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FINANCIAL ASSURANCE SYSTEM IN THE OIL INDUSTRY: A DECISION MODEL FOR AN ENVIRONMENTAL BOND SCENARIO

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Abstract. *In several countries financial assurance requirements are not part of a hypothetical scenario. In fact, this regulatory regime has been adopted by many nations guaranteeing that sufficient financial resources are available for the closure and/or remediation of an oil field at the end of its economic life in the event that the owners or operators become insolvent. Before a permit is issued a bond must be drawn to cover all abandonment and decommissioning responsibilities. The bond provides an incentive for regulatory compliance during operations and guarantees that the site will be restored after activities cease. Considering a hypothetical regulatory scenario in Brazil this paper shows an oil-producing project facing the problem of selecting the best form of bond in order to minimize its financial impact. Based upon a discount cash flow analysis this paper proposes a decision model that estimates for each environmental bond the option which offers the least economic impact in the project and, at same time, provides the best financial guarantee for all stakeholders involved in the process.*

Key words: *Financial assurance, Environmental bonds, Decommissioning, Decision model*

1. INTRODUCTION

The world depends on fossil fuels for more than 60 percent of its total energy needs (ODCP, 1998). Offshore exploration became a very important energy source since it was launched in 1947 in the Gulf of Mexico (GOM) and latter followed by the discovery of expressive reserves in the North Sea (NS) during the 1960's. Of great significance for South American economy, was the development of offshore reserves at Campos basin in Brazil during the 1970's (Formigli, 1997).

Today, there are over 7,270 offshore installations in place around the world (Pane, 1998), installed in the continental shelves of more than 53 countries worldwide. Forty of these 53 nations produce offshore oil and gas in significant amounts. The present distribution of offshore installations is as follow: 4,000 in GOM, 950 in Asia, 700 in the Middle East, 400 in

NS, 340 in South America, 480 in Africa, and 17 in Australia (ODCP, 1998; Poremski, 1998; Griffin, 1998, Prognos, 1997). Retaining the record for deep-water exploration, Brazil has approximately 40 offshore platforms (Brasil Energia, 1999).

Offshore platforms can be designed for a variety of needs, environments and purposes. Parameters such as water depth, distance from shore, environment setting, and climate, prescribe the appropriate type of installation and make them unique and site specific. The types of platforms are: steel jacketed platform, for shallow waters, (it comprises approximately 80% to 95% of all installations in place around the world); concrete gravity structure; steel gravity structure; floating production system; steel jacketed platform, for deep waters; tension leg platform; and compliant tower (Griffin, 1998).

Usually, offshore installations are designed for approximately 20-year projects but most platforms can have a functional life that ranges from 30 to 40 years. Although most offshore structures were not designed to be removed, at the end of this period as recoverable reserves are depleted, unless the platform is reused or relocated, it must be decommissioned.

Many aging offshore oil and gas fields in the world, mainly in the GOM and in the NS, are near the end of their productive lives. Many of them are already economically depleted. Consequently, in the next 30 years it should be expected that over 6,500 installations will be decommissioned at an estimated cost of US$ 20-40 billion (Coleman, 1997).

Although decommissioning operations have been occurring for over 26 years (specially in the GOM), public interest on the issue was only triggered during Greenpeace manifestations and the development of political agitation over the decommissioning of the Brent Spar, a 20-years old loading buoy located at the UK sector of the NS installation, in 1995. The International Maritime Organization (IMO) sets the standards and guidelines for the removal of offshore installations providing foundation for most national and regional legislation governing such processes.

There are not many mechanisms being used to guarantee the availability of financial resources (from the industry) for the decommissioning of offshore installations. Financial assurance mechanisms (bonds) may have a significant impact on the investment, since the cost for decommissioning has to be secured before an exploration permit is issued. Traditionally, the industry looks at any financial resource applied in abandonment or decommissioning as lost investment and companies struggle for low cost solutions. On the other hand, the industry acknowledges that its public image has a great value in today's economy. Governments, which are responsible for creating and implementing the regulations, must come up with financial mechanisms to guarantee the availability of resources in case of environmental accidents and/or insolvency; on the contrary they will cope with the costs. Independent contractors see this as a great financial opportunity. Tougher regulations would bring them more contracts.

Under the public standpoint, decommissioning and abandonment (D&A) costs may be allowable against tax. Consequently, the taxpayer will be paying for part of the process. In the United States where the bonding system is applied in the oil industry, anticipated provisions are not tax deductible. The rule for deductibility is that expenses have to be ordinary and necessary business expenses and not capital expenditure (US IRS consultation, 1999). The model presented in this paper is the first part of a series of studies and will allow deduction for bond instruments.

1.1 Decommissioning

Decommissioning can be described as the process of deciding how best to shut down operations at the end of a field's life (Thornton, 1997). Decommissioning includes closing, plugging and abandoning the wells and pipelines, cleaning and making the facilities and structural components safe, removing some or all of the units and facilities, disposing, reusing or recycling them, clearing the site, and finally, providing monitoring and surveillance where required. Such process is ample and multidisciplinary involving all stages initiated when an installation approaches the end of its useful life (ODCP, 1998). It requires detailed long term planning on several issues (energy conservation, safety, environmental and socioeconomic impact, etc.), a variety of approval procedures, interpretation of the current legal provisions, economic evaluations, decommissioning and bonding alternatives, fiscal planing, involvement of all stakeholders, etc.

The term *decommissioning* can also be used for onshore processes. Despite the terms *decommissioning* and *abandonment* are often used interchangeably for onshore applications, they embodied different meanings. *Abandonment* designates the plugging and capping of a specific well (or purging and capping of a pipeline). *Decommissioning* refers to the facility itself, and is in general a process consisting of three phases: (1) dismantling, (2) decontamination or treatment, and (3) reclamation. Dismantling involves the removal of all surface equipment, buildings, and the abandonment of any well bores and pipelines. It also involves the removal of all salvageable material, including gravel, pipe in the ground, etc. Decontamination, involves clean-up, removal, neutralization, or any other action which would make any surface or subsurface contamination harmless, or of very low risk to the environment. Reclamation involves returning the disturbed site to the land, soil and vegetation standards established by regulatory authorities (Alberta, 1998).

A framework of international conventions, treaties, guidelines, regional agreements, and national legislation, regulates the decommissioning of offshore installations. The IMO sets the standards and guidelines for removal of such installations (an interpretation for the 1982 United Nations Law of the Sea Convention – LOS): (1) Installations weighting less than 4,000 tons, located at places where the water depth is less than 100 meters, must be completely removed from the site; (2) Installations located at water depths greater than 100 meters must be either totally or partially removed to a depth allowing a unobstructed water column of 55 meters above the remaining portions of the installation in order to avoid navigational hazards; (3) Total removal will not be required in the following circumstances: technical unfeasibility, unacceptable human or environmental risk involved in the total removal operations, and extreme costs; (4) All installations (after January 1, 1998) must be designed and built so that their entire removal is feasible; and (5) A structure may be left partially or entirely in place if there is a justifiable and permitted new use or if the structure can be left in place without causing unjustifiable interference with other users of the sea.

In most cases decommissioning will involve two steps: dealing with the "topside" and the "structure" or "jacket". The topside is usually taken to shore for recycling but it could also be disposed of in deep waters, re-used, used as artificial reefs, or toppled on site. The steel sub-structure is the cause of the main controversies since it could be left in place, partially removed, or totally removed. Due to the complexity of the different combinations of installations and settings establishing a single decommissioning solution for all cases may not be possible (ODCP, 1998). Though decommissioning also involves dealing with pipelines, drill cutting piles, etc., this paper emphasizes only issues directly related to platforms.

2. THE PROPOSED SCENARIO

The present model simulates five different scenarios. This is the first of a series of simulations taking into account different regulatory regimes (including tax treatment). For this preliminary simulation, each scenario has two possible outcomes. A total of 10 outputs are produced and evaluated. Each output provides a numeric payoff (total Net Present Value, NPV in US$) and its respective probability of occurrence. The preferable choice should have a high payoff along with a high probability rate. The model provides an methodology to estimate the tradeoffs, and help the decision-maker find the best available alternative.

2.1 A Proposed Brazilian Regulatory Framework

Considering that the current Brazilian legal framework does not require any form of financial assurance instrument to guarantee the proper completion of decommissioning operations several assumptions are adopted in order to make the application of the proposed decision model possible as describe in Fig. 1.

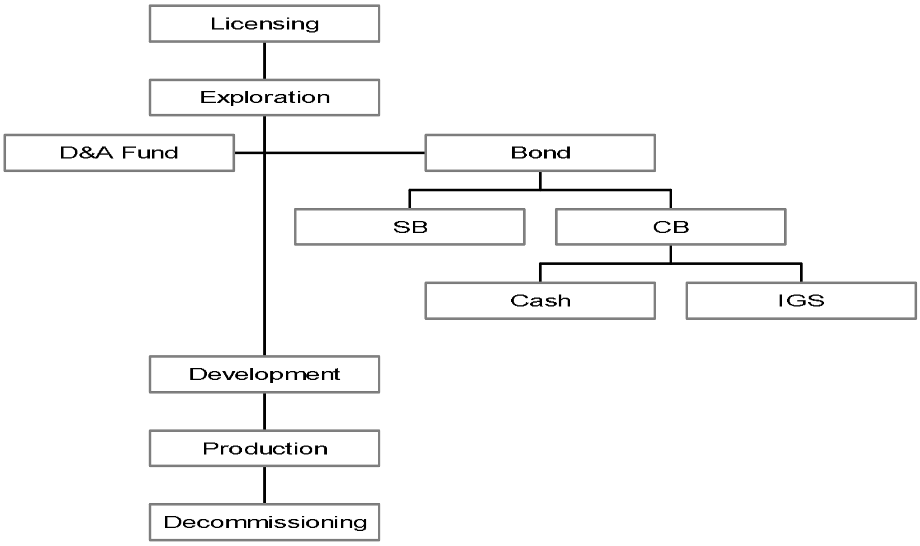


Figure 1 – Flowchart showing stages of the project and possible forms of financial assurance. Decommissioning and Abandonment Fund (D&A fund); Surety Bond (SB); Collateral Bond (CB); Investiment-grade Security (IGS).

The following hypothetical scenario is based upon several different legal regimes, which adopt financial assurance mechanisms in order to ensure environmental compliance both in the US and Canada. Despite of the fact that such mechanisms are not currently being adopted in the Brazilian legal framework they may be use as a benchmark for a comparative analysis

For simplification purposes, this paper assumes a single licensing period taking place at the beginning of the project. During the licensing period an environmental impact assessment report, a risk assessment report and an environmental control plan will be requested. The license granted will authorize, within a particular basin, exploration, development and production activities, including installation of units and systems necessary for production and transportation. Consequently, prior to exploring and/or producing oil, decommissioning operations must be permitted and bonded under the requirements of the hypothetical Brazilian Decommissioning Act (BDA) enforced by the regulatory authority, the Brazilian National Petroleum Agency (ANP).

The main purpose of the BDA is to ensure that the environment and citizens are protected and the portion of the sea occupied during exploration and/or production is restored to its original state, posing no threat to navigation or marine life.

2.2 Financial Assurance - Bonds

Our scenario assumes three major forms of bond : (1) corporate surety bonds, (2) cash collateral bonds, and (3) investment-grade securities. The two alternative scenarios are the “D&A fund”, and the “no compliance”, where the operators choose not to comply with the BDA. The main objective of the bonds is to ensure that decommissioning will be performed as contractually determined. Bonds will move decommissioning costs up front-end towards the beginning of the project (Fig. 2) guaranteeing that resources will be available when required.

Bonds are financial instruments with unique attributes and requirements. Some forms of bonds are the pledged assets of an oil company (cash, securities, real estate, etc.). Others are guarantees for a company's performance, analogous to an insurance policies (surety bonds), and some are instruments that indicate the deposit of cash (certificates of deposit) or the existence of a line of credit (letters of credit) (Bryan, 1998). All form of bonds must be made payable to the ANP.

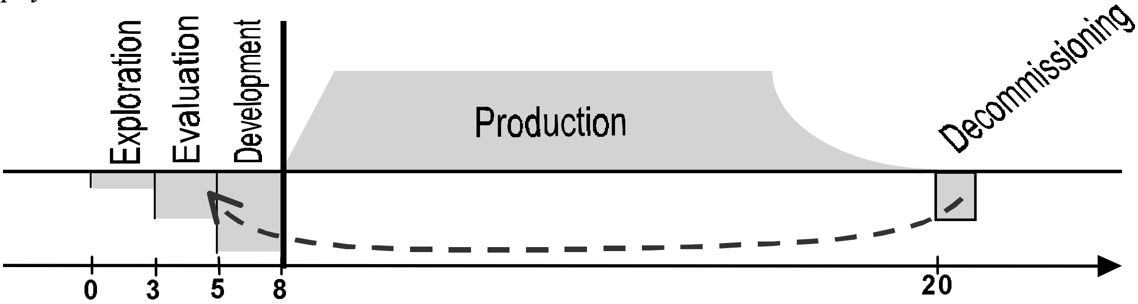


Figure 2 - Finance Assurance Bonds Scheme

The ANP sets the bond based upon the operator's cost estimate for decommissioning. In this simulation the bond amount will be equal to the decommissioning cost plus 15%, which represents the third party cost to complete the decommissioning plan in the event of forfeiture. After decommissioning requirements are met by the operators, there is a 1 year waiting period (liability period) that must expire before the bond may be released. The waiting period will increase the life of the project in one year. For the present simulation bonds are posted to cover a 20-year term of permit, the entire project life.

2.3 The Oil Project

A simulated offshore production project in the Brazilian outer continental shelf is used in the proposed model (bellow). The main project figures can be found at Table 1. The overall production volume during the life of the project was 279.4 million bbl and the oil price, US$ 16.00/bbl.

The installation used is a steel gravity structure. At the end of the project the structure must be cut into sections, placed on a barge, and transported to shore where it will be mechanically dismantled. The parts will be recycled whenever possible and the remains will be disposed as scrap. The decommissioning process will involve different offshore activities such as diving, lifting installation sections with the assistance of a winghline, towing, etc.

Many other alternatives for decommissioning are available, but for demonstration purposes, the most expensive procedure was chosen. The total cost for the decommissioning of the offshore installation was estimated at US$ 78 million.

2.4 Decommissioning Corporate Surety Bond (SB) Scenario

In this scenario, a surety bond is chosen as the financial guarantee instrument. When a surety company writes a bond, it guarantees that the oil company will perform all decommissioning operations, otherwise the surety company will pay the bond sum to the ANP, which will pay a private contractor to perform the decommissioning. Corporate surety bonds posted to meet ANP's bonding requirements are non-cancelable under the law, even for the failure to pay premiums and/or in the event of bankruptcy or insolvency of the operator.

Surety bonds are similar to insurance policies in that oil companies pay annual premiums to keep bonds in place. Each surety company follows its own financial criteria to judge an oil company and fix premium rates (more net worth, smaller premium rates). Premiums are based on a percentage of the bonds. The proposed scenario follows the recommendation of the

Surety Association of America which suggests US$ 12.50 per US$ 1,000.00 per year as the premium (1.25%), which is allowable against tax. Surety companies will also charge according to the financial standing of an oil company (net worth level), credit rating and decommissioning experience.

The ANP relies on the Central Bank to regulate the financial requirements so that surety companies are solvent. If the Central Bank finds that a company no longer fulfills the financial requirements, the company may be liquidated. Oil companies must replace bonds written by surety companies that are liquidated.

The benefit of the use of surety bonds is that no up front-end funds must be disposed of. At the end of the production the company will have to dispose of US$ 78.0 million to perform the decommissioning of the installation. Note that the bond was acquired only as a financial guarantee, but the decommissioning still has to be paid for.

If the company remains solvent and concludes the required decommissioning, the bond is released (the premium payment ceases). In case of forfeiture (insolvency or failure in accomplishing the terms of the contract) the surety company that issued the bond will pay for the decommissioning and a penalty (ANP fine, which corresponds to 10% of the total bond amount) will be imposed on the oil company. Note that there are further complications to a company forfeiting the decommissioning of an installation. The company may loose its operating license, its credit, and reputation, among other punishments. The present paper does not consider the further economic consequences of a forfeiting company.

Table 1. Financial Output for the 5 different scenarios: (1) no compliance (NC); (2) decommissioning and abandonment fund (DAF); (3) surety bond (SB); (4) cash bond (CB); and (5) investment-grade security bond (IGSB).

ITEM	NC	DAF	SB	CB	IGSB
A) OPEX (US$/bbl)	3.16	3.16	3.16	3.16	3.16
B) CAPEX (US$/bbl)	1.56	1.56	1.56	1.56	1.56
C) OIL TAX (income)/bbl	2.00	2.00	2.00	2.00	2.00
D) CORPORATE TAX/bbl	3.47	3.47	3.53	3.56	3.44
E) GOVERNMENT TAKE (C+D)/bbl	5.47	5.47	5.53	5.56	5.44
F) DECOM. FINANCIALCOST/BBL	-	0.52	0.36	0.60	0.60
G) DECOM. INCOME/BBL	-	-	-	0.64	0.89
H) DECOM. BALANCE (F+G)/BBL	0.00	(0.52)	(0.36)	0.04	0.29
K) NET CASHFLOW	1,622,8M	1,476,6M	1,504,1M	1,607,9M	1,551,2M
K) NET CASHFLOW/bbl	5.81	5.28	5.38	5.75	5.55
L) NPV (@15%)	295,2M	246,3M	272,0M	244,2M	225,7M
M) IRR	25.7%	24.1%	25.2%	23.1%	22.6%

Note: Oil Tax: rental fees, bonus, royalties and special participation; Corporate tax: corporate income, COFINS and PIS; Not included in the cash flow: indirect taxes: import duties, IPI, ICMS, etc.); depreciation: 1-year (expended) for wells and 10-year (straight line) for other items.

2.5 Decommissioning Cash Collateral Bond (CB) Scenario

The cash collateral bond is placed in a bank in a federal insured account under an escrow agreement between the oil company, the bank, and the ANP. The escrow agreement would specify that the ANP has full control over the account until it is released after decommissioning. The company earns interest on the escrow account and the interest is available as it is earned (annually). In the proposed scenario the account pays 5.25% interest per year. Since interests are paid annually to the company, there is no change on the total investment and the interests paid will remain the same throughout the project.

Under the proposed scenario the company would not be able to use the deposited collateral money to fund decommissioning. The company would have to pay for decommissioning out of operating costs.

After successful decommissioning and release of the bond, the money would be returned to the oil company. In case of forfeiture, the bond amount (US$ 98.7 million) would not be returned to the company but instead it would be used by the ANP to contract an independent operator to complete the decommissioning. In addition, a penalty (regulatory fine, which corresponds to 10% of the total bond amount) would be imposed.

2.6 Decommissioning Investment-Grade Security (IGS) Scenario

Some bonding instruments such as investment-grade securities, certificates of deposit and letters of credit are considered to be negotiable instruments. Therefore, the ANP secures such instruments in banks. The status of decommissioning bonds being held by the ANP is constantly tracked by the agency.

All forms of instruments used as collateral bond may be held for long term (i.e. 20 years). Certificates of Deposit are set up to be self-renewing so that when they mature, they roll over for the next term(s). In the case of investment-grade securities such as Treasury Bills/Notes, they would have to be purchased with a long-term maturity period to avoid the need for frequent substitution in order to keep earning the interest. The IGS, a US$ 98.7 million treasure bill with a 20-year maturity period, is purchased. The interest rate paid by the security corresponds to 5.50% per year and will not be available to the company until its maturity is reached.

After successful decommissioning and release of the bond, the security is then released to the company along with the accumulated interest. In case of forfeiture, the security would be released to the ANP which would use the fund to contract an independent operator to complete operations. Furthermore, a penalty (ANP fine, which corresponds to 10% of the total bond amount) would be imposed.

2.7 Decommissioning and Abandonment Fund (DAF) Scenario

This fund is set as a “pay as you go” scenario. Decommissioning cost is taken to a future value that is capitalized at a rate of 5.25% per year and spread over the project life. Annual payments are allowable against tax. The fund collected annually is placed in an earmarked federal treasury account assigned to the ANP. The agency would manage the fund and no interest would be earned.

In this scenario the financial burden upon the company is lighter since there is no obligation for advanced financial provisions. On the other hand, it returns to the traditional domestic scenario, where there is no guarantee for funding at the end of the project. The cost will then be transferred to the taxpayer. The only penalty for the company will be an ANP fine, which corresponds to 10% of the bond. In this case there is no incentive for compliance and the penalty for forfeiture is very light.

2.8 No Compliance (NC) Scenario

The “no compliance” scenario can be used to demonstrate the financial performance without decommissioning requirements. Since there is no need for decommissioning, the duration of project is only 18 years.

In the proposed scenario there is no decommissioning cost. The company operates without directing any resources to the removal of the offshore installation. To make the model feasible, heavy penalties are imposed, such as: (1) ANP fine for failure to perform the decommissioning of the installations (10% of the bond amount); (2) ANP fine for failure to bond all decommissioning activities (100% of the bond amount); and (3) IBAMA fine for environmental aggression (150% of the bond amount).

3. THE DECISION MODEL

The decision model used for evaluating all five alternatives was a typical decision tree model associated with each cash flow analysis. This model provides a tool for scenario analysis and its tradeoffs, offering a view of the alternatives for decision making process and was designed using TreeAge® version 2.6.7, a software developed by TreeAge Software Inc. Figure 3 presents the output of the simulation with all its alternatives.

The oil company faces the problem of choosing the best alternative to deal with the decommissioning regulatory regime. The decision-maker has to identify the option that inflicts the lesser impact upon the company's finances. Therefore, the main purpose of this model is to minimize the economic impact of the environmental regulation upon the company's profitability. The probabilities used for each scenario do not have specific bases (Fig.3).

The probabilities used for the "no compliance" scenario obey a common sense rule. The probabilities used for the bonds (surety and collateral) roughly follow the statistics collected in the US coal industry (Bryan, 1998).

3.1 Results

Despite the empirical characteristics of this paper, there are interesting outcomes to be considered (Table 1). The amount directed to the decommissioning of the installation represents only a small portion of the investment. The difference between the NPV from the "no compliance" scenario and the lowest NPV (IGSB), is not significant. If the "no compliance" scenario is not taken into consideration, the difference between the NPV values is only 17%. Even providing financial guarantee for decommissioning in the project, the total net cash flow for all scenarios vary only 9%. Even though the "no compliance" scenario offers a good payoff ("not getting cut" scenario), the alternative payoff for the most probable outcome ("getting cut" scenario) is very discouraging (Fig.3).

The Decommissioning and Abandonment Fund (DAF) mechanism neither provides an incentive or a financial guarantee for the ANP. The DAF scenario provides a good NPV and collects resources for the decommissioning. However, if the company becomes insolvent the burden will be placed on the taxpayer. The difference between payoffs (decommissioning and forfeiture) for this scenario is modest, lacking financial incentive for compliance.

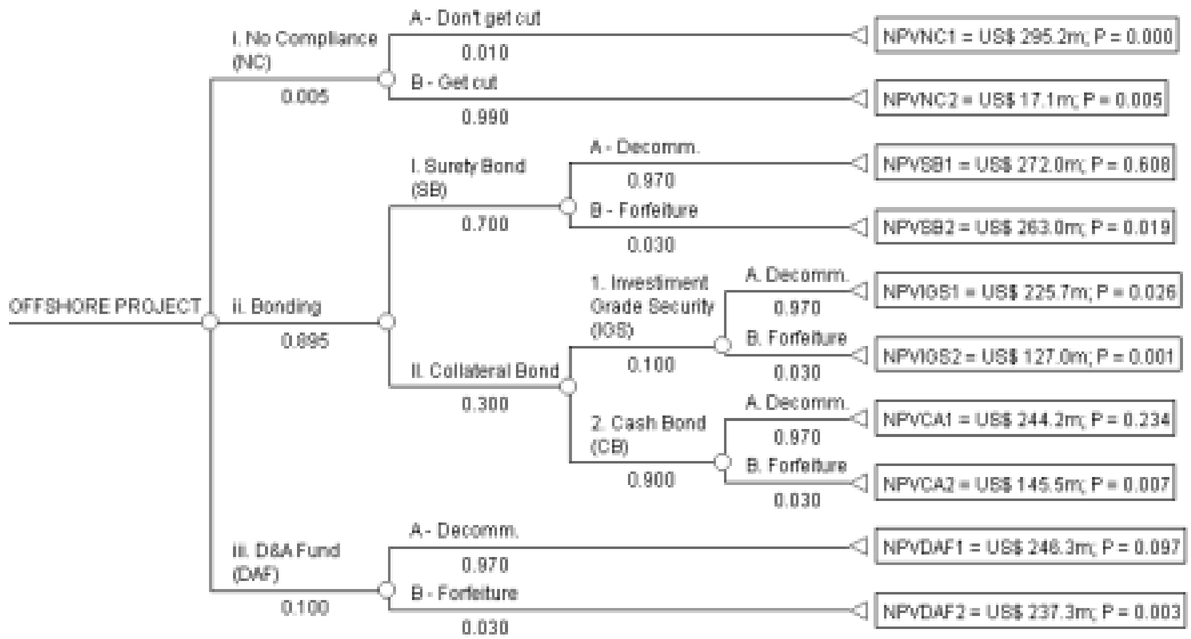
Among the many types of collateral bond, we chose to work with IGS and cash bonds. In this specific scenario, the IGS did not provide a good payoff since it had a maturity period of 20 years. The company was only able to receive the security interest at the end of the project. Probably if other types of securities and maturity periods were used the results would have been better. Cash bonds, as mentioned before, is not an efficient way to finance long-term operations with high decommissioning costs.

The Surety Bond is a very interesting tool. It could be compared to an insurance policy, with the advantage of carrying the economic incentive for compliance. Besides, there is no need for up front disbursement. Companies interested in this type of instrument will have to provide good financial and environmental performance records, consequently it works as an incentive. Good ranking guarantees lower premium rates.

Cash is not an efficient way to finance long-term operations with high decommissioning costs. Long-term (20-year) projects will likely be covered by one or more surety bonds, a trust fund where money is deposited annually in escrow, or letters of credit.

There are no significant differences between NPV values on the different scenarios. Therefore, financial assurance instruments, which guarantees availability of resources for decommissioning, can be considered feasible by regulatory authorities. The economic impact of the financial assurance system has yet to be compared to other economic regulatory approaches such as environmental trust funds, environmental taxation, environmental insurance, etc.

In this phase of the project no significant differences between NPV values on the different scenarios were found. Such result may be attributed mainly to the homogeneous fiscal treatment given to all five scenarios. In the majority of bonding regimes, fiscal planing plays a very significant role in the decision-making process since some bonding instruments will allow tax deductions (i.e. surety bonds) while others will not, penalizing project owners (i.e. cash collateral bonds). Surety bonds will provide better NPVs since no advanced fund allocation is required and a financial institution will be carrying this burden at a cost of 1.25% of the amount bonded per year (premium).



Bond =	(Decom * 15%) + Decom	**NPVDAF2 =**	246,313,994 - FINE1
Decom =	78,000,000	**NPVIGS1 =**	225,674,794
FINE1 =	10% * Bond	**NPVIGS2 =**	225,674,794 - FINE1 - BOND
FINE2 =	100% * Bond	**NPVNC1 =**	295,200,679
FINE3 =	100% * Bond	**NPVNC2 =**	295,200,679 - FINE1 - FINE3 – BOND - FINE2
NPVCA1 =	244,183,551	**NPVSB1 =**	271,955,037
NPVCA2 =	244,183,551 – BOND - FINE1	**NPVSB2 =**	271,955,037 - FINE1
NPVDAF1 =	246,313,994		

Figure 3. Decision tree model diagram. The terminal boxes show the payoffs (NPV @ 15%), and probability of occurrence within the proposed scenario.

4. CONCLUSION

The small difference between the NPV values (17%) from the various scenarios of the simulation indicate the possibility that financial assurance instruments such as bonds may provide a efficient tool to guarantee the completion of decommissioning operations without significantly impacting the economics of a project.

The decision model indicates that additional research on these financial assurance instruments is still needed. Some of the issues that should be further studied are: (1) bonding instruments would be feasible in the current Brazilian regulatory regime; (2) tax regimes in bonding scenarios and potential impacts; and (3) macroeconomic impact of a bond regime in Brazil. Allocated funds brought by bonds and kept in place for long periods of time can positively be leveraged.

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