

Article

Analysis of How Energy Companies Pledge and Attempt to Reduce Their Greenhouse Gas Emissions in Line with National Targets on Climate Change: A Case Study of the Petroleum Authority of Thailand (PTT)

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Abstract: While climate change is increasingly more present in political agendas, companies are called to restructure their businesses to meet national targets by reducing their greenhouse gas (GHG) emissions. Thus, carbon management practices are nowadays critical for most firms, especially those working in the energy sector. PTT represents a peculiar case in this field because it is a state-owned company that in the last few years accounted for 157.83 MtCO₂e per year, though it has not yet taken significant action to reduce its emissions. As Thailand pledged to abate 20% of its GHG emissions within 2030, PTT set out its Climate Change Management plan, yet this still does not contain specific measures or projects that the company intends to undertake to meet the target. This paper thus provides estimations regarding the alternatives available to PTT by applying current academic literature and knowledge on PTT's reduction plan, and by integrating it and verifying it with data retrieved from PTT's competitors' reduction plans. It was found that PTT could cover 6–10 MtCO₂e per year at the cost of USD 5–10 per tCO₂e by continuing to fund REDD+ projects. Moreover, investing in renewable energy leads to a reduction of 21.7 MtCO₂e per year at the cost of USD 2.85 billion. Lastly, it was shown that PTT could obtain a reduction of 3 MtCO₂e per year by implementing CCUS technologies, potentially at a lower cost compared with the current USD 20–25 per tCO₂e abated. This paper also discusses the long-term market implications of each of these alternatives.

Keywords: climate change; carbon management; private sector; emissions abatement



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1. Introduction

Over the past few decades, the issue of climate change has become increasingly more critical for nearly all economic market sectors. In order to maintain the global average temperature well below 2 °C more than pre-industrial levels, the Intergovernmental Panel on Climate Change (IPCC) has set the target of net zero emissions by 2050 [1,2]. This means that the amount of GHG emitted into the atmosphere minus the quantity taken off of it equals zero [1,2]. In particular, GHG emissions are mainly caused by the combustion of fossil fuels, which occurs along the value chain of the energy sector. Therefore, energy companies are definitely among the most involved and affected by the urgency of reducing GHG emissions. This is where carbon management comes into play: it allows companies to rethink their business, goods, and services towards achieving a low-carbon economy [3]. In fact, energy companies now face the task of substantially restructuring their value chains and leading the way in the technological transition to renewable sources of energy or electric vehicles for instance, and they have a limited timespan to achieve this goal [4]. Therefore, carbon management is crucial in order to both meet the targets on emissions set by governments and to adopt the most cost-effective plan available.

Nonetheless, not all states have set net zero by 2050 as a target yet. Thailand, despite having undertaken a phase of rapid implementation of policies over the last decades, has only pledged to the United Nations Framework Convention on Climate Change (UNFCCC) to reduce its GHG emissions 20% by 2030, with no further indication regarding future developments [5]. This leaves the companies significantly more room and time to reorganize themselves into low-carbon businesses compared with other countries which set more stringent targets. Analyzing Thailand's energy sector can thus provide insights as to how companies behave in the absence of severe regulatory frameworks and specific guidelines on how to proceed. Moreover, among Thai firms in this branch, PTT represents a peculiar case due to three main reasons: firstly, it is significantly larger and more important than the others in terms of revenues, emissions, and number of employees and countries in which it operates [6,7]. Secondly, it is a state-owned company: the major shareholder is the Ministry of Finance with 51% [8]. Thirdly, PTT's GHG emissions have fluctuated around 155–160 MtCO₂e per year, while Thailand's emissions were near to 300 MtCO₂e per year. Although not all of PTT's emissions are calculated into Thailand's total, it is clear that PTT's carbon management decisions will greatly influence Thailand's performance overall. It is thus interesting in this case to observe how the government paves the way for the transition to a low-carbon economy using its most powerful company and how it approaches its own policies on GHG emissions reductions. The current state of the literature has thus far analyzed carbon management practices from different perspectives: most notably, Doda et al., explored the role of harmonized reporting standards in corporate accounting [9]; Tang et al. compared firms' carbon management systems [10]; Herold et al. focused on how carbon management practices reflect on different carbon disclosure strategies [11]; and Shi et al. explored the effects of spontaneous combustion of coal [12,13]. Overall, the case studies considered mainly consisted of private companies. In light of this, studying the case of PTT can provide additional insights regarding the approach taken by state-owned companies in order to comply with substantially self-imposed regulations.

1.1. Overview of the Firm

PTT is a state-owned company that works in the energy sector. It is the most influential in Thailand in terms of annual revenues, which oscillated between USD 67 billion and USD 70 billion in the last five years [7]. The only exception to this has been 2020 in which, due to the COVID-19 breakout, the total revenues amounted to USD 50 billion [7]. PTT's businesses are not limited to Thailand solely: it currently operates in eleven countries all around the world, in thirty-nine different projects [7]. PTT's employees number 4616 at the headquarter location in Thailand and 24,680 in subsidiaries spread across those eleven countries. Its businesses encompass several sub-fields in the energy sector: gas, oil, petrochemicals, infrastructures, coal, and renewable sources. In the gas chain, PTT has projects dedicated to exploration and production and gas separation plants [7,14]. As for infrastructure, PTT operates with gas transmission pipelines and coal transportation railways [7,14]. Regarding the oil chain, PTT extracts oil in situ which it then either trades or processes in its refineries [7,14]. Lastly, the refined oil is either sold B2B covering corporate customers, private and public organizations or agencies, or B2C mainly to gas stations and households [7,14]. The value chain of coal was incorporated as well, from mining and transportation to power plants processing and distribution [7,14]. Lastly, PTT has lately committed to investments in solar energy with the creation of PVs and distribution [15].

1.2. Pledges

PTT has not pledged to reach carbon neutrality. The only target set by the company so far is to reduce its GHG emissions 20% by 2030 [16]. The reason behind this is that the state of Thailand itself has made no other pledge except for this one. Indeed, it is not the duty of the company to implement action beyond what is established by the government. As PTT is a state-owned company, it is expectable that it will align its business with the legal framework in place. Although Thailand's only pledge was to reduce emissions by

20% within 2030, the government set several internal targets in its climate-change-related policies. The regulatory framework for this field is extremely complex and it is constituted by more than 30 policies on a regional and national level, yet the overarching laws in place at the moment are [17]: the National Strategy (2018–2037), the Climate Change Master plan, the Energy Efficiency Plan (EEP), and the Alternate Energy Development Plan (AEDP). AEDP is the one that provides the most guidelines concerning the transition to a low-carbon economy for the energy sector, thus for the PTT. In particular, it states that the share of renewable energy will have to increase to 30% by 2036 which requires the installation of new facilities to generate 19.6 GW [18]. Concerning electricity generation, this will be achieved through a mix of renewable energy composed of biomass, biogas, wind, hydro, and solar [18]. As for heat in both private and public buildings, 37% of the total demand will be covered by renewable sources [18].

PTT has not yet included any of these targets in its pledge to reduce GHG emissions 20% by 2030. This may be due to the fact that PTT is still in the decision-making phase regarding where and how to allocate its budget for the GHG emissions reduction plan.

1.3. Emissions Estimates

PTT has published its organizational emissions estimates over the last few years. These were calculated by applying the due formulas depending on the type of coal, gas, or cause of emission as outlined in the national emissions account factor. The emission factors were instead retrieved from the WRI Corporate Accounting and Reporting Standard [19]. Figure 1 represents the totality of PTT's Scope 1, 2, and 3 emissions. The term Scope 1 refers to direct emissions from a company's own activities [20]. Scope 2 instead consists of emissions derived from the generation of purchased energy [20]. Lastly, Scope 3 is the emissions that occur along the whole value chain of the company [20].

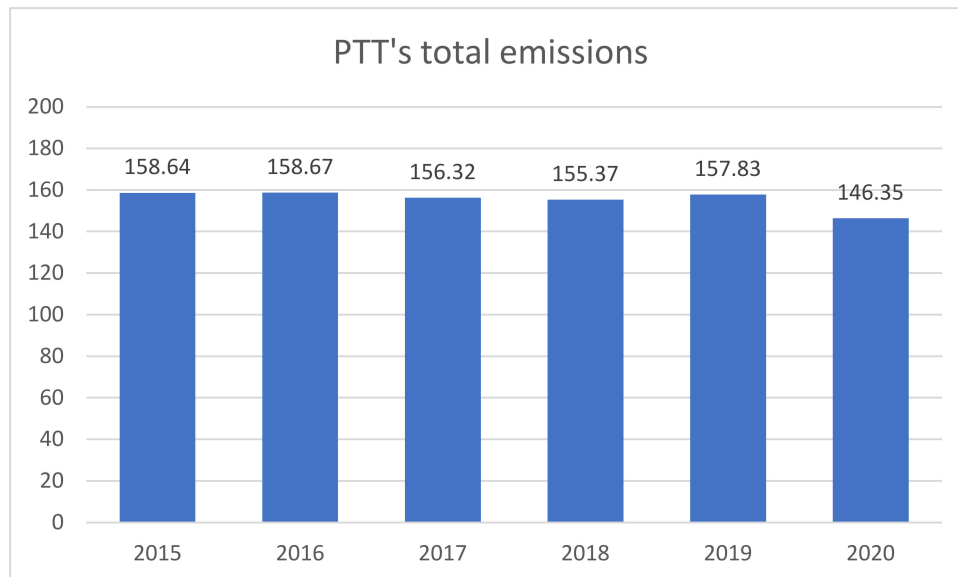


Figure 1. PTT's GHG emissions from 2015 to 2020 in MtCO₂e (Adapted from [16]).

It must be noted that Scope 1, 2, and 3 emissions have not witnessed significant changes over the past six years [16]. This shows that PTT did not make efforts to abate emissions caused by its own activities or by the generation of purchased energy. As for Scope 3 emissions, similarly to Scope 1 and 2, it is not possible to observe relevant changes in the past few years, the only exception to this being 2020 [16]. However, it is likely that the slight decrease in emissions witnessed in 2020 is due to the breakout of COVID-19 and its consequent diminished opportunity for businesses and projects.

Clarification is needed regarding Scope 3 emissions: on its report, PTT specified that "data on Scope 3 on the website is only on fuel combustion activities that PTT sells

(use of sold products)” [16]. Moreover, PTT has not published any data regarding other possible sources of Scope 3 emissions such as employees’ business travel, disposal of waste generated, or transportation of products and materials. Nevertheless, when dealing with energy companies, “use of sold products” causes an outstandingly large amount of GHG emissions compared with the other Scope 3 sources. For instance, it is possible to portray the emissions derived from employees’ business air travel by using the ICAO calculator. Although PTT has not disclosed data regarding how many business flights are taken by PTT employees per year, assuming one round trip per month towards every nation PTT operates in will give an idea of the order of magnitude of air travel related to Scope 3 emissions: in this case, it would amount to 56.4 tCO₂ per year which is irrelevant compared with PTT emissions derived from the use of sold products, meaning 124.49 MtCO₂e in 2017 as an example. Furthermore, other multinational energy companies such as Eni or Shell report that emissions caused by the use of sold products represent the vast majority of the total Scope 3 emissions [21]. Therefore, in the peculiar case of energy companies, the use of sold products can be considered a valid and representative account of the total Scope 3 emissions. Still, Figure 1 clearly shows that nearly no efforts have been made by PTT to reduce GHG emissions over the last five years, which is representative of the fact that Thailand had not made a pledge regarding the time frame 2015–2020 in its NDCs.

The lack of improvements in emissions reductions over the last years by PTT is, however, in line with most of the other multinational energy companies’ performance [22]. Overall, most companies’ reduction plans have not yet been entered into force, thus this sector has not shown significant emissions reductions, as shown in Figure 2 below [22]:

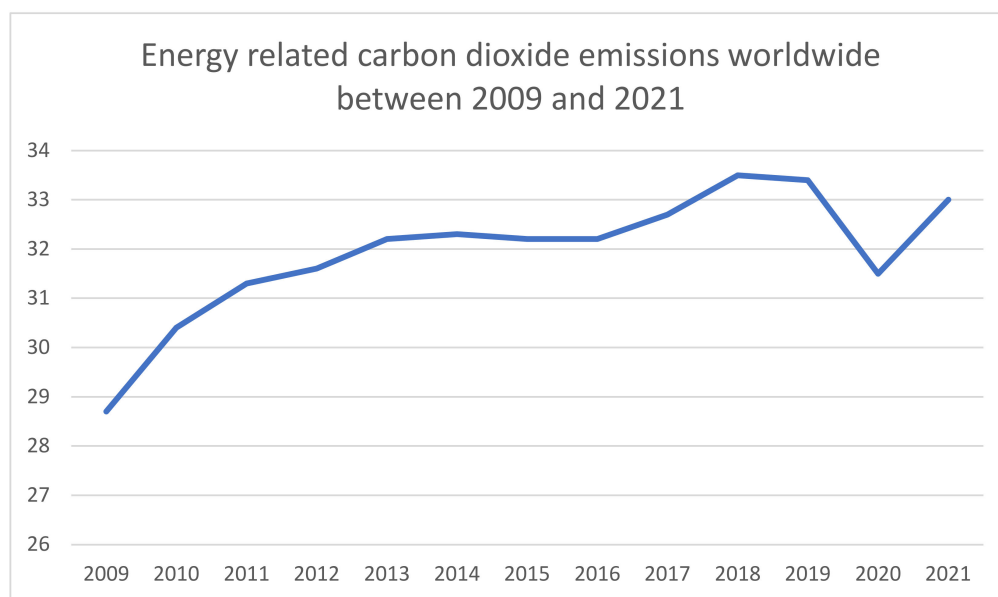


Figure 2. CO₂ emissions caused by companies of the energy sector. Note that data regarding 2021 represent a projection since the year had not ended by the time this research was conducted (Adapted from [23]).

Although PTT’s trend of GHG emissions is similar to that of the global energy sector, PTT still lags behind in the transition to low-carbon businesses compared with its competitors because its GHG emissions reduction plan lacks specific and concrete targets, as will be discussed in the following section.

1.4. Emissions Reductions

While PTT has not made significant efforts to reduce its GHG emissions so far, now it faces the task of meeting the target set by Thailand of reducing GHG emissions 20% by 2030. To comply with the target, PTT set out its Climate Change Management plan [16]. The

plan provides guidelines for business and investment directions that PTT will undertake to favor its transition to a low-carbon economic model. However, compared with other companies' reduction plans, such as Eni or Shell, PTT's strategy does not include specific targets, investment budgets, costs, details on the projects, nor estimates regarding future emissions reductions. Similarly, Thailand's targets outlined in AEDP were not included nor mentioned in the report. As aforementioned, PTT is still in the decision-making phase regarding how to concretely take actions to achieve the 20% reduction. Bearing this in mind, this section will first describe the guidelines provided by PTT in its Climate Change Management plan, and then it will analyze the most significant methods to try to provide an estimate of their costs and GHG reduction potential. Finally, it is important to keep in mind that PTT's Scope 1 + 2 + 3 emissions in the last years were stably close to 157.83 MtCO₂e [16]. Thus, having to reduce it by 20% means a total reduction needed of 31.57 MtCO₂e by 2030.

To achieve the goal of reducing emissions, PTT outlined three different approaches to operation: controlling GHG emissions from business operations, increasing the quantity of clean and low-carbon products, and operating new clean and low-carbon businesses [16]. Specifically, concerning Scope 1 and 2 emissions, PTT aims to: optimize renewable energy sources already in place, improve overall energy efficiency, and make use of Carbon Capture Utilization and Storage (CCUS) technologies and carbon credit offsets. Instead, as far as Scope 3 emissions are concerned, PTT seeks to boost the production of biofuels, increase investments for constructing renewable sources of energy facilities, allocate budgets for research and construction of electric vehicles, shift towards natural gas over coal and oil as a source of energy, and buy carbon offsets in the form of REDD+ forest conservation projects [16]. Additionally, PTT inserted carbon pricing as a tool for enhancing investments in low-carbon businesses and projects. The shadow price adopted during the decision-making phase and investments considerations will be USD 20 per tCO₂e [16]. Figure 3 below summarizes PTT's guidelines for emissions reductions following the Scope 1, 2, and 3 categorizations [16].

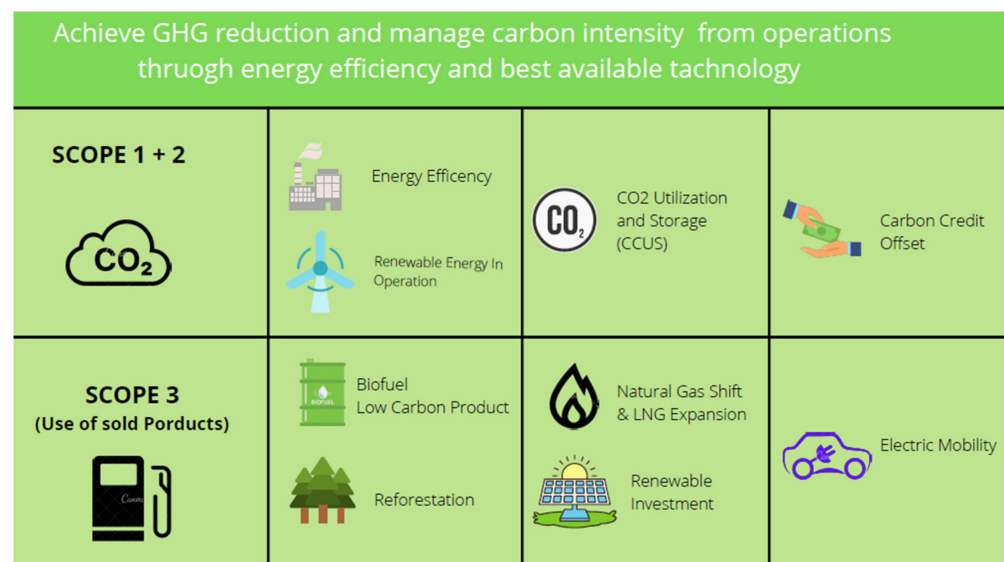


Figure 3. PTT's guidelines outlined in the emissions reduction plan (Adapted from [16]).

As mentioned above, PTT has not officially published details regarding how to concretely implement these guidelines. There is a lack of specification regarding the amount of MtCO₂e emissions reduced and the costs, nor are details on which projects will be undertaken in order to achieve the targets provided. The information published on the website is incomplete. Therefore, in order to evaluate the degree of impact that the methods available to PTT are likely to have in terms of GHG emissions reduction and the relative costs, it was necessary to integrate PTT's officially published strategy with public announcements retrieved from newspapers or journals, and use other companies' significantly more de-

tailed reports to provide accurate estimates. Eni, an energy company operating in Europe will be used most to this extent because it is similar to PTT in terms of revenue, number of employees, and types of businesses [16,21]. The three methods compared will be: carbon offsets, investment in renewable sources of energy, and CCUS.

Regarding carbon offsets, PTT's focus has always been on REDD+ forestation conservation projects. In particular, it has promoted the Network for Natural Resource and Environmental Conservation in Thailand, which works with the Green Globe Network aiming at reforestation of areas previously encroached or damaged [24,25]. Similarly, it undertook various reforestation projects by creating the "PTT Reforestation and Ecosystem Institute" [24,25]. PTT's guidelines for emissions reductions are to continue along this trend of investing in reforestation and conservation of biodiversity projects [16]. The budget allocated to this goal is not specified, however, most REDD+ projects tend to cost USD 5–10 per tCO₂e offset [26]. The total cost naturally depends on the number of emissions that have to be offset, which was not disclosed either. Nevertheless, as an example to capture the order of magnitude of GHG reductions and cost, it is possible to consider that Eni plans to be offsetting 6 MtCO₂e by 2024 and 10 MtCO₂e by 2030 [21]. Thus, it will bear the cost of USD 50–100 million per year by 2030. A similar reasoning could be applied to PTT. Interestingly, if PTT decides to disregard the transition to renewable sources and low-carbon economic models, and focuses on offsetting all of the 31.57 MtCO₂e emissions to reach the 2030 target through REDD+ projects solely, this would be relatively cheap at a cost between USD 157.8 million and USD 315.7 million per year. Nevertheless, this is profitable only in the short term, because in the long run energy companies will be imposed with further targets on emissions and the energy market will most likely convert to renewable sources and low-carbon businesses. To this extent, carbon offsets represent a cost that does not create new business opportunities, which might be suitable for other companies, yet not for those working in the energy sector.

The second method of emissions reduction is constituted by investments in renewable sources of energy. According to Reuters [27] and Bloomberg [28], Mr. Auttapol Rerkpiboon, president and CEO of PTT, claimed to increase the share of renewable sources of energy from 8 GW to 12 GW. Assuming that CO₂e emissions derived from renewable energies are irrelevant compared with those caused by fossils fuels, it is possible to calculate the emissions reductions by looking at what would have been emitted if those 4 GW of difference were emitted from fossils fuels. Emissions derived from purchased electricity can be calculated through the formula:

$$Y = Q \times EF/1000 \quad (1)$$

The emission factor in question can be retrieved from WRI's GHG protocol [19]. Given all this, the investment in renewable energy can ensure a reduction of 21.7 MtCO₂e per year. Moreover, Eni as well has set the target of investing in renewable energies to generate 4 GW [21]. Eni allocated a budget of USD 2.85 billion to this extent, which should be representative of what PTT would similarly need to spend.

The last method to discuss is the implementation of CCUS technologies. However, these are still in the development phase and offer limited room for reduction. Eni foresees a potential of 3 MtCO₂e per year. PTT plans to start adopting CCUS by 2025 when it will allow more room for reduction and will arguably be cheaper than current costs [29]. For the time being, the cost of CCUS technologies is estimated to be between USD 20 USD and USD 25 per tCO₂e, thus significantly more expensive than carbon offsets [29]. Nevertheless, depending on the budget available, carbon offsets have significantly more potential for emissions reduction. Compared with these two methods, investing in renewable sources of energy is outstandingly more expensive initially, yet it of course offers a return on investment once the electricity is sold, and it offers the possibility for undertaking new projects and businesses in the sector of renewable energies.

In conclusion, although PTT has not yet made significant concrete efforts to reduce its emissions, it is clear that the options available allow for meeting the target of 20%

reductions by 2030 for a total of 31.57 MtCO₂e, at a relatively low cost compared with PTT's annual revenues which oscillate between USD 67 billion and USD 70 billion.

2. Discussion

As outlined in the previous sections, before 2020 PTT had not undertaken significant efforts in mitigating its GHG emissions, which remained stably close to 157.83 MtCO₂e [16]. There was a lack of investments in low-carbon projects and PTT's business entirely revolved around fossil fuels consumption [7,16]. Because Thailand submitted its Nationally Determined Contribution (NDC) to the UNFCCC, PTT worked on a strategy to abate GHG emissions 20% by 2030 meaning a reduction of 31.57 MtCO₂e compared with the business-as-usual scenario, which was published in 2021 [16]. Nonetheless, PTT's Climate Change Management plan contained general guidelines regarding how the company intends to proceed, not specific targets or actions chosen in order to reduce emissions. These reasons may lead to assessing PTT's carbon management practice as insufficient. However, it is critical to understand why PTT has not yet undertaken significant efforts nor it has inserted future concrete goals in its reduction plan. Firstly, it is possible that the company is still in the decision-making phase regarding how to best allocate its budget in order to favor the transition to low-carbon businesses. It is definitely possible that the Climate Change Management plan will soon be followed up with further GHG emissions reduction strategies. Secondly, Thailand has made less stringent pledges to the UNFCCC and the international community than developed countries in which most energy companies operate. This puts less pressure on PTT to achieve goals in the short term. In fact, Petronas' sustainability targets are similar to PTT's and the former has its headquarters located in Malaysia, which has not made severe pledges to the UNFCCC either [30]. As was shown in the emissions reduction sections, PTT already has available methods to meet the 2030 target in time, such as investing in renewable sources of energy, the implementation of CCUS technologies, and buying carbon offsets. It is thus possible that PTT deems it counterproductive to begin taking action for the time being: fossil fuels as sources of combustion are the most cost-effective option at the moment, thus PTT may be planning to operate in coal, gas, and oil businesses for as long as possible. Lastly, it is also a possibility that PTT does not disclose information on its planned transition to a low-carbon economy because it deems those data commercially sensitive. In particular, specifications regarding its investments in research and development of chassis for electric vehicles, as reported by Reuter [27], could make other companies more competitive. In summary, neither of these explanations leads one to think that PTT is unwilling or unable to meet Thailand's 2030 target. In fact, the Climate Change Management plan includes a section concerning climate risks, which discusses risks related to changes in the regulatory frameworks, decline in reputation, natural disasters, uncertainty in technological development, and market volatility [16]. This implies that PTT is well aware of climate risks although it has not yet taken notable actions to address them.

In light of all this, assessing whether PTT's carbon management practices are effective depends on the criteria taken into consideration. It can be evaluated by assessing whether PTT is operating accurately to meet Thailand's national pledge and directing its business decisions to maximize economic profit without severely incurring the climate risks outlined above or in terms of minimizing GHG emissions to protect the environment and countering climate change. Regarding meeting the target of 20% GHG emissions reduction by 2030, as was previously discussed, although PTT has not undertaken notable concrete action yet and its reduction plan lacks specific targets, this does not prevent PTT from abating 31.57 MtCO₂e within the deadline. Different roadmaps could be set for meeting such a target, depending on the methods deployed to abate GHG emissions. Taking into consideration the alternatives highlighted in the "emissions reductions" section it can be argued that PTT will be able to reduce 20% of its emissions within 2030 by: initially, investing in renewable sources of energy to cover 4 GW. Doing so will bring a reduction of 21.7 MtCO₂e per year at the cost of USD 2.75–3 billion. Naturally, the sooner the

investments are made the higher the return on those investments will be. Then, PTT can implement CCUS technologies, when they start being sufficiently cost-effective to mitigate 3 MtCO₂e per year. Proper timing for starting to invest in CCUS technologies is expected to be around 2025 [29]. Lastly, approaching the end of the decade, PTT will still have the option of investing in carbon offset projects to abate the remaining GHG emissions to meet the target, which should be around 6.87 MtCO₂e per year. Instead, concerning economic profit, it was argued that PTT is operating in the more cost-effective fossil fuels market for as long as possible. Other energy companies such as Eni or Shell have instead faced high initial costs for decarbonization and the transition to renewable sources of energy. However, in the long run, this may grant them a more competitive position in low-carbon energy markets and better possibilities to grow new businesses. Although PTT is not vulnerable to climate risks related to sudden severe changes in the regulatory frameworks because it is a state-owned company, it might still face losses due to the volatility of the type of energy demanded by the market and due to a decline in reputation. Lastly, it seems natural to claim that if the criterion taken into account is that of reducing GHG emissions to protect the environment and counter climate change, PTT's performance is critically insufficient. This derives from its lack of actions undertaken to mitigate emissions thus far and of specific targets for the future within its guidelines. In comparison, companies that respond to headquarters in developed countries, such as Eni or Shell, for instance, have made remarkably more ambitious and specific pledges, also due to a more stringent national regulatory framework [31]. Regarding developing countries, it was pointed out how energy companies tend to align to national commitments, as was the case for Petronas in Malaysia. However, most companies have at least announced a commitment to reach Net Zero by 2050, which PTT has not done yet. Naturally, this might change as a consequence of COP26 in Glasgow, where it was established that NDCs will be a matter of revision already in COP27 and COP28. The international political pressure could lead Thailand to increase its 2030 emissions reduction target. Nonetheless, it is difficult to estimate how much influence this would have on PTT: on the one hand, Thailand is a developing country, thus it is unlikely that it will be required to implement particularly ambitious NDCs in the near future. On the other hand, as PTT is a state-owned company and Thailand a major emitter, it is highly sensitive to any modification in emissions reduction targets. This is both because the government is liable for PTT's emissions, and due to the fact that it can be used to provide an example for private sector target setting in Thailand. In the case of modifications in the 2030 target, for as little as they may be, PTT would need to operate adaptive management practices to ensure that PTT's targets are aligned with Thailand's revised NDCs.

As for the reliability of PTT's emissions estimates, it was not possible to compute the due equations that show the amount of CO₂e given, for instance, the tons of brown coal combusted by multiplying for the respective emission factor and energy content. This is because PTT has not provided the necessary specifications regarding its current fossil fuels-based businesses. Notwithstanding that, in the emissions estimates section PTT's published emissions estimates were compared with energy companies of similar scale in terms of revenues, employees, and types of businesses, such as Petronas and Eni, and it was observed that the respective estimates fit together. Moreover, it was argued that mentioning the use of sold products as the only source of Scope 3 emissions does not significantly undermine the validity of the estimates in the case of PTT.

3. Conclusions

By analyzing the case of PTT, this report has found that this state-owned company has not yet undertaken significant action to abate its GHG emissions, which left them stably close to 157.83 MtCO₂e per year mostly being Scope 3 emissions. As Thailand set the national target of reducing GHG emissions 20% by 2030, PTT set out a reduction plan; however, it contains general guidelines rather than specific targets or descriptions of projects.

This report's main limitation is the lack of specific data published by PTT regarding both its current fossil fuels-based businesses and its actions to mitigate GHG emissions. Nonetheless, it was possible to provide estimations regarding the alternatives available to PTT by applying current academic literature and knowledge on PTT's reduction plan, and by integrating it and verifying it with data retrieved from PTT's competitors' reduction plans: it was found that PTT could cover 6–10 MtCO₂e per year at the cost of USD 5–10 per tCO₂e by investing in carbon offset projects. Moreover, the investment in renewable energy can ensure a reduction of 21.7 MtCO₂e per year for which PTT would have to allocate a budget of USD 2.85 billion. Lastly, it was shown that PTT could obtain a reduction of 3 MtCO₂e per year by implementing CCUS technologies, potentially at a lower cost compared with the current USD 20–25 per tCO₂e abated.

This report can thus provide insight regarding how to proceed towards meeting Thailand's 2030 pledge. It was argued that renewable energies imply higher initial costs while ensuring a return on investment in the long run, better possibilities to open new businesses, an increase in a company's reputation, and a more competitive place in the low-carbon energy market in the future. CCUS technologies can contribute with minor reductions, yet are less expensive than renewable sources and can be used to cover hard-to-abate emissions. Lastly, carbon offsets through REDD+ projects are the cheapest option at the moment, yet they should be as limited as possible because they do not offer a return on investment nor business possibilities in the long run.

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