Bureau of Ocean Energy Management

Recommended Discount Rates and Policies Regarding Special Case Royalty Relief for Oil and Gas Projects in Shallow Water

Bureau of Ocean Energy Management

Economics Division

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Summary

The Bureau of Ocean Energy Management (BOEM) has conducted analyses to help inform the Bureau of Safety and Environmental Enforcement's (BSEE) policies and procedures for applying Special Case Royalty Relief (SCRR) for certain shallow water oil and gas projects in the Gulf of Mexico. In this report, BOEM presents its research and recommendations regarding the appropriate discount rates to use when computing the net present value of cash flows within SCRR applications. BOEM recommends that companies should self-report discount rates, but that BSEE should impose a 25 percent upper bound on reported discount rates for shallow water leases. This policy would allow companies to earn appropriate rates of return, and would protect the government's right to receive fair amounts of royalty payments. BOEM also provides some analysis regarding the form of royalty relief. In particular, a Value of Suspended Royalties (VSR) offers some appealing features, and BOEM recommends that BSEE work with BOEM and the Office of Natural Resources Revenue (ONRR) to further examine the potential use of a VSR.

Chapter 1: Introduction

Section 1.1: Project Background

The Bureau of Ocean Energy Management (BOEM) sets royalty rates for oil and gas leases in federal waters. In the most recent Gulf of Mexico (GOM) lease sales, BOEM has set a 12.5% royalty rate for shallow water leases (water depths less than 200 meters) and a 18.75% royalty rate for deepwater leases (water depths of 200 meters or more); existing leases can have royalty rates of 12.5%, 16.67%, or 18.75% (in either shallow or deep water). Royalties help ensure the public receives a fair return for leasing federal submerged lands. However, situations can arise in which companies are unwilling to develop certain oil and gas resources at the prevailing royalty rate because doing so would not yield a sufficient rate of return. In these situations, an operator may apply for certain types of royalty relief.[1] The Bureau of Safety and Environmental Enforcement (BSEE) administers discretionary royalty relief programs.

The oil and gas resources of the federal shallow water GOM region have been explored and developed for more than 65 years. As a result, the most profitable oil and gas projects have been developed, and a number of marginal accumulations are currently leased but may not be profitable (and thus may not be pursued) at current royalty rates. Operators of existing leases may apply to BSEE to obtain SCRR for certain oil and gas development activities. When analyzing SCRR applications, an important consideration is the extent to which the relief shifts the project from being unprofitable to being profitable. Therefore, reviews of SCRR applications often entail calculations of the profitability of the project with and without royalty relief. A key component of these determinations is an interest rate (or discount rate) used to compute the net present value (NPV) of expected cash inflows and outflows. A discount rate accounts for the time value of money, as well as the uncertainty associated with future cash flows. In general, the higher BSEE sets the discount rate, the more royalty relief would be required to make a particular project profitable. Therefore, the appropriate discount rate should facilitate the development of oil and gas resources, while minimizing the loss of government revenue.

This paper provides BOEM's research, analyses, and recommendations regarding the appropriate discount rates to use when evaluating shallow water SCRR applications. BOEM also suggests BSEE consider providing royalty relief in the form of a Value of Suspended Royalties (VSR). A VSR would protect the taxpayer and reduce lessee uncertainty. Section 1.2 provides a numerical illustration of how different discount rates can affect the NPV of an oil and gas project. Chapter 2 provides a theoretical framework for determining and understanding the appropriate discount rate in a particular situation. Chapter 3 describes the available data regarding discount rates. Chapter 4 provides BOEM's analysis regarding the appropriate form of royalty relief. Chapter 5 summarizes BOEM's findings and recommendations.

[1] More information regarding royalty relief programs is available at: https://www.boem.gov/Royalty-Relief-Information/ (BOEM 2019).

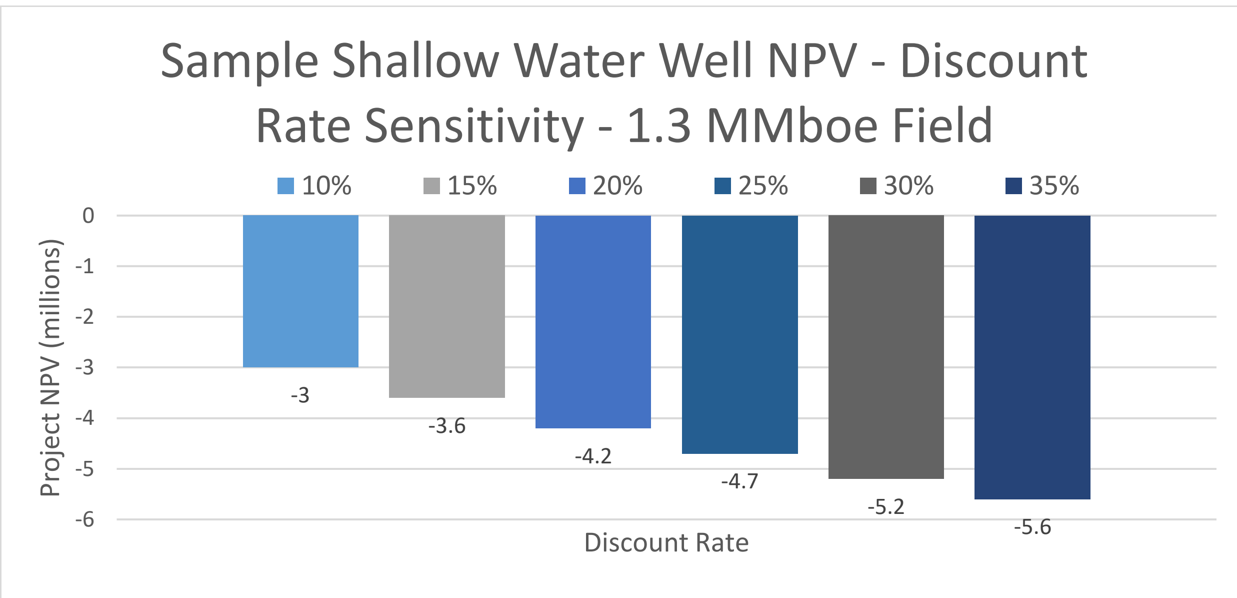
Section 1.2: Numerical Illustration of Discount Rates Impacting Net Present Value

Discount rates have significant impacts on oil and gas project evaluations. This section will present a numerical example of how discount rates can affect profitability, which will inform the analyses in subsequent sections.

$$NPV = \sum_{t=1}^{T} \frac{Expected\ Cash\ Flows}{(1+DR)^t} \qquad \text{(Equation 1)}$$

In Equation 1, NPV is computed by applying a discount rate (DR) to expected cash flows in each time period (t), and then summing the values for each time period. Figure 1 displays the NPV of a hypothetical 1.3 MMboe (million barrels of oil equivalent) shallow water project using discount rates ranging from 10-35%. As the discount rate increases, the NPV of a project decreases. Therefore, more royalty relief would be required to change the project's NPV to zero. For this sample project, each five-percentage point change in the applied discount rate changes the project NPV by roughly one-half of a million dollars.

Figure 1: Example Regarding Discount Rates and NPVs



A higher discount rate will generally reduce the NPV of an oil and gas project and require a larger amount of royalty relief to be economic. However, there is a limitation on the extent to which royalty relief can offset a negative NPV. At very high discount rates, reducing the royalty rate, even to zero percent, may not be sufficient to bring the project NPV to zero. Under Special Case Royalty Relief, royalty relief is provided to turn an uneconomic project economic. That is, BSEE provides royalty relief to change the NPV of a project from being negative to being non-negative. This highlights the importance of applying an optimal discount rate that allows BSEE to assess whether royalty relief is appropriate and, if so, to grant an amount of relief that allows a company to earn an appropriate rate of return (while protecting the government's right to receive fair amounts of royalty payments).

Chapter 2: General Discussion of Discount Rates

Section 2.1: Introduction

This chapter provides a theoretical framework for determining and understanding the appropriate discount rates in the context of SCRR applications[2]. In particular, this chapter describes how various risks faced by shallow water operators influence discount rates.

Businesses typically determine which projects to pursue by assessing the size and timing of expected cash inflows and outflows. The timing of cash flows is important because money received sooner is more valuable than money received later. In addition, the owners of businesses prefer certainty and seek to minimize risk regarding the size and timing of cash flows. However, the cash flows from oil and gas projects are subject to numerous uncertainties. Therefore, businesses need a framework to value these uncertain cash flows. A common framework is to use risk-adjusted discount rates (RADRs), which entails applying higher discount rates for riskier projects.[3]

$$\mathrm{DR} = \mathrm{WACC} + \mathrm{IHR} + \mathrm{SWRA} \qquad \text{(Equation 2)}$$

Inkpen and Moffett (2011) decompose discount rates as shown in Equation 2, where:

- DR: Discount rate applied to expected cash flows
- WACC: Weighted average cost of capital
- IHR: Incremental hurdle rate
- SWRA: Shallow water risk adjustment

In other words, companies will expect to earn at least as much as their weighted average cost of debt and equity capital. In addition, if companies have multiple profitable investment opportunities (and a limited budget), they will require more than the WACC (an incremental hurdle rate) in order to pursue an average-risk project. Finally, a GOM shallow water project, particularly one for which royalty relief would be requested, likely faces additional risks compared to a company's average project. For example, the probability that a marginal project will be profitable overall is more sensitive to deviations of variables (such as reserves and prices) from their expected values. In addition, the most profitable areas of the shallow water GOM have already been developed, which limits the likelihood of a highly profitable outcome. Therefore, businesses will likely require a higher discount rate to compensate for these risks.

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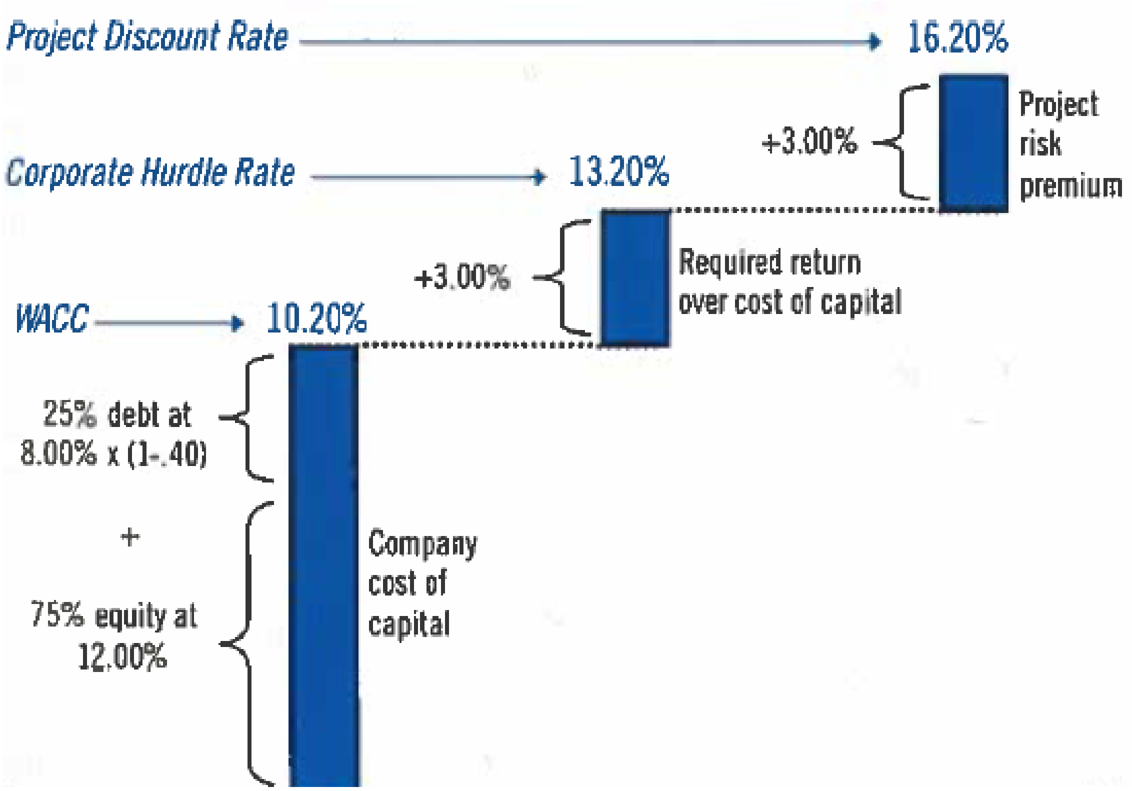
[2] This paper generally refers to *nominal* discount rates, which do not remove expected inflation. One can convert nominal discount rates to *real* discount rates (which do remove expected inflation) as:
Real discount rate = [(1+ nominal discount rate)/(1 + expected inflation rate)] -1
(where all variables are entered as decimals).

[3] An alternate approach is to discount cash flows using a lower discount rate than in Equation 2, and to then to decrease the resultant net present value by a reserve adjustment factor (Society of Petroleum Evaluation Engineers 2018). There has also been some research regarding the use of option theory related to oil and gas projects, but these methods are not often used in practice (Dickens and Lohrenz 1996).

Figure 2: Components of a Risk-Adjusted Discount Rate



Source: Inkpen and Moffett (2011)

Figure 2 presents a hypothetical example from Inkpen and Moffett (2011) regarding the components of a risk-adjusted discount rate. In this example, an oil and gas company is analyzing the profitability of a particular project. The company is financed by 75% equity and 25% debt. Suppose the cost of equity is 12%, the cost of debt is 8%, and the corporate tax rate is 40%. The weighted average cost of capital of these funding streams is 10.2% (see Section 2.2 for more information).[4] Due to competing investment projects, this company has an average incremental hurdle rate of 3% (and a total corporate hurdle rate of 13.2%). Finally, the particular project under consideration is riskier than the company's average project, so the company adds a 3% percent risk premium. This yields a total project discount rate of 16.2%. Therefore, this company will use a discount rate of 16.2% to compute the net present value of cash flows from this project. Sections 2 through 4 will describe these components of discount rates in more detail. Section 5 will qualitatively discuss how discount rate policies can affect society as a whole.

[4] The current corporate tax rate is 21%. If this 21% corporate tax rate were applied to the example in Figure 2 (and assuming other variables did not adjust), the WACC would equal 10.58% (and the project discount rate would equal 16.58%). The WACC would increase because there would be less of a tax shield associated with debt financing (see Section 2.2).

Section 2.2: Weighted Average Cost of Capital

When analyzing an oil and gas project, a company will expect to earn at least the weighted average cost of its debt and equity financing in order to undertake the project.

$$WACC = \left(\frac{E}{V}\right) R_E + \left(\frac{D}{V}\right) R_D (1 - T_C) \quad \text{(Equation 3)}$$

Equation 3 is the formula for the WACC (Corporate Finance Institute 2019), where:

- E: Market value of total equity
- D: Market value of total debt
- V=E+D (the total market value of debt and equity combined)
- R_E: Cost of equity
- R_D: Cost of debt
- T_C: Corporate income tax rate

The first part of Equation 3 represents the portion of a company's cost of capital represented by required returns on equity. In particular, equity investors will require a rate of return commensurate with a company's collective risk profile. There are numerous risks associated with oil and gas projects, such as price volatility, uncertainty regarding reserves, and variability of input costs. Since investors often can diversify their equity holdings, a common assumption is that equity investors will only receive compensation for risks that cannot be eliminated through diversification[5]. However, given the numerous sources of uncertainty for oil and gas companies, as well as the interdependence between energy markets and the broader economy, many of the risks cannot be diversified away. In addition, many shallow water oil and gas operators are privately-held companies, which further limits their ability to diversify risks. Therefore, for most oil and gas companies, the required return on equity capital is high.

The second part of Equation 3 represents the cost of debt financing (since debt interest payments are tax deductible, one considers the after-tax cost of debt financing). One can roughly think of the cost of debt as the sum of a risk-free interest rate, often approximated by the interest rate on a U.S. Treasury bond or bill, plus a premium to compensate lenders for the possibility that some or all of a loan may not be paid back on schedule. U.S. Treasury yields have been low in recent years. However, given the various risks associated with oil and gas development, lenders often require a sizable risk premium. This is particularly the case for smaller companies and companies experiencing financial difficulties. Therefore, the cost of debt (and the overall WACC for oil and gas companies) can be substantial.

[5] This is the core assumption of the Capital Asset Pricing Model, a widely-used framework for determining required rates of return (Sharpe 1964). Other theories of asset prices incorporate additional factors in their models, such as a company's size and the ratio of a company's book equity to its market equity (Fama and French 1993).

Section 2.3: Incremental Hurdle Rate

At any point in time, oil and gas companies likely have several potential projects under consideration. The minimum requirement for these projects is that they yield a return that is greater than (or equal to) the WACC. However, in many cases, a company will have multiple profitable projects under consideration. A company may be able to obtain additional funding to pursue more or all of these projects, but to the extent a company is unable or unwilling to do this, the company will apply a framework for deciding which projects to pursue. In the context of understanding discount rates, an appropriate framework is to think in terms of an incremental hurdle rate that represents the rate of return above the WACC that would induce a company to undertake a particular project relative to other projects. This incremental hurdle rate will thus vary through time given market conditions.

In practice, other factors may influence oil and gas investment decisions. For example, the size of the project (and the resulting overall profits earned) will be an important factor. U.S. shallow water projects are typically smaller than other projects (such as deepwater projects) and thus may not be as lucrative, particularly if certain factors make the projects mutually exclusive. Therefore, all else being equal, an average company will require a higher rate of return for a small shallow water project. However, the size of the oil and gas company may also affect its incremental hurdle rate. In particular, large companies may require a higher incremental hurdle rate than smaller companies because large companies have more (and larger) investment options. This has resulted in a trend of major oil and gas companies leaving the shallow water GOM to focus on larger projects (for example in the deepwater GOM) that offer more potential upside. The remaining operators of shallow water projects are thus smaller companies that are willing to accept smaller overall returns on projects.

Companies may also chose projects that recover their costs more quickly than other projects. In general, shallow water projects recover their costs faster than deepwater projects, but slower than onshore projects. In addition, spillover effects from a particular project to other future projects can influence development decisions. For example, pursuing a particular oil and gas project could position a company to pursue similar projects in the future through cost efficiencies or technological improvements. This issue would tend to lead companies to pursue alternatives to shallow water projects, since the future prospects for GOM shallow water projects are significantly less than for other areas. In addition, the shallow water GOM produces a higher percentage of natural gas (compared to oil) than the deepwater GOM. Natural gas is unlikely to be very profitable given the boom in, and the cost advantages of, onshore natural gas production.

Given the various factors discussed above, the extent to which an average shallow water project requires a higher or lower incremental hurdle rate than other projects will depend on the magnitude of these factors.

Section 2.4: Shallow Water Risk Adjustment

The discount rate for SCRR applications should account for the risks of these shallow water projects. These projects are by definition only marginally economic or uneconomic (often due to their limited oil and gas resources). Therefore, the likelihood that these projects will be profitable is sensitive to any deviations of economic variables (such as market prices, discovered resources, and development costs) from their projected values. A primary determinant of the risk adjustment should be the uncertainty of the oil and gas production likely to arise from a particular project. The risk adjustment should also account for the fact that there is a very low probability of a much higher than expected return because the most resource-rich areas of the shallow water GOM have already been developed. There is a higher probability of a large downside return (if the oil and gas resources turn out not to be present or are unobtainable for some reason). Finally, shallow water operators in the Gulf of Mexico face infrastructure-related risks associated with operating in a declining province. For example, older infrastructure requires more repairs, and longer-term infrastructure gaps (such as the eventual unavailability of certain platforms or pipelines) could arise. Therefore, the discount rate should be adjusted upwards to account for these risks.

Section 2.5: Societal Considerations

The analysis of discount rates in prior sections focused on discount rates used by oil and gas companies when making investment decisions. This is appropriate because companies ultimately determine whether to pursue certain projects, and because federal policy regarding this issue has typically focused on the extent to which royalty payments (and the resulting royalty relief) determine whether a project is economic to pursue. However, when considering policy decisions, it is appropriate to consider the costs and benefits of policy options from the perspective of society as a whole. In the analysis of discount rates, a societal viewpoint highlights the effects of decisions by an oil and gas industry on other actors in an economy. A societal viewpoint also highlights the risks of setting the discount rate too high or too low.

When an oil and gas company undertakes a discounted cash flow analysis in its decision-making process, it does not incorporate numerous effects on society as a whole. Some of these effects are beneficial, such as increased government revenues, lower energy prices, and less dependence on substitute energy sources. On the other hand, some of these effects, such as potential environmental effects, may be negative (depending on the alternatives). An important issue that is not sufficiently captured in an individual company’s analysis is the viability of the shallow water GOM province as a whole, and whether the collective decisions of many companies will leave oil and gas resources undeveloped for the foreseeable future.

The OCS Lands Act authorizes the Secretary of the Department of the Interior to issue regulations in the interest of conservation of OCS natural resources.[6] Conservation of OCS resources promotes economic efficiency, and from an economic perspective, leasing, development, and production activities should be carried out in a manner that will increase the net economic value to society from the development of OCS resources. In the context of GOM shallow water development, conservation of resources is a concern because much of the infrastructure to support shallow water activities, such as production platforms, are required to be removed not long after oil and gas production ceases; BSEE (2018) describes the decommissioning requirements for wells and platforms. Once infrastructure is removed, it is unlikely that similar infrastructure will be re-installed in the future because of the significant costs involved. Therefore, oil and gas companies, and society as a whole, may eventually lose the option to develop these shallow water assets even if economic conditions become more favorable in the future. Therefore, one can view the determination of discount rates as a policy lever to better account for these societal interests. While this is not the core analytical question at issue in this paper, it is useful to keep this perspective in mind.

It is also informative to consider the risks to society of setting discount rates too low or too high. If the government sets discount rates too low, certain projects may not be pursued (that may have been pursued if appropriate discount rates were used). As mentioned previously, society may also lose the value of the option to develop certain shallow water oil and gas resources in the future. If the government sets discount rates too high, it will encourage royalty-relief applications for projects that would have proceeded without royalty relief. Thus, the government would lose a fair amount of royalty revenue. In addition, for very marginal projects, setting the discount rate too high may lead to the conclusion that no amount of royalty relief would make these projects economic (and thus the projects would not be pursued). These effects highlight the need to select optimal discount rates that appropriately balance society's varied interests.

[6] 43 U.S.C. § 1334(a)

Chapter 3: Analysis of Data Sources for Discount Rates

The discount rates the government uses for evaluating SCRR applications should be similar to the rates companies use when evaluating similar upstream oil and gas investment opportunities. Unfortunately, the discount rates companies use, and the evaluation techniques they employ, differ across companies and are proprietary. There are several methods for estimating companies' discount rates. These methods include (1) measuring the cost of capital from financial data, (2) estimating the average return on upstream oil and gas investments, and (3) surveying companies to elicit their discount rates. There are various data and confidentiality limitations regarding methods 1 and 2. Therefore, this Chapter will summarize the available data from surveys and related reports. Section 3.1 will describe discount rate data from the Society of Petroleum Evaluation Engineers (SPEE). Section 3.2 will describe some other relevant data sources.

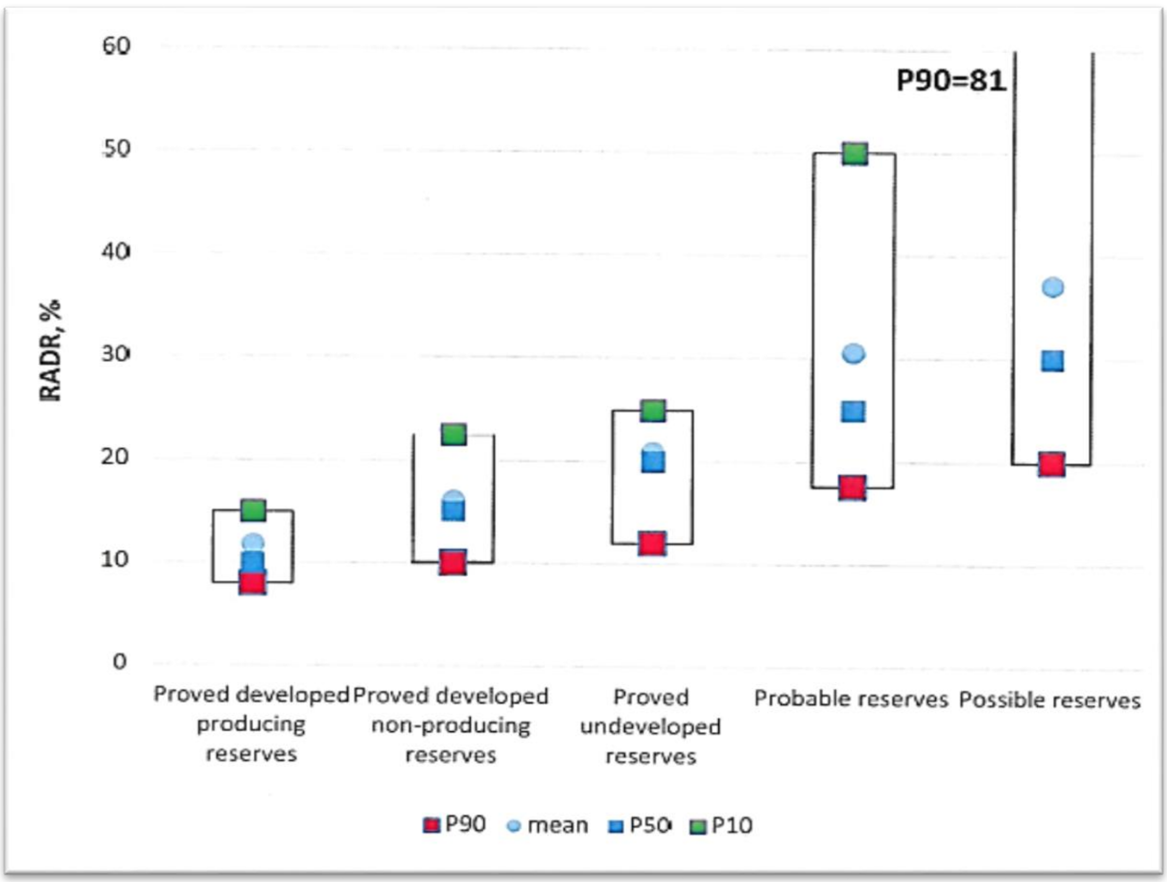
Section 3.1: Society of Petroleum Evaluation Engineers Data

The SPEE conducts an annual survey of their members regarding upstream resource evaluation topics. The survey asks members a wide range of questions, including questions about SPEE member companies' risk-adjusted discount rates (RADRs) used for different types of projects. BOEM acquired reports that summarized the data from the 2016, 2017, and 2018 surveys. The majority of survey responses came from employees of either exploration and production companies or oil and gas consulting companies, whose job functions primarily entail property valuation, reserves estimation, or acquisition and divestiture activities. The surveys do not differentiate between offshore and onshore evaluation methods. In the 2018 SPEE survey, almost 80% percent of respondents were located in the United States, and the vast majority of them spent a significant amount of time evaluating resources in the United States. When asked for reasons why RADRs were used to evaluate assets, 88% of respondents to the 2018 survey stated that reserve risk made the use of RADRs appropriate in their evaluations. Other reasons that were cited in over 33% of responses include price uncertainty, expense uncertainty, mechanical risk, and political regulatory uncertainty.

The 2018 SPEE survey asked members for the actual RADRs used when evaluating projects targeting certain categories of reserves; the results of the survey are presented in Figure 3. As one would expect, the less certainty companies had regarding the volume of recoverable resources, the higher the RADR used to evaluate these projects. Creating asset decline curves and cash flow models is straightforward when the asset being evaluated is proved developed or producing. While there is risk involved with any investment decision, the reserve risk is mitigated when companies are more certain about the recoverable resource. This is why *proved* reserves require a lower RADR than *probable* reserves.

In Figure 3, the 2018 SPEE survey results show that the median RADR used for probable reserves appears to be around 25%. Similarly, the 2016 and 2017 SPEE surveys found that the median RADR used for probable reserves was 25%. The 2016, 2017, and 2018 surveys found that the median RADR for proved developed producing reserves was approximately 10%. These differences illustrate that discount rates used for asset evaluations vary depending on the reserve classifications.

Figure 3: Risk Adjusted Discount Rate by Resource Classification - 2018 SPEE Survey Results



A limitation of the data in Figure 3 is that some of the survey responses relate to RADRs used for purposes somewhat different from oil and gas exploration and development. For example, RADRs are also used for asset acquisitions and overall corporate valuations. The 2017 SPEE survey presented results for the different categories of use (the SPEE data for other years did not provide these breakouts). The 2017 SPEE data found that the mean RADR used for oil and gas field development was 19.5% (sample size=24), and the mean RADR used for decisions to drill exploration wells was 17.4% (sample size=20). However, there were wide ranges of RADRs used.

Section 3.2: Other Data Sources

Other than SPEE data, there is limited alternate survey data regarding discount rates used by oil and gas companies. Below are a few sources that were found.

The Texas Comptroller of Public Accounts (2018) describes the RADRs used to assess oil and gas properties. This report developed an average range of discount rates of 14.62%-20.81%, and described some contexts that would allow for deviations from this range. For example, this study applied a 2 percent increase in RADRs for offshore properties.

Oil and Gas Journal (2018) presents discount rate data from Wood Mackenzie's 2017 and 2018 annual surveys of upstream oil and gas companies. The discount rates for various project categories in 2017 and 2018 were:

- Unconventional projects: 14.0% in 2017; 14.1% in 2018
- Deepwater projects: 15.9% in 2017; 14.8% in 2018
- Exploration projects: 15.8% in 2017; 14.8% in 2018

The Oxford Institute for Energy Studies (2019) emphasizes the risks of oil and gas projects in the context of a long-run transition towards renewable energy sources. This study cites survey results that a deepwater project has an average 18% discount rate (it does not cite a discount rate for shallow water).

Section 3.3: Analysis of Available Data

The SPEE surveys (for 2016, 2017, and 2018) provide the most detailed discount rate data. These surveys report that the median discount rate used for probable reserves was approximately 25%. While informative, some of the survey responses related to discount rates for uses other than oil and gas exploration and field development. The 2017 SPEE survey was the only survey to provide discount rates specifically for these categories. The 2017 SPEE survey found that the mean RADR used for field development was 19.5%, and the mean RADR used for exploration wells was 17.4%. These mean values are roughly consistent with the other data sources found. However, as described in Chapter 2, shallow water projects for which royalty relief would be sought have above-average risks. Therefore, companies will likely apply above-average discount rates when evaluating these projects. However, given the myriad of factors that affect discount rates, there is no formula that BSEE can apply to precisely estimate the appropriate discount rate for a particular SCRR application. Therefore, BSEE needs to set a generally-applicable discount rate policy that accounts for the various factors described in this paper. BOEM recommends that BSEE allow companies to self-report discount rates, but to impose an upper bound of 25%. This 25% upper bound on discount rates allows companies to earn appropriate rates of return, and protects the government's right to receive appropriate royalty payments.

Chapter 4: Form of Royalty Relief

Section 4.1: Royalty Suspension Value, Royalty Suspension Volume, or Lower Royalty Rate?

Although the main purpose of this paper is to provide analyses and recommendations regarding the appropriate discount rates for shallow water SCRR applications, utilizing the appropriate policy to deliver the intended relief to operators is very important. Traditionally, BSEE has provided SCRR in the form of a reduced royalty rate on all production from a lease up to a specific price and production volume threshold. However, as will be described in this chapter, a lower royalty rate is an inefficient form of royalty relief. BSEE has the authority to use a variety of royalty suspension policies as provided in its regulations[7], including (but not limited to):

- A lower royalty rate.
- A Royalty Suspension Volume (RSV): A fixed volume of initial production that is royalty-free as long as prices remain below a pre-determined price threshold.
- A Value of Suspended Royalties (VSR): A predetermined dollar amount that the operator does not pay in royalties. Once the lessee's calculated royalties exceed the VSR, royalty payments resume as provided in the lease.

BOEM recommends that BSEE consider applying royalty relief using a VSR formulation because it provides a number of benefits to operators and the government. A VSR yields the most optimal and timely royalty relief, and provides operators with a consistent benefit in all price cases. Since a VSR is a defined benefit where a value of royalties is the limiting factor, a VSR does not require additional triggers, such as inflation adjustments, price thresholds, or volume limits. When prices deviate from the forecast, only the rate at which the VSR benefit is consumed is affected; the intended value remains constant. By comparison, the amount of relief granted from an RSV or from a lower royalty rate can vary widely if prices or volumes diverge from their projections; the potential of significant price or volume increases also necessitate thresholds to ensure practical limits to royalty benefits. Due to a VSR's design, thresholds are unnecessary and an operator can be certain that they will receive the full amount of the intended benefit at any price, and can build the VSR into their cash flow analyses with confidence.

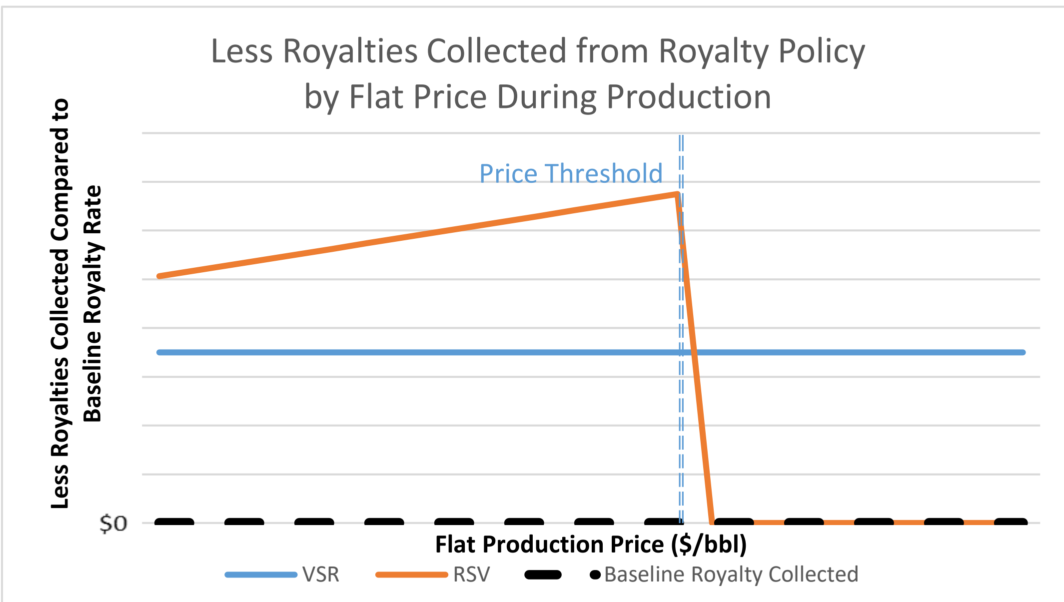
An RSV has been a common form of royalty relief issued by BOEM and BSEE (and their predecessors). However, RSV policies generally suffer from several significant drawbacks due to the necessity of price thresholds to limit the potential royalty relief. A project granted an RSV receives an intended benefit based on a specific price forecast; the derived value of the benefit is calculated by multiplying the royalty rate by the price forecast and the predetermined production volume. The thresholds must be set at the time of the relief determination and are unlikely to reflect actual oil and gas prices or production over time. Price and volume thresholds function as the limits of the royalty suspension benefit. Given the volatility in commodity

[7] 30 CFR Part 203

prices, the actual benefit derived from an RSV policy can vary widely. If actual prices are higher than forecasted, but remain below the price threshold, the benefit granted by the RSV increases beyond the intended benefit. If prices are lower than forecast, the RSV provides less monetary benefit than intended as the amount of paid royalties are lower than forecasted. In either case, the value of the benefit is not as intended.

When prices are above the price threshold, additional undesirable effects occur. First, the value of RSV policies experience a "cliffing" effect, that whenever prices breach the price threshold the value of the project drops sharply as a result. Figure 4 illustrates the "cliffing" effect that RSVs have once the price threshold is breached. In this graph, when the price breaches the threshold, the amount of suspended royalties drops to zero, and the value of the project drops immediately. Second, production that occurs above the price threshold is not royalty free, but continues to count toward the royalty suspension volume, essentially "wasting" the benefit of the RSV. These undesirable effects could cause operators to produce in a suboptimal fashion to avoid these effects.

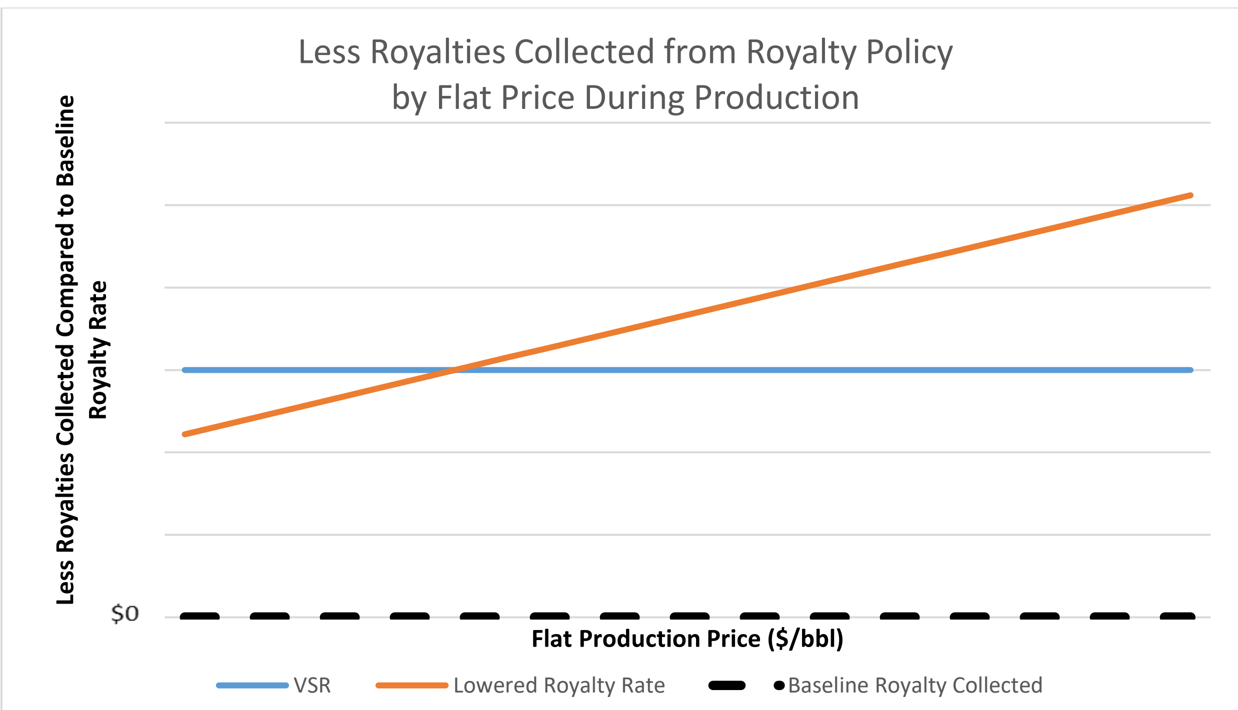
Figure 4 – RSV "cliffing" effect, compared to VSR



On the other hand, a VSR does not require price or volume thresholds and thus does not suffer from the same "cliffing" or "wasting" effects discussed previously. Higher than forecasted prices or production volume simply consumes the intended benefit at a faster rate, which is more beneficial to the operator's cash flow; at lower than forecasted prices or production, the VSR is consumed slower and thus provides more benefit than a royalty suspension policy. Many of the drawbacks of the RSV approach are not applicable, as a VSR provides the intended benefit in any price scenario.

A VSR policy also compares favorably to a lowered royalty rate traditionally used in BSEE royalty relief applications. A lowered royalty rate still requires price and volume thresholds to limit the maximum benefit and inherits all of the related drawbacks (discussed above). A lower royalty rate provides significantly less downside price protection to the operator than a VSR; as prices drop the benefit of a lower royalty rate also drops, whereas a VSR's defined benefit lasts longer at lower prices since it is consumed slower. Another major drawback of a lower royalty rate is that it does not improve cash flow as quickly as a royalty suspension policy. Suspended royalties provide a greater present value on a dollar-for-dollar basis than the remaining paid royalty stream by returning capital as fast as possible; the operator would still pay partial royalties with a lower royalty rate. Figure 5 below illustrates that at low prices a VSR provides more relief to the operator than a lower royalty rate. At high prices, a lower royalty rate delivers significantly more benefit than intended. The use of price and volume thresholds along with a lower royalty rate can limit the over-provision of royalty relief, but use of the thresholds result in the undesirable "cliffing" and "wasting" effects discussed previously.

Figure 5 - Illustration of Less Royalties Collected with VSR vs. Lowered Royalty Rate



A VSR approach could also provide certain administrative benefits to the operator and the government. Price thresholds require annual inflation adjustments, specialized tracking overhead when accounting for suspension volumes, and additional workload if royalties have to be returned to the operator due to prices close to the threshold. A VSR does not require price thresholds or suspension volumes, and thus would not suffer from these issues. However, a VSR could raise other administrative issues and BOEM recommends BSEE discuss this form of royalty incentive with the Office of Natural Resources Revenue.

Section 4.2: VSR Examples

This section uses cash flow data from an SCRR application to illustrate the effects of different discount rates and royalty relief policies. Figure 6 shows the effect that the discount rate has on the NPV of the SCRR project at various royalty rates. Figure 6 displays this relationship for the following royalty rates:

- 16.67%: The baseline royalty rate for the example project.
- 12.50%: The current royalty rate for shallow water leases.
- 7.59%: The royalty rate at which the project would have a zero NPV at a 25% discount rate.
- 0%: A zero royalty example for comparative purposes.

For all royalty rates, the project NPV decreases as the discount rate increases. A VSR policy would entail a VSR amount that would fill the gap between the dashed zero NPV line and the NPV of the project at a particular royalty rate and discount rate. However, since the VSR benefit would be not be received all at once (but rather at the rate royalties would not have to be paid), the amount of the VSR will be slightly higher than this gap. At a 25% discount rate:

- At a 16.67% royalty rate (and no VSR), the project would have an NPV of -$5.42 million.
- At a 12.50% royalty rate (and no VSR), the project would have an NPV of -$2.93 million.

Figure 7 illustrates the amount of VSR required to move up to the dashed black zero NPV line in Figure 6 from either the 16.67% or 12.50% royalty cases over a range of discount rates. Note that above a 34% discount rate, the project is below zero NPV even with a 0% royalty rate. At a 25% discount rate, the following VSR amounts would bring project NPV to zero:

- A $6.63 million VSR at a 16.67% royalty rate
- A $3.45 million VSR at a 12.5% royalty rate

Figure 6 - Project NPV by Discount Rate and Policy

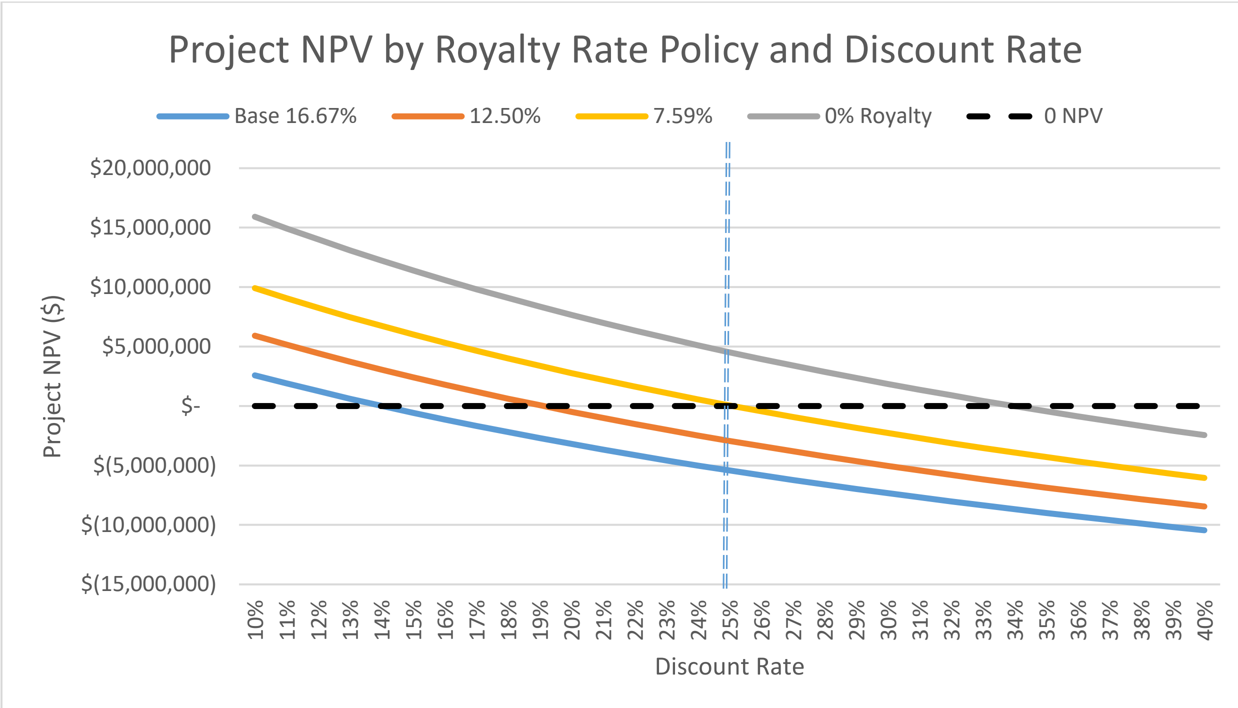


Figure 7 – VSR Required to Reach Zero NPV

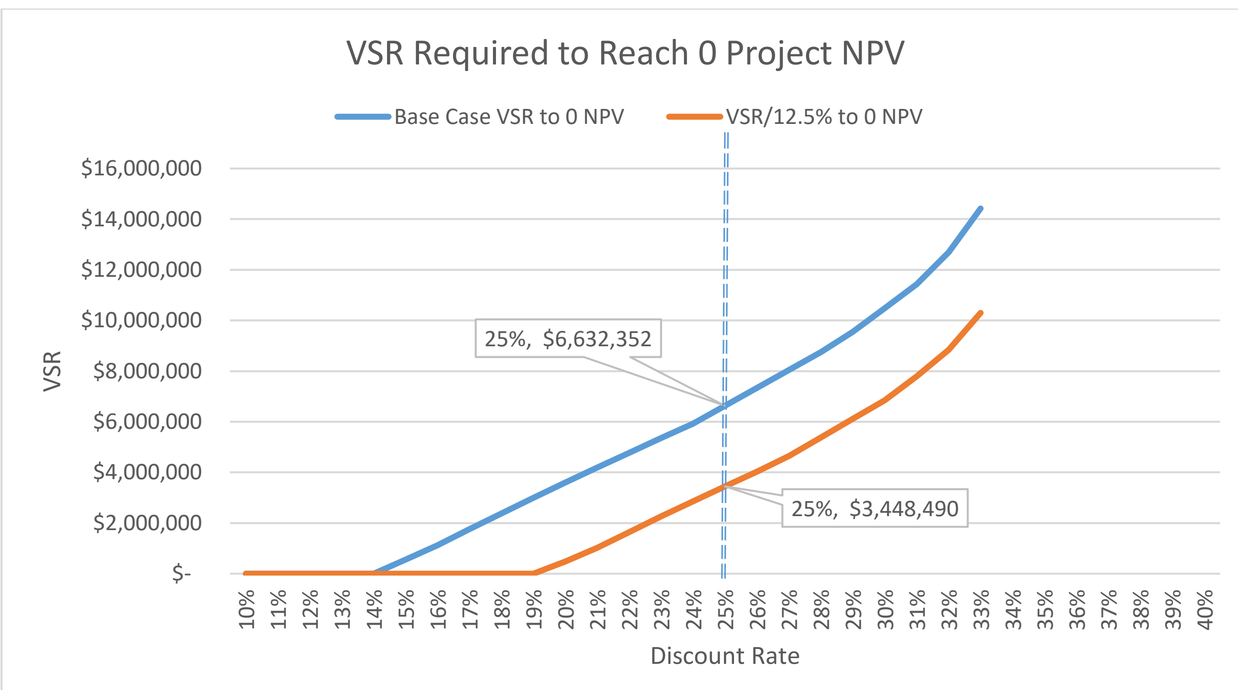


Table 1 compares the results (NPV and royalties collected) of various policy options to the baseline case of a 16.67% royalty rate and no VSR. The rows of Table 1 represent the following policies and royalty rates:

- A 16.67% royalty rate and no VSR (the baseline).
- A 12.5% royalty rate and no VSR.
- A 7.59% royalty rate and no VSR. Note that 7.59% is the royalty rate at which the project NPV is zero (so no VSR is needed to take NPV to zero). This is also the royalty rate that would be applied using a standard formulation of royalty relief.
- A 16.67% royalty rate and a VSR that would take NPV to zero.
- A 12.5% royalty rate and a VSR that would take NPV to zero.

Table 1 - Royalty Breakdown of VSR Policies

Policy @ 25% Discount Rate	Nominal Royalties Paid	Discounted Royalties Paid	VSR Amount	Nominal Less Royalty Collected	Discounted Less Royalty Collected	NPV
16.67% Royalty	$17,299,744	$9,946,349	$0	$0	$0	-$5,418,591
12.5% Royalty	$12,974,808	$7,459,762	$0	$4,324,936	-$2,486,587	-$2,932,003
7.59% Royalty	$7,875,157	$4,527,759	$0	$9,424,587	-$5,418,591	$0
VSR/16.67% Royalty	$10,667,392	$4,527,759	$6,632,352	$6,632,352	-$5,418,591	$0
VSR/12.5% Royalty	$9,526,318	$4,527,759	$3,448,490	$7,773,426	-$5,418,591	$0

The columns of Table 1 represent the following results (assuming a 25% discount rate):

- Nominal royalties paid: The nominal value of royalties paid over the project lifetime.
- Discounted royalties paid: The value of royalties paid discounted to the initial time period.
- VSR amount: The VSR amount for the particular scenario that takes the NPV to zero.
- Nominal less royalty collected: The nominal amount of lower royalties received under a particular scenario compared to the base scenario of 16.67% royalty and no VSR.
- Discounted less royalty collected: The discounted amount of lower royalties received under a particular scenario compared to the base scenario of 16.67% royalty and no VSR.
- NPV: The lifetime NPV of the project.

One can use the *7.59% Royalty* row and the *VSR/16.67% Royalty* row to compare the results of a standard royalty relief policy to a VSR policy. In particular, a VSR policy provides faster relief to the project operator, meaning that the nominal amount of foregone royalties is lower using a VSR policy than using a standard royalty rate reduction (although the discounted loss of royalties are identical under the two policies).

Chapter 5: Conclusions

BOEM has examined the available research and data regarding the appropriate discount rates to use in the context of Special Case Royalty Relief applications for shallow water oil and gas projects. When determining its policy recommendations, BOEM needed to account for the numerous factors that determine discount rates, and the fact that shallow water SCRR projects likely entail above-average risks. BOEM recommends that BSEE allow companies to self-report discount rates, but to impose an upper bound of 25% for shallow water leases. This 25% upper bound for shallow water discount rates allows companies to earn appropriate rates of return, and protects the government's right to receive fair amounts of royalty payments.

BOEM has also provided analyses regarding the use of a VSR, and BOEM recommends that BSEE consider applying royalty relief using a VSR formulation. A VSR provides the operator and the government with certainty regarding cash flows, and avoids some problematic features of other forms of royalty relief. A VSR could also simplify the accounting and tracking for both the lessee and the government. Implementing a VSR could raise administrative issues and require certain adjustments by the Office of Natural Resources Revenue. Therefore, if BSEE elects to examine potential future use of a VSR in its royalty relief decision-making, BOEM recommends that BSEE begin coordinating with BOEM and ONRR to ensure that there is sufficient time to work through any needed process changes.

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