

COMPARATIVE ANALYSIS OF FINANCIAL ASSURANCE INSTRUMENTS FOR OIL AND GAS DECOMMISSIONING AND MINE RESTORATION

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Summary

This paper introduces how different bonding mechanisms for oil and gas decommissioning and mine restoration can ensure operators' accomplishment of restoration/decommissioning liability and affect their budget. Four mechanisms presented and compared herein include surety bonds, cash collateral bonds, decommissioning and abandonment provisions, and lease-specific abandonment accounts.

The author also provides some cautions and recommends amendments for each mechanism to be efficiently applied to oil and gas decommissioning in Vietnam so as to assure operators' decommissioning duties without discouraging their potential investments.

Key words: Financial assurance, bonding mechanisms, decommissioning, restoration.

1. Introduction

In an oil and gas or a mining project, decommissioning¹ or restoration² occurs at the closure phase³ when extraction or production operations terminate. Since no more revenues are created, financial assurance mechanisms aim to provide adequate funds for such work [2]. Lessons show that there are many cases where unplanned and premature closures occurred [4] and financial assurance is particularly helpful in such cases, whether in the mining industry or the oil and gas industry [5, 6]. Therefore, selecting a financial assurance mechanism or a bonding approach that can ensure full restoration or decommissioning is crucial to the regulator. Meanwhile, given that bonds can restrict the operator's operating capital which reduces when the deposit amount is high [7], choosing a bond instrument that does not discourage the operator's investment and simultaneously assures their compliance is not less critical to any regulator. Given such context, this paper aims to address three key questions: (i) how different types of bond instruments guarantee fulfillment of restoration/decommissioning liability, (ii)

how they affect the operator's budget, and (iii) which type of bond instruments is most effective in ensuring the operator's compliance without highly discouraging their investment?

Vietnam has a great potential of oil and gas resources. In 2017, Vietnam's crude oil reserves were 4.4 billion barrels, ranking third in Asia, after China and India and could be enhanced in the future since the country's waters were largely unexplored [8]. However, as in other regions, many offshore oil and gas fields in Vietnam are reaching the end of their productive lives [9, 10] and hence will be decommissioned soon. In addition, any offshore platforms will be eventually decommissioned. Therefore, timely amendment for improvement of Vietnam's legislation on oil and gas decommissioning to be applied to existing projects and new ones is critical. With recommendations for Vietnam's relevant legislation, this research contributes to ensuring sufficient financial guarantee funds for full oil



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¹The research uses the term "decommissioning" to refer to the process that contains all activities related to removing and disposing offshore platforms [1].

²The research uses the term "restoration" to refer to the activities that repair mined land and are undertaken after mining operations (extraction) cease as part of the mining project.

³The life cycle of a mine comprises eight phases: design, exploration, permitting, construction, operations, decommissioning/closure, post-closure and relinquishment [2]. Likewise, an oil and gas project life consists of six phases which are lease, exploration, development, production, closure and post-closure [3].

and gas decommissioning throughout the project life without discouraging operators' investments.

2. Methods

This research is the continuation of the study of Ferreira and Suslick [1, 5, 11-13] regarding different bonding regimes for offshore decommissioning. Ferreira and his colleagues focused on evaluating the effects of alternative bond options on the operator's net present value (or payoff) and the government earnings in hypothetical oil-producing projects in the Brazilian Continental Shelf [5]. Whereas this research focuses on the extent to which different bond approaches can assure full decommissioning or restoration work to be delivered without discouraging the operator's investment. This research also differs from Ferreira and Suslick's study in terms of methodological approach. Ferreira and Suslick applied a financial valuation model for bonding approaches based on discounted cash flow and sensitivity analyses for the hypothetical oil-producing projects [5]. Differently, this research compares different bonding mechanisms as specified in Vietnam's legislation, Ferreira and Suslick's scenarios, and the literature. The effects of some bonding mechanisms on operators and the government are contextualised in oil field X in Vietnam and three opencast coal mines in East Ayrshire, Scotland.

Four types of data were collected for the research, comprising documentation, two informal conversations and a telephone conversation. Data about oil field X was collected between March 2019 and July 2020. Whereas data about three opencast coal mines in East Ayrshire, Scotland, were collected from March 2016 to April 2018 as part of the data for the author's PhD study and all such data were documented.

3. Overview of bonding mechanisms

Liability risks can be decreased by bonding mechanisms in respect of: (i) creating impetus for complying with contract requirements; (ii) indemnifying the government and taxpayers sensibly from failure; and (iii) providing environmental protection against possible damages due to not implementing appropriate closure activities [13]. Bonding mechanisms can be in the form similar to insurance policies (surety bonds), the form of an upfront fund that covers full restoration/decommissioning costs at the project approval stage (cash collateral bonds), the form of fund paid in annual portions during the project life (decommissioning and

abandonment provisions), or the form of an account within a specified period (lease-specific abandonment accounts) [1, 5, 11, 14]. The followings are an overview of these financial assurance instruments.

3.1. Surety bonds

In the context of the mining industry and the oil and gas industry, surety bonds are agreements among three parties: the operator who is required to undertake site restoration/decommissioning as approved by the government, the government who must ensure the accomplishment of restoration/decommissioning work and a surety company who guarantees the availability of funds for restoration/decommissioning work irrespective of the operator's financial capacity [7, 15]. Surety bonds have been favoured by a number of mining companies because of the relatively small payments required [16].

Since the surety company's responsibility is limited to the insured amount, the bond value may not fully cover the decommissioning cost [15]. In addition, surety bonds are maintained by operators' annual premiums [1] which are not aimed to pay for losses to the same level as traditional insurance premiums because in fact, a great amount of the premiums for surety bonds are underwriting fees [15]. Furthermore, unlike insurance policies, of which premiums are calculated to cover anticipated payments, surety bonds are issued based on credit worthiness principles: If there is higher financial uncertainty given the operator's reputation, the surety issuer may charge a higher premium [7]. Then it is important that the government must precisely calculate the bond value and strictly monitor it during the project life to ensure its sufficiency for the entire restoration/decommissioning work. Another problem is that if the operator goes into liquidation, the surety company may not have to pay out the whole value of the bond, but they will never have responsibility for the exceeding value [15]. Therefore, effective negotiations with surety company are essential for the government's success in securing the whole bond value.

3.2. Cash collateral bonds

Cash collateral bonds can be in the form of letters of credit, certificates of deposit, cash or real property and are the least preferred option for mining companies since they require huge expenditures [16]. In this mechanism, an amount of cash equivalent to the whole restoration/decommissioning cost is deposited upfront with a

governmental agency or to an insured bank account [1, 14]. The interest earned from the account is either added to the bond value or returned to the operator [14]. The operator is not allowed to utilise the deposited cash to undertake the required work and can only receive it back when the work completes [1].

3.3. Decommissioning and abandonment provisions

Under the decommissioning and abandonment provision mechanism, the total decommissioning cost is paid by the operator in annual portions throughout the field's life cycle or producing life [1, 17, 18]. Different from cash collateral bonds, the fund collected in this mechanism can be used by the operator to implement the required work [1]. As the name suggests, this mechanism is used in the oil and gas industry and although its application to the mining industry has not been found in the literature, it can be understood similarly.

3.4. Lease-specific abandonment accounts

Different from the decommissioning and

abandonment provisions, the lease-specific abandonment account approach requires the operator to pay the decommissioning cost within four years since production or by the start of the year when the operator is expected to have produced 80% of the economically recoverable reserves, whichever is earlier; the first payment is equivalent to 50% of the total bond value [5, 12]. This approach only applies to the field's producing life [12]. Like cash collateral bonds, this mechanism requires operators to use out-of-pocket funds to cover decommissioning activities and the deposited cash is only returned to operators upon completion of the required activities [5]. Similar to the decommissioning and abandonment provisions, the literature review does not show whether this approach has been utilised in the mining industry; however, it can have similar application.

4. Results

4.1 Surety bonds

Surety bonds are more advantageous to operators than cash collateral bonds in the aspect that the operators

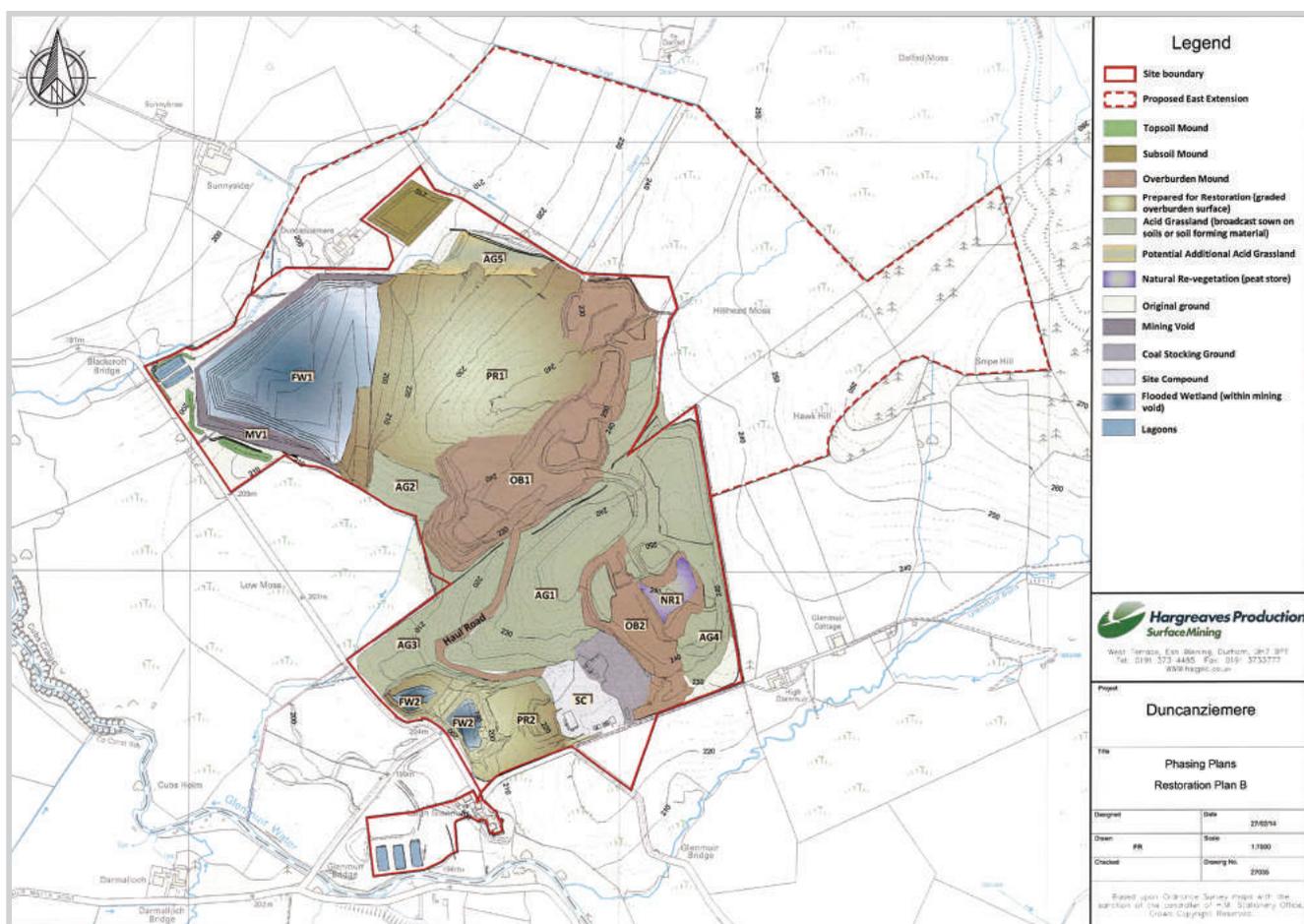


Figure 1. Restoration Plan B for Duncanziemere complex in 2014 [29].

do not have to pay for a large upfront fund [1]; if being calculated precisely and monitored strictly, they are more beneficial to regulators than the decommissioning and abandonment provisions because if the operators go bankrupt at some point in the project life, the regulators will be paid by the surety company for full restoration/ decommissioning work. Experience from Dunstonhill Surface Mine (Dunstonhill), Duncanziemere Surface Mine (Duncanziemere) and Netherton Surface Mine (Netherton) - three opencast coal mines in East Ayrshire, Scotland, showed that calculating and monitoring surety bonds are critical.

Dunstonhill, Duncanziemere and Netherton were operated by Scottish Coal (Dunstonhill) and Aardvark (Duncanziemere and Netherton) after being granted planning permissions on 29 March 2010, 30 March 2011 and 19 October 2010 respectively [19 - 21]. Nevertheless, Scottish Coal went into liquidation on 19 April 2013 and the same situation happened to Aardvark on 16 May 2013 [22]. In order to be granted planning permissions for the sites, the mining companies were required to lodge restoration and aftercare bonds at the planning stage to ensure fulfilment of the restoration and aftercare obligations as specified in the Section 75 Agreements [20 - 22]. Those restoration and aftercare bonds are surety bonds [23 - 26]. Dunstonhill was provided with a restoration bond valued at GBP 4.2 million and an aftercare bond worth GBP 0.377 million [22] whereas Duncanziemere and Netherton were granted restoration bonds of GBP 2.6 million and GBP 4.5 million respectively [21, 22]. However, at the time of the operators' liquidation, the estimated costs for restoring the sites according to the original restoration plans would be GBP 10.241 million, GBP 6.593 million, and GBP 11.811 million respectively [22]. Those wide gaps between the bond values and the restoration costs were caused by East Ayrshire Council's failures in calculating and monitoring the bonds at the planning stage and during the operations phase [27]. For example, the schedule of restoration and aftercare liabilities for Dunstonhill related the bond quantum to specific time periods [23]. However, no compliance monitoring was executed after the signing of the Section 75 Agreement, particularly by an independent mining engineer (who should be appointed by the Council) to guarantee the operational and restoration works on site were pursuant to the approved scheme and hence could make any necessary adjustment to the bond quantum for sufficient coverage of the outstanding restoration

work [27]. Especially, the Council's lack of monitoring led to the bond for Duncanziemere having expired without being replaced by Aardvark [28] and it became unsecured due to not having been called in by the Council before its expiry [29].

The cases of Dunstonhill and Netherton also showed negotiations with bond providers are crucial for securing bond values. After the liquidation of Scottish Coal and Aardvark, East Ayrshire Council had a lot of challenges in this regard. In relation to Netherton, the bond provider made the final offer of GBP 3.96 million, equivalent to 88% of the maximum value of the bond after some negotiations with the Council [30]. Regarding Dunstonhill, given the potential decreases of the restoration bond values, the Council managed to call in the bond prior to the expiry dates [31]. The first bond call was repudiated by the bond provider who, after the second call, only agreed to present a cumulative offer of GBP 6 million for Dunstonhill and Ponesk (another opencast coal site in East Ayrshire - the author) [32, 33]. This means the original bond value for Dunstonhill was reduced by GBP 1.2 million.

4.2 Decommissioning and abandonment provisions

The financial assurance instrument currently applied to the oil and gas industry in Vietnam can be categorised as decommissioning and abandonment provision. Particularly, oil operators in Vietnam shall, within one year since the production of the first oil and gas flow, establish a financial guarantee fund to which annual payments shall be made according to the previous formula:

$$Payment\ level = \frac{\begin{matrix} The\ production\ within\ the\ year \\ \times\ (Total\ decommissioning\ cost \\ -\ The\ paid\ balance) \end{matrix}}{Remaining\ recoverable\ reserves} \quad [34]$$

or the present formula:

$$E_n = \frac{A_n \times (B_n - C_{(n-1)} - I_{(n-1)})}{D_n}$$

in which:

- E_n : The level of payment in the year n; the calculation unit is USD.
- A_n : The production in the year n, defined by the actual production in the respective year; the calculation unit is barrel of oil equivalent.
- B_n : The total decommissioning cost updated in the year n, $B_n = (b_1 - b_2)$, in which:

+ b_1 : The total decommissioning cost estimated in the (most recently approved) decommissioning plan; the calculation unit is USD.

+ b_2 : The cost estimate defined in the (most recently approved) decommissioning plan corresponding to the equipment, property or structure decommissioned up to the year (n-1); the calculation unit is USD.

- $C_{(n-1)}$: The balance of the financial guarantee fund on December 31st of the year (n-1), defined by the total balance of all the bank accounts to which PVN sends the financial guarantee fund of the respective field, and certified in writing by the relevant commercial banks; the calculation unit is USD.

- $I_{(n-1)}$: The profit from the savings accounts received by organisations and individuals after PVN, on behalf of them, fulfils all the duties to the national budget (if any) for the year (n-1).

- D_n : The remaining recoverable reserves, $D_n = d_1 - d_2$, in which:

+ d_1 : The recoverable reserves defined in the economic development plan or the early production plan already approved by authorities up to the end of the year n; the calculation unit is barrel of oil equivalent.

+ d_2 : The total production accumulated from the relevant field(s) up to the year (n-1); the calculation unit is barrel of oil equivalent [35].

Following the above-mentioned formulas, operators only deposit in the financial guarantee fund part of the decommissioning cost during the project life. This could lead to financial burdens on taxpayers if the operators go into liquidation [1]. Therefore, the mechanism does not ensure the compliance [1] as the operators may choose to liquidate at some point of the project to avoid the remaining financial liability if the field production does not compensate for the decommissioning cost.

Slightly different from the Brazilian hypothetical cases where no interest would be earned from the fund [1], pursuant to Vietnam's legislation, interest will be earned and added to the fund after all financial duties to the Government of Vietnam have been fulfilled [34, 35]. This helps reduce the financial burden on the operator as their actual total payment is less than the total decommissioning cost. Particularly, PVN will deposit the fund in a separate interest-bearing account in a stable credit institution in Vietnam [34, 35]. PVN will

transfer part of the fund to the operator for undertaking decommissioning activities if being called during the project life [35]. If the decommissioning work is not implemented wholly or partially by the operator, PVN can use the fund for fulfilling the work [34, 35].

4.3 Cash collateral bonds

Compared to surety bonds and decommissioning and abandonment provisions, cash collateral bonds are likely the most reliable approach to ensure full restoration/decommissioning work to be undertaken. This is because operators have to deposit an amount of money equal to full restoration/decommissioning cost in an escrow account in advance and the government completely controls such account until the bond is released after the completion of the required operations [1]. This was probably the reason why East Ayrshire Council chose this bonding approach for Duncanziemere after the liquidation of the previous operator. Particularly, the Council approved another mining company to extract the remaining coal and restore the site to a revised restoration plan but required such mining company to deposit in advance a sufficient amount of money into an escrow account which would be used if they did not fulfil the task [29].

However, the problem of cash collateral bonds is that the operators have to pay in advance (prior to extraction/production) for an upfront fund which covers the whole restoration/decommissioning work and cannot be used by the operators for implementing restoration/decommissioning activities. This means the operators must pay double for restoration/decommissioning activities during the project life, which requires large capital and is not attractive to investors. Investments from large companies like mining ones are important for the local and regional areas. For example, the development at Dunstonhill would create totally 276 jobs including indirect jobs through offering or retaining about 120 jobs for directly employed staff and continuing support for local businesses [36]. The development at Duncanziemere would provide 36 jobs and sustain indirect employment in supplying mechanical, engineering and fleet services to opencast sites [37]. Meanwhile, Netherton would provide or retain about 110 direct jobs [38] and support indirect employment for local subcontractors, trades and small businesses related to the site operations and coal haulage [40]. In fact, all the mines are located in rural areas where the unemployment rates were high [37, 38, 40 - 42] and most of the employees were expected to reside within

15 kilometres of the site or within East Ayrshire [36, 37, 39]. Therefore, such job provision was considered to contribute substantially to the local economies [37, 38, 43, 44]. Likewise, the oil and gas industry can play an important role in the economic development of a region or even a nation. Tremendous investment activities in oil and gas exploration and production have made Vung Tau - the oil and gas hub of Vietnam - become a prosperous city and contribute significantly to the nation's economy [45]. Between 2006 and 2015, PVN made an average annual contribution of 20 - 25% of the total national budget and 18 - 25% of the GDP [46]. Since 2015, despite facing many difficulties, PVN has still contributed about 9 - 11% of the total national budget and 10 - 13% of the GDP annually [46].

4.4 Lease-specific abandonment accounts

Another approach mentioned by Ferreira and Suslick [5] that has not been applied in the oil and gas industry in Vietnam and the mining industry in Scotland is lease-specific abandonment account. This approach seems to be beneficial to both regulators and operators.

For regulators, it is assured that, by the end of the maximum 4-year period since production, they have held the fund that can cover all required decommissioning activities. It is safer than the decommissioning and abandonment provision approach if the production lasts more than 4 years and much safer than surety bonds though a bit riskier than cash collateral bonds. Although there may be cases where the operator is insolvent before the fourth year, the regulator is assured to have held at least half of the total decommissioning cost from the initial payment, which, following Vietnam's legislation, must be fulfilled within one year since the first oil and gas production [34, 35] instead of an undefined date within 4-year time in the Brazilian hypothetical context [5]. Again, this approach is safer than the decommissioning and abandonment provision if the production lasts more than 2 years, much safer than surety bonds and safe by half of the cash collateral bond mechanism.

For operators, this mechanism is more advantageous than the cash collateral bond approach in the aspect that their initial payment does not have to cover the whole decommissioning cost. However, compared to

the decommissioning and abandonment provision and surety bond options, it is less advantageous. If the project lasts 10 years, their annual payments to the fund are spread over the project life in the former and thus the total payment within 4 years is much less than the total decommissioning cost; whereas their annual premiums for 4 years to maintain the bond in the latter are even much lower than the total decommissioning cost⁴.

5. Discussion

Given the problems associated with surety bonds, the author does not recommend this approach to oil and gas decommissioning in Vietnam. Surety bonds only serve as a form of financial guarantee and operators still have to pay for their restoration/decommissioning activities on their own [1]. If the operator is solvent to complete the task, the bond will be released and the premium payment will be terminated. On the contrary, the bond issuer will finance restoration/decommissioning activities [1]. This explains firms' choice of going into liquidation when seeing that they would not be able to produce adequate profits to fund the required work like the cases of Scottish Coal and Aardvark in East Ayrshire, Scotland in 2013. In addition, the bond issuer will not have to pay the whole bond value and the experiences in East Ayrshire show that negotiations with bond issuers to reclaim the maximum bond value is very challenging.

The cases of opencast coal mines in East Ayrshire also showed what mining companies would do to avoid restoration liabilities. After the liquidation of Aardvark, two companies namely OCCW (Duncanziemere) Limited and OCCW (Netherton) Limited, which were actually hived down from the interest of Aardvark, were set up to continue coaling operations at Duncanziemere and Netherton and undertake the remaining restoration liabilities [47]. It should be noted that these liabilities addressed the revised restoration schemes only, which are at lower levels than the original ones [21, 29]. The situation seems to be similar in the oil and gas industry because small spurious firms can be set up from big ones to circumvent decommissioning obligations if no stringent financial guarantee regime is in place [5].

As aforementioned, the decommissioning and abandonment provision approach has been

⁴This comparison only considers annual premiums of which the rates in the offshore surety industry are often between 1 and 3% but can be up to 5% of the covered loss [15]. There might be cases where operators also have to collateralise 100% of the bond to keep the bond in place [15].

applied to decommissioning of oil and gas projects in Vietnam. This approach is more advantageous to operators than cash collateral bonds and lease-specific abandonment accounts in the aspect that they can pay the decommissioning fund in annual portions over the project's or the field's lifetime. For regulators, while this approach can avoid the issues associated with securing bond money if the operators go into liquidation under the surety bond option, it does not ensure compliance of full financial liability until the end of the project as mentioned earlier. In the case of oil field X developed by Truong Son Joint Operating Company (Truong Son JOC) from 24 November 2008 and then by Petrovietnam Exploration Production Corporation (PVEP) since 24 November 2013 [48, 49], the financial liability was entirely fulfilled by the previous operator. Particularly, Truong Son JOC, before handing over the field in 2013, had revaluated the financial guarantee fund and added to the fund to ensure its adequacy for decommissioning operations, given the early cessation of the Production Sharing Contract⁵. Doing this way, Truong Son JOC complied with Article 20 of Decision 40/2007/QĐ-TTg which requires that within one year before the end of the petroleum contract or the expiry of the petroleum production period, operators must recalculate the financial guarantee fund and must add to the fund if it is not sufficient for decommissioning [34]. While in Vietnam so far there have never been cases of oil companies liquidating to avoid decommissioning liability and apart from laws, there would be contractual terms binding operators' liability, the potential deficiency of decommissioning funds during the project life under this bonding mechanism should be paid attention to by Vietnamese regulators. Additionally, since the fund deposited by the operator during the project life will be managed by PVN [34, 35], administrative issues will arise and need to be handled by the Group diligently.

Regarding cash collateral bonds, while the upfront fund shall be paid by the operator prior to coal extraction or oil and gas production as in the Scottish and Brazilian cases respectively, it can be paid within one year since the production of the first oil and gas flow following Vietnam's legislation for the timing of establishing the financial guarantee fund [34, 35]. This is quite sensible to regulators because under the current law, projects which are determined during the exploration phase to be

unnecessary or unused for future petroleum activities must be decommissioned within this phase and the operators do not have to pay for a financial guarantee fund in such cases [35]. In addition, requiring the operators to pay for the financial guarantee fund within one year since the first oil and gas production is more attractive to investors since it gives them more time to accumulate profits from the project. However, there is a risk of noncompliance if the operators liquidate just within this period.

Similar to the decommissioning and abandonment provisions, if the cash collateral bond approach is applied to oil and gas decommissioning in Vietnam, it can be amended such that the upfront funds can be used by the operators to implement decommissioning activities during the project life upon calling PVN. Moreover, interest earnings from the upfront fund should be returned to the operator annually like in the Brazilian cases [1] to support its capital needs. These help reduce financial burdens on the operator and thus also attract more investment. Again, since the upfront fund will be managed by PVN in Vietnamese cases [34, 35], administrative issues will arise and need to be resolved diligently by the Group. Furthermore, compliance monitoring must be undertaken stringently by the Government in collaboration with PVN to ensure the money withdrawn from the upfront fund equates to the decommissioning work carried out by the operator on site.

Whereas, like cash collateral bonds, if the lease-specific abandonment account approach is applied to oil and gas decommissioning in Vietnam, it can be amended so as the money in the account can be utilised by the operator to undertake the decommissioning work during the project process upon calling PVN. Also, interest earnings from the account can be returned to the operator yearly like in the Brazilian cases [5] to support its capital needs. These will also help attract more investment from the operators. Again, similar to the decommissioning and abandonment provision and cash collateral bond options, the account will be managed by PVN in Vietnamese cases [34, 35], therefore, the Group needs to be diligent in dealing with administrative issues arising. Also, the Government in collaboration with PVN must have strict compliance monitoring to make sure the money withdrawn from the account corresponding to the decommissioning work implemented by the operator on site.

⁵The production of the field X should have been ceased when Truong Son JOC terminated the Production Sharing Contract; however, PVEP, on behalf of PVN which was assigned by the Government of Vietnam, continued the operations of the field in order to maximise the oil extraction and thus does not have financial liability for the field decommissioning.



Figure 2. Large flooded hole with steep wall at Dunstonhill opencast coal mine in April 2013 after being abandoned.

So how about the existing oil and gas projects in Vietnam that have been operated for more than 10 or 20 years? Since the decommissioning and abandonment provision approach has been applied to them, the government in collaboration with PVN needs to check the balance of the financial guarantee fund for each project and monitors the site to assess the outstanding decommissioning liability. If the fund is inadequate for undertaking the outstanding work, the operator must add to the fund immediately or as soon as possible. This is especially important for projects executed via joint ventures or production sharing contracts between PVN and international firms since the latter may go into liquidation at any time. It is not only reasonable but also fair because the projects have lasted more than 10 or 20 years, bringing certain profits to the operators from oil sales.

6. Conclusions

The comparison of different bonding instruments with practices from the oil and gas industry in Vietnam and the opencast coal mining industry in Scotland shows the outbalance of each instrument to the government and the operators.

Cash collateral bonds are most advantageous to the government since they ensure the site is fully restored or decommissioned. Contrarily, this option is least advantageous to operators who have to make double payment for the restoration/decommissioning cost during the project life.

The second choice for the government should be the lease-specific abandonment account option because by the end of the fourth year, the government will have held the fund that can cover the total decommissioning cost.

For the operator, lease-specific abandonment accounts are more favourable than cash collateral bonds because the initial payment is equivalent to only half of the restoration/decommissioning cost.

The third desirable option for the government should be decommissioning and abandonment provisions. Getting annual moneys until the year when the operator goes in liquidation (if this is the case), it is more reliable for the government than the surety bond option in which they need to calculate the bond quantum precisely and monitor carefully throughout the project phases to ensure the bond money is adequate for the remaining restoration/decommissioning liability. The operator is more advantageous with this option than with the cash collateral bonds and lease-specific abandonment accounts since they can pay the decommissioning fund in annual portions over the whole project life or the field's producing life.

Among the four options, surety bonds are least reliable to the government due to issues associated with bond securing while the operator may not undertake the required restoration/decommissioning during the project life and go into liquidation near the end of the project to avoid using their out-of-pocket funds in addition to the annual premiums to maintain the bond to cover restoration/decommissioning activities. However, if the government is successful in bond securing, they are more advantageous than under the decommissioning and abandonment provision approach due to being paid by the surety company for the exact outstanding restoration/decommissioning liability in case the operator becomes insolvent at some point of the project life. On the contrary, the operator is most advantageous under this approach. Clearly, with this approach, the operator does not have to pay either an upfront fund equal to the total restoration/decommissioning cost like with the cash collateral bonds or payments equating to the total restoration/decommissioning cost within four years or an initial payment equivalent to half of the restoration/decommissioning cost like with the lease-specific abandonment accounts. If the project lasts more than 10 years and the operator chooses to liquidate just after the fourth year of production/extraction, the annual premiums to keep the bond in place within four years are much lower than the annual payments out of the total restoration/decommissioning cost and thus the operator is more beneficial than with

the decommissioning and abandonment provision approach.

If the afore-mentioned bond instruments are applied to oil and gas decommissioning in Vietnam, some amendments need to be considered. Cash collateral bonds and lease-specific abandonment accounts will become more advantageous to the operator if the upfront fund in the former and the money in the account in the latter can be used by the operator to carry out decommissioning activities during the project and any interest earnings can be returned to the operator annually to support its capital needs. In addition, the upfront fund for cash collateral bonds and the initial payment for lease-specific abandonment accounts can be deposited within one year since the production of the first oil and gas. Regarding the decommissioning and abandonment provision approach which has been applied to oil and gas decommissioning in Vietnam, the Government should be cautious of the potential deficiency of decommissioning funds if operators go into liquidation at some point within the project life. For all those types of bond instruments, the Government in collaboration with PVN needs to monitor operators' compliance stringently to ensure the money withdrawn from the financial guarantee fund is equivalent to the decommissioning work execution. Furthermore, as the manager of the financial guarantee fund, PVN needs to deal with any arising administrative issues diligently.

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