Impact of the New Brazilian Fiscal System on Development of Oil Production Strategy


Abstract

Production strategy is an important component of the oil reservoir development phase. Among the main parameters are the geometry, number and position of wells and platform liquid capacity, influencing the level of the project investment required, which all depend on geological characteristics, economic scenarios and fiscal regimes. In the oil industry, companies produce under a fiscal system imposed by the government, which has a strong impact on economic and operational indicators, influencing production strategy.

Recently, the Brazilian government established a law changing its fiscal terms on pre-salt areas from Royalty and Tax (R&T) to Production Sharing Contract (PSC) to increase the government take. Previous works have shown that, in optimistic scenarios, an optimal recovery strategy presents low discrepancy in the production strategy configuration across both fiscal regimes. This study considers four economic scenarios for further evaluation. For this purpose, a simulation model was submitted to the production strategy selection process for both fiscal systems.

In more pessimistic economic scenarios, the results indicate that the number of wells and the level of investment tend to be lower under PSC than under R&T system. Thus, the new system could lead to fewer industrial investments, which would reduce the government return compared to the former tax system. In the most pessimistic scenario considered, profitable production could be expected under R&T, while under PSC it would be unprofitable, generating lower revenues.

It is still not clear whether a company, under PSC, will also be able to develop its strategy plan based on NPV or whether negotiation with the government regarding a minimum oil recovery factor will take place. Regardless, this study identifies the impact on production strategy selection for the new Brazilian PSC system compared to optimized strategy for R&T, and in both cases the objective-function is the company’s NPV. From the company’s point of view, depending on the economic scenario, the prevailing fiscal system will influence decisions at the level of the investment to be made. The results show the importance of considering the impact of the new fiscal system when selecting production strategies.

Key words: Production Sharing Contract, Production Strategy, Reservoir (Simulation), Economic Scenarios, Petroleum Engineering

Introduction

Selecting a development strategy is a very important task for the oil industry and has the purpose of enabling the exploitation strategy plan, which considers some variables such as physical, operational and economic restrictions. The great majority of cases select production strategy aiming to maximize revenues, choosing as objective-function the Net Present Value (NPV) as it also includes discount rate in its calculation. The strategy plan will then be assigned for an oil field, the result of which has to be in accordance with both company and government goals.

When a production strategy is being developed, the fiscal system has to be considered, since depending on the one in vogue the company will prefer investing in a different proportion. In Brazil, thirteen years after the establishment of the “Petroleum Law” n° 9.478 (Brazil, 1997), characterized by the national market opening through oil fields concession contracts, Brazilian government implemented a new law n° 12.351 (Brazil, 2010) changing its current fiscal regime from Royalty and Tax (R&T) to Production Sharing Contract (PSC) on pre-salt and other strategic areas. For the government, it is important that the establishment of a fiscal regime attract investors, allowing income to be directed to social benefits. According to Ribeiro Lima (2011), in general, in countries with a low relationship between petroleum reserves and consumption, where exploratory risks are high, R&T prevails, whereas countries with high oil potential tend to adopt the PSC fiscal system. In this context, with the
high reserve potential and good prospective recovery of pre-salt areas, the Brazilian government has changed the fiscal regime aiming for higher government take and consequently a better national development policy.

In addition to the regulatory system, each country has its own regulations established by law. Therefore, considering economic variables such as: discount rates, corporate taxes, royalties, involved costs, among others, a way to evaluate the project attractiveness is based on the prediction of the final profit percentage to the government, denominated as Government Take (GT). For both tax systems, R&T and PSC, these percentages are the ratio of net liquid revenue for each party and the total net liquid revenue from both parties, government and company. According to Johnson (2008), the world GT average is around 70% of net liquid revenue. However, this varies from approximately 25% in Ireland to over 95% in Iran.

Currently, the main types of fiscal regimes applied in the petroleum industry are concession, which includes corporate income tax and royalty payments, and production sharing contracts. Under the R&T system, the country gives the right of ownership title for the resource produced for a certain period of time in exchange for a portion of income achieved, with royalties and tax payments. This system is used in many countries such as Colombia, Egypt, Venezuela, Canada and United States. Regarding the PSC system, the government retains ownership of the natural resource produced and the company acquires the right to earn either a portion of the total oil production or in monetary value, according to the contract agreed. Countries such as Indonesia, India, China and Vietnam adopt this particular fiscal system for oil and gas (O&G) industry (Ernst & Young, 2012).

As changes in fiscal systems result in distinctive levels of government participation, it is important to identify viable economic scenarios, enabling the prediction of profitable scenarios for the oil industry in the midst of economic uncertainty. Previous works have showed that optimal production strategies present low discrepancies in configuration for both fiscal regimes in certain economic scenarios (Ravagnani et al., 2012). Now the question is whether this behavior remains consistent in more pessimistic economic scenarios. This work considers four deterministic economic scenarios to verify how the configuration and level of investments differ from one fiscal regime to the other. A simulation model is submitted to an oil production strategy selection process for both R&T and PSC.

Thus, this study evaluates the differences and similarities of optimized production strategy between the R&T and the PSC systems for pre-salt areas over different economic scenarios. The study also assesses the attractiveness of business for both the government and companies operating under the new Brazilian fiscal regime.

The Changes in Brazilian Fiscal Regime for the Pre-Salt Areas

Before 1997, the Brazilian oil industry produced oil under market monopoly. Petrobras being the state industry. The “Petroleum Law” no 9.478 (Brazil, 1997) allowed other companies to enter in the oil Exploration and Production (E&P) industry, and the National Agency of Petroleum, Natural Gas and Biofuels (Agência Nacional de Petróleo, Gás Natural e Biocombustíveis, ANP) was created to be responsible for the national political execution for the sector, and also for bidding oil blocks.

This concession contract model, applied to the Oil and Gas (O&G) industry consists of corporate income tax plus royalty based taxation (R&T), which is still in use today. Under this particular contract, the ANP establishes a minimum payment required of signature bonus, thus, the company that offers the greatest amount of signature bonus for the block to the government usually wins. However, there are also other parameters involved in the bidding process, such as higher royalty percentage or local content, that is, the percentage of local purchase and local professionals contributing to the project that they are willing to invest with. Although the usual winner comes from the highest proposed signature bonus, committing a higher percentage for local content (national investment proportion and participation) or offering a higher royalty percentage to the government are also important for a winning bid. For a company that wins the right to explore and produce, besides royalties and corporate taxes, there are other contributions involved such as area occupation payments and special taxes in cases of high production volume.

As from December 2010, the production sharing contract was established as the new regulatory framework directed specifically to the pre-salt and other strategic areas for Brazilian O&G industry. Under this contract, the winning bid is not which offers a greater signature bonus, but a greater percentage of the field production to the government, known as government share. The volume to be shared is basically the result revenue after royalty payments and cost recovery (where the company is allowed to recover 50% of the gross revenue over the first two years of production on operational costs and other investment expenses and 30% the following years), both a percentage of the gross revenue established in the contract. In fact, the first bid held for the exploration of Brazilian pre-salt (Libra oilfield) was sold on October 21, 2013, with a single bid made by a consortium composed of: Petrobras, Shell, Total, CNPC, and CNOOC, which paid an amount of US$6.63 billion as signature bonus to the Government. Also this consortium offered the Federal Government the required minimum of 41.65% of the pre-salt Libra field production. Furthermore, pre-granted pre-salt areas are being developed by a special concession contract model called onerous concession, where Petrobras was authorized to carry out the oil exploitation of 5 billion barrels of oil equivalent without a bid procedure. The onerous fiscal model basically follows concession contract rules.

When comparing both regulatory systems, the level of government participation items involved is different. In the concessionary system, it includes the signature bonus, royalties, special participation fees and occupation costs. In a production sharing contract, it includes signature bonus and royalties. In both cases, royalty is a percentage of the gross revenue production. As for the special participation percentage, it is only directed to concession contracts, and it is based on progressive tables, in cases of great volumes of oil production. This type of payment is not included in production sharing due to other kinds of
division of the oil-profit with the government and company shares established in the contract. Lastly, occupation or retention of area is also applicable only under R&T and for large production volumes.

Taking into consideration the rules of each fiscal system, values and percentage generally practiced in the oil industry, this study allows the comparison of investments to be made for each fiscal model on optimized strategy production. How the Government will regulate the level of investments companies (or consortium) will have to make under the new regime is still unclear. In the R&T system, as the companies acquire the right of oil ownership over the granted E&P period, maximized profits are the main goal. However, for PSC regulation it is uncertain, as this type of fiscal system aims for a larger amount of oil recovery, despite the above, this study assumes that under both fiscal regimes, the company will be able to produce aiming at maximize its own profits, therefore, developing strategy production based on NPV.

Methodology

Economic and operational parameters definition

The definition of an economic scenario takes into consideration common and specific fiscal parameters of each tax system. For this work, four different deterministic economic scenarios were selected with the purpose of creating a sensitivity analysis. The same probable economic scenario (at the time) as the one proposed in Ravagnani et al. (2012) is used and considered here as scenario 1, while the other three are gradually more pessimistic.

To define operational parameters, first we need to study the reservoir characteristics and the properties of the fluids. Then, we define important operating parameters such as well type and geometry. The recovery strategy definition will then include vertical/horizontal producer and/or injector wells. Finally, the production/injection pattern is set and based on the field and technical characteristics as well as available financial resources.

Exploitation strategy selection

The methodology adopted for the production strategy selection consists of 4 steps, based on the selection strategy process proposed by Mezzomo & Schiozer (2003) and Gaspar et al. (2014).

Initially, considering previously defined well types and geometry, along with the production/injection pattern, the numeric model is submitted to deterministic optimization procedure of the development design variables with high impact in the objective -function.

(1) Approximate initial number of wells and platform capacity definition: the initial strategy production must start with a certain number of wells and only then proceed to its optimization. In this study, an approximate number of producers is calculated using an equation that considers a stipulated oil recovery factor, the original oil in place (OOIP) in the field and the cumulative oil production of one well, according to Equation 1 (Botechia, 2012):

\[
N_{\text{producer}} = \frac{\text{OOIP} \times RF}{\text{Np well}}
\]

Considering the production/injection pattern previously set and the estimated number of producers, the number of injectors can also be estimated. Then, based on production profiles without imposing platform liquid production capacity restrictions, other simulations are then carried out imposing different liquid restrictions. It is possible to define a reasonable initial platform capacity with these results.

(2) Optimization of number of wells: after the initial exploitation arrangement is settled, an optimization procedure provides the ideal number of wells considering economic and operational parameters. The indicator used to measure economic performance of each well was the Net Present Value of the Production/Injector Well (NPVp, NPVv) proposed by Botechia et al. (2013), an adequate indicator for strategy production improvement. For that, producer and injector wells were added or removed according to their influence on the field NPV, obtained by calculating the difference between the NPV of the field with and without a specific well.

(3) Opening schedule definition and platform capacity adjustment: until this step, wells were opened simultaneously to be compared under the same conditions. As the number of wells are optimized, the well opening scheduling is defined according to their productivity behavior. With updated strategy results, adjustments are made in the platform capacity.

(4) Well placement: aiming to maximize the NPV of the field, the wells are placed in other locations considering the best regions of oil per area unit map.

This study has no intention to indicate the best methodology strategy for an oil field, the aim is to compare the results of optimized production strategies developed for different fiscal regimes based on an efficient optimization procedure. Furthermore, the objective-function used for this optimization process is only based on the NPV of the company, not considering a possible agreement between both parties, government and company, regarding minimum exploitation volume, for example.

Optimized strategies analysis for each fiscal system

After selecting an optimal strategy configuration for each economic scenario and each fiscal regime, the last step of the study consists in comparing the following economic and technical evaluation indicators:
• Strategies configurations (total number of wells, injectors/producers and platform capacities)
• Cumulative oil production ($N_p$)
• Net present value (NPV)
• Investment present value (IPV)
• Return of investments (ROI)
• Government revenue (GR)
• Government take (GT)

These evaluation indicators are calculated for further analysis between both fiscal regimes. The IPV indicator includes development investments, such as capital platform costs, well perforation costs and initial necessary investments. The GR includes, in monetary value, the government participation of the specific fiscal system, and other taxes such as corporate taxes (for both fiscal regimes) and the corresponding value of the oil from the government share (for PSC cases).

With these results we analyze similarities and differences among selected production strategies under different tax systems in a specific economic scenario.

Application

Simulation model description

The strategy evaluation between both fiscal regimes, R&T and PSC, were conducted in a carbonate synthetic reservoir model containing 32º API. The geological characteristics correspond to trombolite-stromatolite formations, as described in Adams et al. (2005). The original oil in place has an estimated volume of 616 million barrels, partially fractured, composed of permeable and impermeable fractures and with no aquifer or gas cap. Also, the model is compound by a grid with 158,928 blocks (8x77x24), with dimensions of 70x70m and approximately 100m deep.

Figure 1 illustrates a three dimensional oil map per unit area with the initial production strategy containing 25 wells, with 16 producers and 9 injectors. As seen, the chosen recovery pattern is the five-spot. This configuration is initially chosen for both fiscal systems and for each economic scenario to be optimized. The maximum production period considered is 30 years.

According to a previous study (Ravagnani et al., 2012) of this particular synthetic reservoir the production and injection capacities of the platform are 13,000 and 15,000 $m^3$/day, respectively. In addition, producers and injectors were set to operate at the maximum bottom-hole pressure of 200 kgf/cm² and 400 kgf/cm², respectively, and with maximum production liquid rate and maximum injection water rate of 1500 and 1400 $m^3$/day, respectively.

Economic parameters

There are many economic parameters involved in a fiscal system. Some are established by law, others depend on the specific contract. Table 1 presents common economic parameters to both systems. Royalty and corporate taxes are established by law and are considered in both fiscal regimes in study.

Table 1: Common economic parameters for both tax systems.
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depreciation (years)</td>
<td>10</td>
</tr>
<tr>
<td>Discount rate (% per year)</td>
<td>10</td>
</tr>
<tr>
<td>Initial Investment (millions USD)</td>
<td>100</td>
</tr>
<tr>
<td>Royalty (%)</td>
<td>10 (R&amp;T) and 15 (PSC)</td>
</tr>
<tr>
<td>Corporate Taxes (%)</td>
<td>34</td>
</tr>
</tbody>
</table>

There are other parameters that are applied to a specific fiscal model. Tables 2 and 3 present those values for R&T and PSC systems, respectively.

Table 2: Specific parameters of R&T system.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social contribution taxes levied on gross revenue (%)</td>
<td>9.25</td>
</tr>
<tr>
<td>Special Participation Fee (%)</td>
<td>Up to 40</td>
</tr>
</tbody>
</table>

As previously mentioned, social contribution taxes are associated with an internal program of the national government referring to social integration and security contribution of the country. As for the special participation fee, it is an additional required contribution taxed on the profit made from fields with great production volume or profitability.

Table 3: Specific parameters of PSC system.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Recovery (%)</td>
<td>50 initially/30</td>
</tr>
<tr>
<td>Government share (%)</td>
<td>41.65</td>
</tr>
<tr>
<td>Company share (%)</td>
<td>58.35</td>
</tr>
</tbody>
</table>

In the PSC system, after royalty payment, the operator may recover costs related to exploration, operation and abandonment. There is a limit on this recovery which is a percentage of the gross revenue which is established at beginning of the fiscal contract. Once those costs are recovered, the remaining oil is shared between the exploratory operator and the government. This division portion is also previously settled in the PSC and is denominated company and government share. The 41.65 percentage chosen for this study is based on the minimum amount to be offered of surplus in oil for the Federal Government established in the first production sharing contract for exploration and production of oil and natural gas (Brazil, 2013). In the contract, there is a progressive table in which the amount offered may vary according to the production per active production wells and to the oil price (Dated Brent). Government share assume higher percentage with increase of oil prices and well productivity.

Finally, Table 4 presents the economic variables that differentiate all four economic scenarios of this study.

Table 4: Deterministic economic parameters for both fiscal regimes.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SCENARIO 1</th>
<th>SCENARIO 2</th>
<th>SCENARIO 3</th>
<th>SCENARIO 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil price (USD/m³)</td>
<td>409</td>
<td>359</td>
<td>340</td>
<td>315</td>
</tr>
<tr>
<td>Oil production cost (USD/m³)</td>
<td>75.5</td>
<td>88.0</td>
<td>96.2</td>
<td>97.5</td>
</tr>
<tr>
<td>Water production cost (USD/m³)</td>
<td>12.6</td>
<td>18.9</td>
<td>28.3</td>
<td>31.4</td>
</tr>
<tr>
<td>Water injection cost (USD/m³)</td>
<td>6.3</td>
<td>12.6</td>
<td>12.6</td>
<td>15.7</td>
</tr>
<tr>
<td>Well investment (USD millions/well)</td>
<td>65</td>
<td>75</td>
<td>83</td>
<td>90</td>
</tr>
<tr>
<td>Abandonment costs (USD millions)</td>
<td>28.6 – 29.2</td>
<td>26.4 – 28.6</td>
<td>23.9 – 26.4</td>
<td>25.3</td>
</tr>
<tr>
<td>Platform Investments (USD million)</td>
<td>573 - 584</td>
<td>528 - 573</td>
<td>480 - 528</td>
<td>507</td>
</tr>
</tbody>
</table>

Note that the oil prices from these chosen economic scenarios decrease whereas operational costs increase. Normally, the opposite occurs, since the oil cost follows the rise in expense. However, the aim here is to evaluate optimal production strategies responses over more pessimistic economic scenarios. For this, selection of exploitation strategies is carried out based on the criteria of NPV maximization for both fiscal regimes.

Results and Discussion

The production strategy selection process yielded eight production strategies with NPV as the objective-function, considering that exploitation occurs under two different fiscal regimes and four economic scenarios. Table 5 presents the
amount of producers and injectors resulting from each strategy. As seen, production strategies present low discrepancies in the configuration for the most optimistic scenario in both fiscal regimes, considerably differing from more pessimistic scenarios. In scenario 4, for example, 12 wells were obtained for R&T system, however, for PSC system no profitable production strategy were achieved.

Table 5: Numbers of wells for each economic scenario and fiscal regime after optimization.

<table>
<thead>
<tr>
<th>Total Number of Wells</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Sharing</td>
<td>18</td>
<td>14</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>Royalty and Tax</td>
<td>19</td>
<td>18</td>
<td>17</td>
<td>12</td>
</tr>
</tbody>
</table>

The next optimization process aims to strategically positioning wells in the reservoir. Therefore, the most productive and, consequently, most profitable wells remain in the production strategy. Geological characteristics strongly contribute to well productivity. Thus, parameters such as permeability, porosity, oil saturation and other reservoir characteristics: permeable or sealant, fractures and faults affect the wells positioning and type. Figure 2 shows the effective fracture permeability map (md, horizontal I axis) of the reservoir model of the natural fractures and the initial strategy configuration for this study.

Figure 2. Effective fracture permeability map of the initial production strategy.

In our simulation, a maximum of 30 years exploitation is considered (although in reality this period can be extended depending on the case). Having the NPV as objective-function, Figure 3 shows the maximum time period of which the net cash flow is positive for each case.
Figure 3. Selected strategy production period for each fiscal regime and economic scenario.

Naturally, with fewer wells, cumulative oil production tends to diminish (Figure 4). Note that for the most pessimistic scenario - 4, only one blue point is shown corresponding to the cumulative oil production obtained under R&T. In this case, results of cumulative oil production for PSC is not presented due to impractical production, thus a company would not carry out this unprofitable strategy. As for optimized configuration for both fiscal regimes for the optimistic economic scenario 1, a similar recovery factor is obtained due to similar configuration strategies.

Figure 4. Cumulative oil production for different economic scenarios.

Results of the company NPV are presented in Figure 5. Both fiscal regimes have decreased NPV, as expected, over more pessimistic scenarios. Regarding monetary values, a company would benefit more from producing under concessionary terms than under Brazilian production sharing contract. However, even with the discrepancy of NPV values, it is still worth producing up to a certain point under both fiscal regimes. The only aspect that requires special attention is producing under pessimistic scenarios. For the company, unviable productions are first achieved through PSC and then through the R&T system, as shown in the scenario 4.
Figure 5. Net present value for each economic scenario and tax system.

Figure 6 shows how much development investment would be necessary to produce using each strategy considering the fiscal system and the scenario involved. It is noticeable that under concessionary terms the company has more opportunity to invest due to higher expected earnings. As previously mentioned, the IPV considers all investments made but brings it to the value at the present time.

Figure 6. Investment present value for each strategy.

The return of investment (ROI) was calculated for each selected strategy of the study. This indicator enables the efficiency evaluation of an investment for the company. Comparing values of ROI among all economic scenarios, a greater ROI is achieved in the optimized production strategy under the R&T system. As cited previously, for scenario 4, there is no ROI calculation due to an unprofitable strategy under this condition. Figure 7 shows how it is not always advantageous for the government to adopt PSC as the standard fiscal regime for E&P industry. This is because depending on the financial situation of the period, either the companies would not invest as much as they would in concessionary terms or they would not be attracted enough to invest in the project.
As for the government, Figure 8 shows the GT for each analysed case. Development under PSC system provides higher GT than from the strategies optimized for R&T system. However, as mentioned before, unviable productions are first achieved through PSC system (scenario 4). Therefore, in these cases, the production development is better under R&T terms for both the company and government. Furthermore, as the scenario gets more pessimistic, the GT rises, which may further repel investors.

When analyzing monetary value, Figure 9 shows the results of GR for each optimized production strategy. In scenarios 1 and 2, a higher GR is achieved in strategies developed under PSC system. However, in scenario 3, although a different GT is obtained for both strategies under economic scenario 3 (99% under PSC against 71% under R&T system), the government receives the same amount of revenue, a total of USD 2215 million.
Figure 9. Government revenue for each optimized production strategy.

Note from results for scenario 3 (Figure 8 and Figure 9), that even with higher GT, the government would profit just the same if the production strategy were developed under a concessionary fiscal system. For scenario 4, under the production sharing contract it would be unprofitable for the company to produce oil, resulting in an absence of revenue for the government, as seen with the lack of results for PSC. Also, it is important not to misinterpret both GR (monetary values) and GT (percentage) indicators, as one decreases with pessimistic scenario, the other increases.

With these results, we can analyze each optimized production strategy for a specific economic scenario. Also, this study enabled both fiscal regimes comparisons over more rigorous scenarios. Overall, the main differences in strategy configuration and investment are when the company has to develop the project under more pessimistic scenario. Finally, we once more highlight that these strategies where selected on the assumption that the new Brazilian PSC will allow companies to develop a production strategy only based on their NPV maximization.

Conclusions

The selection of the optimal production strategy for two different fiscal regimes, concession and production sharing contract was shown in this work for four deterministic economic scenarios. As examined in previous work (Ravagnani et al., 2012), the operational configuration between both systems does not differ substantially when production strategy is developed under more optimistic economic scenarios. However, when facing economically unfavorable scenarios, care is required because the optimum configuration will differ and possibly lead to companies not producing depending on the fiscal terms involved.

From a company’s perspective, the optimized strategy according to the PSC system is not as favorable as with the R&T system due to lower NPV revenue. Consequently, as the scenario becomes more pessimistic, it becomes unviable to produce under PSC, whereas under a concessionary system it would still be profitable. The return of investment naturally achieves smaller values for production sharing or no value at all when compared with the ROI for R&T regime, under the same deterministic scenario.

As for the government, the PSC allows higher GT as expected for this particular fiscal regime. However, this may change in other economic scenarios. If the oil industry faces an unfavorable economic scenario, companies will make even fewer investments (fewer under PSC), resulting in higher GR under R&T terms and compromising the main objective of the regulatory change, to enhanced government participation.

Nomenclature

E&P Exploration and Production
GT Government Take
IPV Investment Present Value
$N_{producer}$ Number of Producer Wells
$N_{well}$ Cumulative Oil Production of one Well with no Constraints
O&G Oil and Gas
NPV Net Present Value
OOIP Original Oil in Place
PSC Production Sharing Contract
R&T Royalty & Tax
RF Oil Recovery Factor
ROI Return of Investment
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