICP were proposed by GPSC for building the business cases. After the kick-off meetings, the Consultant team refined a conceptual framework and methodology for setting up the ICP for GPSC. The main objective is to design intensive & hand-on capacity building activities.

The Consultant then collaborated and worked with GPSC on a list of required information/data for ICP calculation and analysis to estimate initial carbon price of each pilot plant. This process took a longer time than planned since GPSC did not have information available on hand and needed to gather from several business units. During the process of information/data gathering, the Consultant were requested to present and explain how the information/data will be used which provided capacity building across relevant teams at the participating plants.

The methodology for setting up ICP was also developed which GPSC learned how to:

- Approach#1: to apply a shadow price for stress testing climate risks on profitability.
- Approach#2: to apply a shadow price for supporting capital expenditure decisions.
- Approach#3: to apply an internal carbon fee for supporting operational expenditure decisions.

The Consultant created the financial model to analyze and calculate initial carbon prices' results. In October 2020, the Consultant organized the technical meetings with GPSC to present the results the ICP results. Several comments and feedbacks were taken to improve the analysis of the case studies. A draft monitoring plan and an implementation plan for rolling out and continuing the operation in the future was also be discussed with the plants at the meetings. In November 2020, the conclusion meeting was organized to conclude the ICP test results to be used for developing this Guideline, including implementation and monitoring plans.

Case Study Results

Approach#1: Stress testing of climate risk on profitability by shadow pricing

As explained in the Methodology section, the Consultant team conducted a stress test of carbon taxes at different levels on the profitability of GPSC, with an assumption of carbon tax introduction in 2025. This analysis helps to understand the sensitivity of GPSC's financial performance to external carbon pricing, and consequently allows to determine GPSC's level of climate risk (low, medium, or high) from potential regulatory compliance.

The stress test was conducted under two assumed scenarios as follows against the baseline scenario (no carbon taxation).

- *Scenario 1: a carbon tax (static price) at US$5/tCO₂e from 2025 – 2030; and*
- *Scenario 2: a carbon tax (evolving price) starts at US$5/tCO₂e in 2025 and gradually raises to US$30/tCO₂e in 2030*

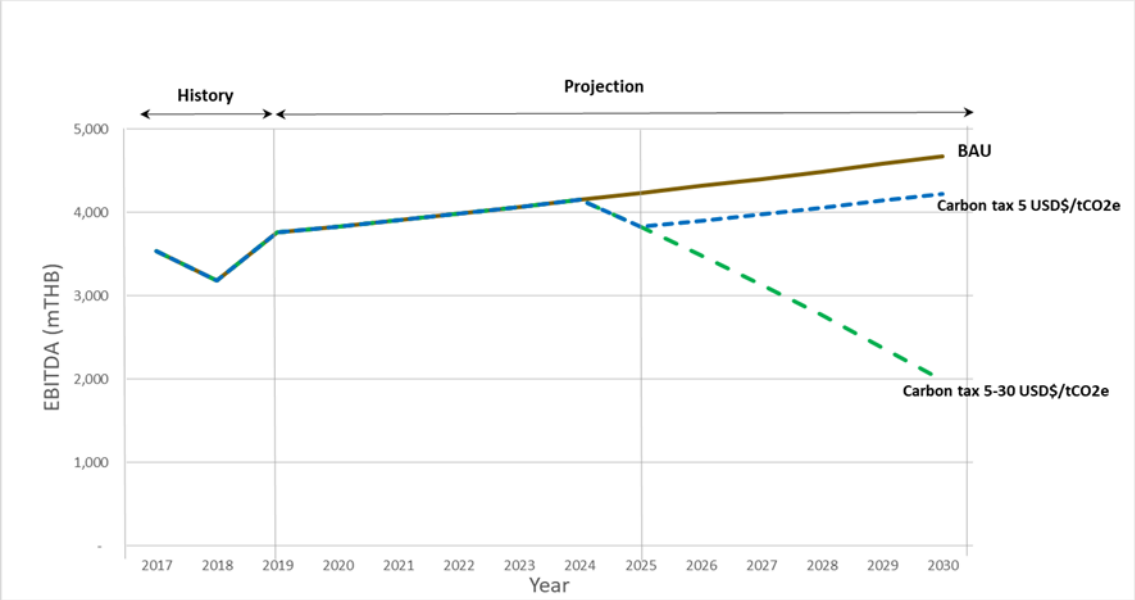


FIGURE 21 SCENARIO ANALYSIS OF GPSC'S CLIMATE RISK FROM CARBON TAXES

The result shows that GPSC's EBITDA will decrease by about 9% under Scenario 1 when US$5/tCO₂e is applied as a cost of carbon to GPSC's carbon footprints, while the decrease in EBITDA will be more significant by 9-55% under Scenario 2. In the worst case of the Scenario 2, GPSC would risk losing more than half of its profits if it were charged a carbon tax at US$30/tCO₂e.

TABLE 24 CARBON PRICING RISK ON PROFITABILITY FOR GPSC

Scenario	Level of Impact (Cost of carbon comparing to EBITDA)	Likelihood of the scenario	Risk Assessment Result
Scenario 1 a carbon tax (static price) at US$5/tCO$_2$e	Medium	High	High
Scenario 2 a carbon tax (evolving price) at US$5-30/tCO$_2$e	High	High	High

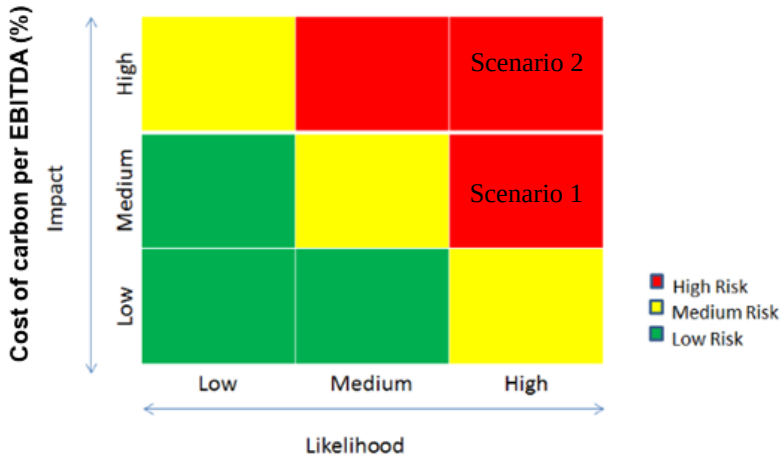


FIGURE 22 VALUE-AT-RISK OF GPSC'S SCENARIOS

Based on these results, GPSC could be considered as "High Risk" from carbon pricing. Overall, GPSC's margins are thin and price elasticity is high.

Approach#2: shadow pricing in capital expenditure (CAPEX) decisions

As explained in the Methodology section, the Consultant team incorporated the shadow prices of carbon into the financial analysis of a project or a case study for supporting in capital expenditure decisions. The marginal abatement cost which is the shadow price at the level that could make investment decision of the base case changes is determined for each case study.

- **Case #1: Small Power Producer (SPP) Plant replacement.** The SPP replacement project is an energy efficiency investment by renewing four gas turbines in the existing combine-cycled power plants.
    - Investment: 6,000 mTHB
    - Project life: 25 years
    - Minimum required return: 11%
    - Expected return: 33.1%
    - Potential GHG reduction: 878,000 tCO_2e/year
- **Case#2: Energy Recovery Unit (ERU).** The ERU project is an investment in a thermal power plant that uses petroleum pitch to produce electricity and steam, which is part of the Clean Fuel Project (CFP).
    - Investment: 24,766 mTHB
    - Project life: 25 years
    - Minimum required return: 7.25%
    - Expected return: 8.00%
    - Expected GHG emissions: 1,443,469 tCO_2e/year
- **Case#3: RDF Power Plant.** This is an investment in a RDF power plant that uses RDF from waste in Rayong province to produce electricity.
    - Investment: 2,282 mTHB
    - Project life: 20 years
    - Minimum required return: 5.60%
    - Expected return: 2.6 0%
    - Expected GHG emissions: 108,033 tCO_2e/year
- **Case#4: GHECO-1**. This is an energy efficiency to build coal roof at coal stock yard to reduce heat loss of coal from moisture impact at coal stock yard of rainwater (2-3% increasing from rain).
    - Investment: 250 mTHB
    - Project life: 25 years
    - Minimum required return: 6.62%
    - Expected return: 5.30%
    - Expected GHG emissions: 17,491 tCO_2e/year

The modeling result of the ดนีพ cases is summarized in the table below (see attached excel sheet for more details).

TABLE 25 INITIAL ICP MODELLING RESULT OF SELECTED PILOT CASES FOR GPSC (CAPEX)

		Sensitivities of ICP cases														
		US$/tCO$_2$e														
Small Power Producer (Spp) Replacement		0	1	2	3	4	5	10	15	20	25	30	35	40	45	50
NPV	mTHB	14,375	14,639	14,904	15,169	15,434	15,699	17,023	18,347	19,671	20,996	22,320	23,644	24,968	26,292	27,617
IRR	%	33.05%	33.40%	33.75%	34.10%	34.45%	34.79%	36.47%	38.10%	39.69%	41.23%	42.73%	44.19%	45.61%	47.01%	48.4%
NPV per tCO$_2$e	THB/tCO$_2$e	1,713	1,636	1,562	1,514	1,576	1,643	1,831	2,024	2,241	2,480	2,725	3,015	3,341	3,694	4,124
Energy Recovery Unit (ERU)		0	1	2	3	4	5	10	15	20	25	30	35	40	45	50
NPV	mTHB	1,430	998	566	134	(298)	(730)	(2,890)	(5,050)	(7,210)	(9,370)	(11,531)	(13,691)	(15,851)	(18,011)	(20,171)
IRR	%	8.04%	7.80%	7.57%	7.32%	7.08%	6.84%	5.59%	4.29%	2.91%	1.43%	-0.18%	-1.98%	-4.06%	-6.56%	-9.8%
NPV per tCO$_2$e	THB/tCO$_2$e	107	75	42	10	(22)	(55)	(217)	(379)	(541)	(703)	(865)	(1,027)	(1,189)	(1,351)	(1,513)
Rayong Waste to Energy phase 1 (RDF Power Plant)		0	1	2	3	4	5	10	15	20	25	30	35	40	45	50
NPV	mTHB	(424)	(388)	(351)	(315)	(278)	(242)	(60)	122	304	486	668	850	1,033	1,215	1,397
IRR	%	2.64%	2.90%	3.16%	3.42%	3.68%	3.94%	5.20%	6.41%	7.60%	8.77%	9.91%	11.03%	12.14%	13.24%	14.33%
NPV per tCO$_2$e	THB/tCO$_2$e	(367)	(336)	(304)	(273)	(241)	(210)	(52)	106	264	421	579	737	895	1,053	1,210
GHECO-1 : Reduce heat loss of coal from moisture		0	1	2	3	4	5	10	15	20	25	30	35	40	45	50
NPV	mTHB	(28.52)	(21.86)	(15.20)	(8.54)	(1.88)	4.77	38.07	71.36	104.65	137.95	171.24	204.54	237.83	271.12	304.42
IRR	%	5.35%	5.65%	5.95%	6.25%	6.54%	6.83%	8.23%	9.57%	10.87%	12.13%	13.36%	14.57%	15.76%	16.93%	18.10%
NPV per tCO$_2$e	THB/tCO$_2$e	(135)	(104)	(72)	(40)	(9)	23	180	338	496	654	812	969	1,127	1,285	1,443

For the SPP replacement project, it is found that applying the shadow price (i.e. shadow revenue of carbon) to the project has no impact on the existing investment decision. This is because the SPP replacement project is commercially sound, and it also has GHG emission reduction potentials. It was selected as a pilot case because GPSC would like to test ICP on energy efficiency investment, and it has complete GHG data for modelling.

For the ERU project, when applying a shadow price at as low as US$4/tCO$_2$e (i.e. shadow cost of carbon), the adjusted IRR will turn lower than the minimum threshold of the expected return in investment, making this project not commercially feasible. Therefore, US$4/tCO$_2$e is basically the marginal abatement cost of project and any shadow cost higher than US$4/tCO$_2$e would make the project not economically feasible.

For RDF Power Plant project, only when applying the shadow revenue of carbon higher than US$15/tCO$_2$, the investment decision will change from not feasible turn feasible.

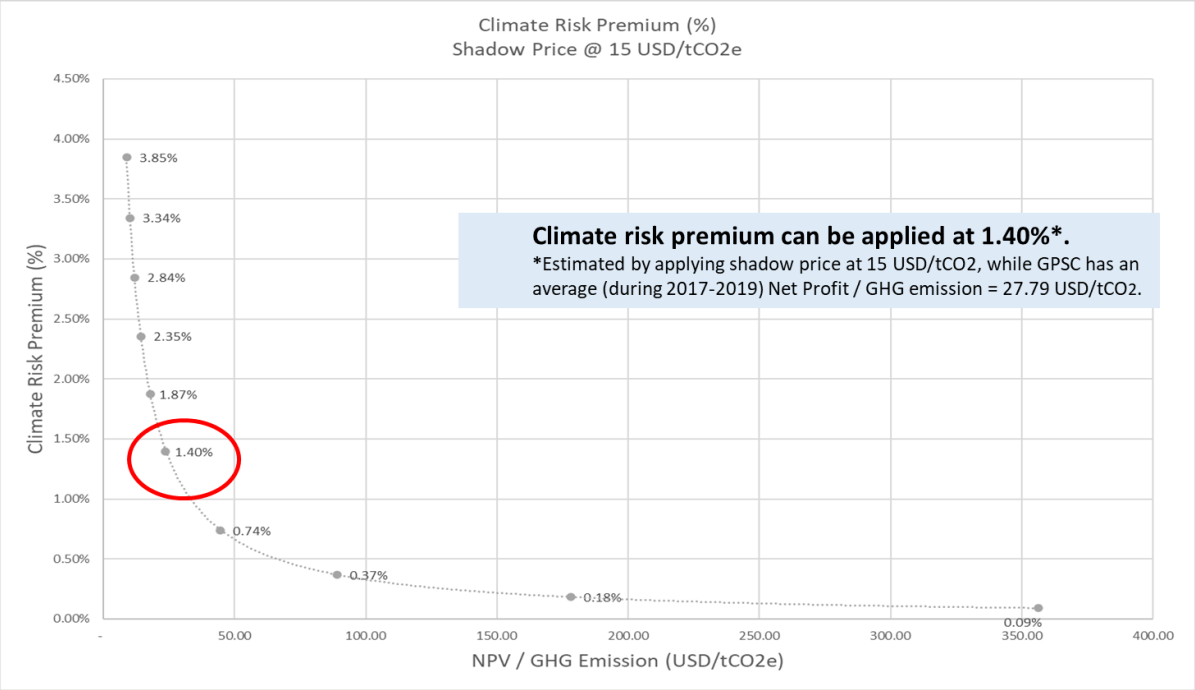
For GHECO-1 project, only when applying the shadow revenue of carbon higher than US$5/tCO$_2$, the investment decision will change from not feasible turn feasible.

From this exercise, the minimum ICP value GPSC could consider is US$15/tCO$_2$e and above.

Alternatively, the consultant team has introduced a concept of climate risk premium and climate premium as new investment criteria. The concept is to add a “climate risk premium” to the existing WACC of any high GHG emissions project such that it will become less attractive due to reduced internal rate of return (IRR), while subtracting a “climate premium” from the existing WACC of any low GHG emissions investment such that its IRR will meet the required hurdle rate (or minimum acceptable rate of return in investment).

Steps for applying climate risk premium and climate premium to support CAPEX investment decisions are laid out as follows:

1. Estimate the Net Present Value (NPV)
2. Forecast GHG emission covers the lifetime of the project (tCO$_2$e)
3. Estimate the Net Present Value of investment per GHG exposure (USD/tCO$_2$e)
4. Choose the climate risk premium (%) and insert it into the equation below for CAPEX investment evaluation.



Remark: estimated using the carbon price at US$15/tCO$_2$e

The equations of applying a climate risk premium to financial assessment of a project are shown below:

GHG reduction project

Project IRR ≥ WACC +Country Risk Premium + Margin – Strategic Factor

From this exercise, GPSC will apply 1.40% to increase Strategic Factor for new GHG reduction project.

Approach#3: internal carbon fee in operational expenditure (OPEX) decisions

To conduct a test result to set up an internal carbon fee, GPSC set a mitigation target of 10% GHG emissions reduction by 2030. Based on this target, the absolute GHG emissions reduction is estimated at around 1.5 MtCO$_2$e by 2030. Assuming the average marginal abatement cost at US$15/tCO$_2$e, GPSC would need the budget for funding low carbon investment (i.e. energy efficiency and renewable energy) around 22 mUSD per year. Therefore, required Internal carbon fee level can estimated to be at US$1.56/tCO$_2$e, (assuming the average GHG inventory from scope 1 & scope 2 is around 14 MtCO$_2$e/year. This revenue collected from the fee can

then be recycled to support the marginal cost of low carbon investment for the development of energy efficiency and renewable energy within the company.

TABLE 26 ESTIMATION OF INTERNAL CARBON FEE

Parameter	Unit	Value @Shadow price US$15/tCO$_2$
A. GHG emission reduction target by 2030	MtCO$_2$e/ year	1.46
B. Shadow price for CAPEX decision	USD/tCO$_2$e	15
C. Required fund for supporting marginal costs (C = A x B)	mUSD/year	21.9
D. The average company carbon footprint from the past 3 years.	MtCO$_2$e/year	14
E. Level of required Internal carbon fee (E = C / D)	USD/tCO$_2$e	1.56