Abstract
The motivation for this study is the expected intensification of bid rounds for Brazilian Pre-salt, while adopting the Production Sharing Contracts (PSC). The objective of this work is to present a risk analysis of key parameters (average well production and price) that determine the percentage of surplus in Oil for the Government at PSC, in Brazil. The percentage of sharing offered is been used to choose the winner in the Bid Round of Pre-salt areas, as in Libra.

Based on the production history of 39 wells since 2009 of two Pre-salt fields, a frequency distribution for production per well is analyzed. The process to perform the risk analysis included, first, the identification of the variability of the well production in Brazilian Pre-salt, showing key issues by field, by location in the reservoir. Further, a probabilistic function of the average production per well is estimated, as well as the average decline rate of well production is calculated to be used in the forecast of production curve per year for a typical module/ FPSO, considering 12 wells starting production in an chronogram that optimize a 150 Mmbbl/day FPSO capacity.

The values estimated from probabilistic functions of petroleum price and production per well are used to determine production sharing percentage, applying the same process used in the Bid round of Libra's block (Brazil, 2013). The probabilistic function of petroleum price is based on estimates of specialized Institutes.

Through a Monte Carlo simulation, using random choices of (i) average well production and (ii) price, it is generated a probabilistic distribution of the percentage of surplus in Oil for the Government at PSC for Brazil.

The results of this work may be used in future studies of the fiscal system of PSC in Brazil, to make a risk analysis of the offer to be done in the Bid Round of Pre-salt Fields in Brazil.
Introduction

In 2000, the main fields currently in production in the legal pre-salt were acquired in the bid for exploratory blocks Brazil Round 2, in the Santos Basin, under Concession Regime, by the consortium: Petrobras (65%), Group BG (25%) and Petrogal (10%) (Brazil, 2000).

In 2006, a discovery in an exploratory well marked the origin of what would be the pre-salt legal polygon. The size of the new oil province has caused the National Council for Energy Policy - CNPE to withdraw from the auction forty blocks near the pre-salt that would be offered in the 9th Bidding Round of Exploratory Blocks and to begin the discussion of a new legal framework, which is currently called sharing of production.

As a result of this discussion, the National Congress approved the Laws that define the Regulatory Framework of the pre-salt in 2010: (i) nº 12.276 (onerous assignment to Petrobras), (ii) nº 12,304 (creation of PPSA) and (iii) nº 12.351 (production sharing regime and Social Fund).

In this new model, the CNPE established the technical-economic parameters and authorized the 1st Round of Bids for Exploratory Blocks under the scheme of production sharing in October 2013.

For the 1st PSC auction, the bid offered was the percentage of surplus in oil for the Government to be put in the Table 1, yellow cell, to build a range of percentage of sharing for the government that will be determined, in each period, based on the current average production per active well and price.

The percentage of the surplus in oil for the Federal Government to be offered, by the tenderers, should be relate to the oil price (Brent dated), between $100.01 and $120.00, and the column corresponding to the production per active producing well corresponding to between 10 and 12 thousand barrels/day (Brazil, 2013).

The offerings should be composed exclusively with the indication of the percentage of surplus in oil for the Federal Government, respecting the minimum percentage of 41.65%.

Table 1 – General Table to Offer Minimum Percentage (%) of Surplus in Oil for the Government.

<table>
<thead>
<tr>
<th>Price Brent (US$/bbl)</th>
<th>From To</th>
<th>0</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
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<td>0,00</td>
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<td>31,72</td>
<td>15,85</td>
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<td>1,48</td>
<td>0,86</td>
<td>0,29</td>
<td>0,23</td>
<td>0,69</td>
</tr>
<tr>
<td></td>
<td>0,01</td>
<td>80,00</td>
<td>26,45</td>
<td>12,85</td>
<td>7,51</td>
<td>4,70</td>
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<td>0,54</td>
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<td>0,48</td>
<td>0,92</td>
<td>1,32</td>
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<tr>
<td></td>
<td>0,02</td>
<td>100.00</td>
<td>19,44</td>
<td>8,86</td>
<td>4,71</td>
<td>2,52</td>
<td>1,14</td>
<td>0,00</td>
<td>0,71</td>
<td>1,13</td>
<td>1,51</td>
<td>1,85</td>
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<td>120.00</td>
<td>14,98</td>
<td>6,32</td>
<td>2,92</td>
<td>1,13</td>
<td>0,93</td>
<td>1,51</td>
<td>1,86</td>
<td>2,17</td>
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<td>140.00</td>
<td>11,89</td>
<td>4,56</td>
<td>1,69</td>
<td>0,17</td>
<td>0,79</td>
<td>1,57</td>
<td>2,07</td>
<td>2,36</td>
<td>2,62</td>
<td>2,86</td>
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<td>2,04</td>
<td>2,47</td>
<td>2,72</td>
<td>2,95</td>
<td>3,16</td>
<td>3,34</td>
</tr>
<tr>
<td></td>
<td>&gt; 160,01</td>
<td>5,94</td>
<td>1,18</td>
<td>0,69</td>
<td>1,68</td>
<td>2,30</td>
<td>2,81</td>
<td>3,13</td>
<td>3,32</td>
<td>3,49</td>
<td>3,65</td>
<td>3,73</td>
<td>3,91</td>
</tr>
</tbody>
</table>

AF = Amount offered. Source: Brazil, 2013

In the 1st PSC auction, a single consortium submitted a proposal, with the minimum bid stipulated, 41.65% of the percentage of surplus in oil for the government. The winning consortium comprises the following companies: Petrobras (40%), Anglo-Dutch Shell (20%), French Total (20%) and Chinese companies CNOOC (10%) and CNPC (Brazil, 2013). Table 2 shows the final table of surplus in oil for the government based on the bid offered.

Recently, Resolution 05/2016 of the CNPE was published in the Official Gazette (DOU), authorizing the ANP to develop studies to make feasible the execution of the 2nd bidding of blocks for exploration and production of oil and natural gas, under the regime of production sharing, in unitized areas in the region of the pre-salt polygon.

In order to present a risk analysis of key parameters (average well production and price) that determine the percentage of surplus in oil for the government at PSC, in Brazil, it was used the
production data from the two main Pre-salt fields in the phase of production and development, Lula and Sapinhoá. These fields are under the Concession Regime.

Table 2. Table of Percentage (%) of Surplus in Oil for the Government Resulted in the Bid of Libra.

<table>
<thead>
<tr>
<th>Price Brent (US$/bbl)</th>
<th>From</th>
<th>To</th>
<th>0</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
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<td></td>
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<td>42,57</td>
<td>42,97</td>
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<td>100,00</td>
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<td>39,13</td>
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<td></td>
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<td>44,97</td>
<td>45,14</td>
<td>45,30</td>
<td>45,38</td>
<td>45,56</td>
</tr>
</tbody>
</table>

Lula discovery was made in Ago/2006; the commerciality and production start was in Dec/2010. The current development plan considers 10 modules/ FPSOs, six already in the production phase, the first ones with 100 and 120 Mbb/d liquid capacity and the others eight with 150 Mbb/d. In Jun/2016, there were 105 wells installed, 77 producers, 66 injectors and 16 abandoned. (ANP, 2017)

Sapinhoá discovery was made in Jun/2008, the commerciality and production start was in Dec/2011 and Jan/2013, respectively. The current development plan considers two modules/ FPSOs already in the production phase, both with 150 Mbb/d liquid capacity. In Jun/2016, there were 33 wells installed, 15 producers, 12 injectors and three abandoned. (ANP, 2017)

The Resolution 05/2016, CNPE, authorized the ANP to include in the 2nd bidding of blocks for exploration and production, under the regime of production sharing, unitized areas with Sapinhoá.

The location of Lula, Sapinhoá and Libra in Santos Basin is showed in Figure 01.

Figure 1. Location of Lula and Sapinhoá Fields, Source: BDEP Webmaps, 2017

In Figure 2, it is possible to see the relative positions of the FPSOs in the fields of Lula and Sapinhoá.

In Sapinhoá, the FPSO Ilha Bela is in the north, while FPSO Sao Paulo is in the south. In Lula, from north to south, there are the following FPSOs (a) Cernambi area: Itaguai and Mangaratiba; (b) Tupy area: Paraty, Marica, Saquarema and Angra d. Reis (Marine Traffic and BDEP Webmaps, 2017).
The production data per well for all Fields in Brazil is public and is available in National Agency of Petroleum – ANP website (ANP, 2017). A database with the historic data of production for Lula and Sapinhoá was collected in ANP website. Also, the database informs the FPSO that the well is connected.

Production data collected from the start of production until Jun/2016, includes 46 wells, 35 in Lula and 11 in Sapinhoá. Since each well includes all monthly historic data, 766 production data is available. Some monthly data are clearly outliers, since it was collect in the start or end of the well production. The average monthly production of the database, as it will be showed, is significantly higher than 10 Mbbl/day. In order to eliminate outliers, it was excluded from the database values of production less than 1 Mbbl/day. The remaining database contains data from 39 wells with a total of 735 samples, 539 in Lula and 196 in Sapinhoá. Figure 3 shows the number of wells (w) and samples (s) of the database by FPSO.

<table>
<thead>
<tr>
<th>#Well (w) and #Samples(s)</th>
<th>(Cernambi area)</th>
<th>(Tupy area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Itaguai (2015)</td>
<td>5 w, 31 s</td>
</tr>
<tr>
<td>2</td>
<td>Mangaratiba (2014)</td>
<td>6 w, 83 s</td>
</tr>
<tr>
<td>(3)</td>
<td>Paraty (2013)</td>
<td>5 w, 117 s</td>
</tr>
<tr>
<td>(4)</td>
<td>Mariça (2016)</td>
<td>3 w, 9 s</td>
</tr>
<tr>
<td>(5)</td>
<td>Saquarema (2016)</td>
<td>na</td>
</tr>
<tr>
<td>(6)</td>
<td>Angra d. Reis (2010)</td>
<td>6 w, 261 s</td>
</tr>
<tr>
<td></td>
<td>-Exploratory Rigs</td>
<td>4 w, 38 s</td>
</tr>
<tr>
<td>Lula</td>
<td>29 w, 539 s</td>
<td></td>
</tr>
<tr>
<td>(7)</td>
<td>Ilha Bela (2013)</td>
<td>4 w, 61 s</td>
</tr>
<tr>
<td>(8)</td>
<td>Sao Paulo (2014)</td>
<td>5 w, 102 s</td>
</tr>
<tr>
<td></td>
<td>-Exploratory Rigs</td>
<td>1 w, 33 s</td>
</tr>
<tr>
<td>Sapinhoá</td>
<td>10 w, 196 s</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39 w, 735 s</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Amount of production samples by FPSO.
Methods, Procedures, Process

Based on the production history of 39 wells since 2009 of Lula and Sapinhoá fields, a frequency distribution for production per well was analyzed. The universe of data considered was the production per well in each month. Thus, the monthly production rates were considered as different samples for each well.

A histogram of those data was built and an adjusted set of data was considered in order to qualify the variability of data by field, location in the reservoir/ FPSO.

The average decline rate of well production was calculated to be used in a curve of production forecast per year.

A probabilistic function of the average production per well was estimated, considering a typical module of production with 12 wells, starting production at an appropriate chronogram to optimize a 150 Mbbl/day FPSO capacity.

Petroleum price scenarios were built based on key specialized Institutes estimates.

The criteria for winning used in the Bid of Libra’s (2013), in Brazil, based in a table of average production versus price, was considered to determine production sharing percentage, per year.

Through a Monte Carlo simulation, using random choices of (i) average well production and (ii) price, it was generated a probabilistic distribution, per year, of the percentage of sharing between Oil Companies and Government at PSC for Brazil, for a typical module.

Results, Observation, Comments

Figure 4 presents for both fields, Lula and Sapinhoá, a frequency distribution for the 735 production data available.

The probability distribution for production per well has three main ranges of production: Range1 (1 to 4 Mbbl/day), Range2 (4 to 19 Mbbl/day) and Range3 (19 to 42 Mbbl/day).

Figure 5 shows the comparison between the frequency distribution for production in Lula and in Sapinhoá. Since Lula has more than twice the number of samples than Sapinhoá, the peaks of the bimodal distribution are determined by the samples of Lula.

Sapinhoá, as a younger field with 42 months of production data, also has its frequency distribution bimodal, but in a more subtle and stable pattern.

It can be noticed that the frequency distribution for Lula in the first 42 months (Lula_young) also had a more subtle and stable pattern, similar to Sapinhoá. There is a relevant difference in Lula, the presence of wells with higher production rates (between 30 to 36 Mbbl/day) than in Lula_young, considering only the initial 42 months.

When comparing the frequency distribution for Lula, including all historic data, with that of Sapinhoá, it is noticed that there are wells/ samples with similar frequency of those of Sapinhoá (between 30 to 36 Mbbl/day).

Thus, it is reasonable to believe that, most likely, in the future, the frequency distribution for Sapinhoá will evolve with more samples and will be well represented by the frequency distribution that includes all the current historic data of Lula and Sapinhoá. This will represent an overall frequency distribution for production rate in the pre-salt polygon.
Figure 4. Frequency distribution for all production data in Lula and Sapinhoá until Jun/2016.

Figure 6 presents Sapinhoá’s FPSOs frequency distribution for production. FPSO Ilha Bela in the north, mainly in the range of production 19 to 41 Mbbl/day, presents more frequency of wells/ samples with higher production rate (> 30 Mbbl/day) than FPSO Sao Paulo, in the south.

The reason of that difference of behavior may be due to (i) reservoir characteristics (ii) injection support (iii) time of production/ number of sample. FPSO Ilha Bela has almost one year more of production and twice the number of sample than Sao Paulo has. It reinforce the assumption that the FD for production in pre-salt evolves with time/ amount of samples and that the FD that includes all the current historic data of Lula and Sapinhoá will represents an average overall FD for the production rate in the pre-salt polygon.

Figure 7 and 8 presents Lula’s FPSOs samples of production.

FPSO Angra d. Reis, the first one to start production in Lula, 2010, has more than twice the number of samples than any other FPSO. The FD for the samples of this FPSO is quite similar to that of all sample.

Being the first definitive unit of production in the field, its production history, most likely, provided knowledge that was incorporated into the following units.
This may be the reason why the FPSOs Paraty and Mangaratiba present significantly more frequency of samples with higher production rates, in the range of 28 to 32 Mbbl/day for the second unit, Paraty, and 29 to 34 Mbbl/day for the third unit, Mangaratiba. This continuous improvement demonstrate the learning curve of Petrobras in producing at pre-salt.

It is important to mentioning that FPSO Mangaratiba is positioned in a reservoir in the Northwest of Lula. This reservoir is considered by Petrobras as independent from the main reservoir of the field (Petrobras, 2010), in the south, where the FPSOs Angra and Paraty are positioned. The difference of reservoir characteristics also may be responsible for its productivity.

Similar to Lula’s units, Paraty (2013) and Mangaratiba (2014), the units of Sapinhoá also started production in the same years. Since Sapinhoá in average presents more frequency of samples with higher production rate than the average that of Lula, beside the reservoir differences, the learning curve acquired in Lula, most likely, beneficited Sapinhoá.

FPSO Saquarema started production in the 2nd half of 2016 and has no samples in the database analyzed. FPSO Itaguai and Maricá have few samples because the recent production start and, also, most samples includes commissioning operations period, that are not well representative of the steady production.
In Figure 9, the blue line “ALL(e)” is the plot of the frequency distribution generated to represent all selected samples in the database.

The “ALL(e)” distribution was built as the weighted sum, by number of samples, of three lognormal distributions designed to represent the “Rng1”, “Rng2” and “Rng3”.

These three lognormal distributions were generated based on average and standard deviation of the production samples in each range of production – “Rng1” (1 to 4), “Rng2” (4 to 19) and “Rng3” (19 to 42), all in Mbbl/days.

Since the majority of the population has an average higher than 10 Mbbl/day, the “Rng1” was assumed to represent outliers of production samples, most likely in the beginning or end of well production.
To evaluate the behavior of the well production in time, it was realized a decline analysis for the most representative wells. Figure 10 shows, as an example, the chart of monthly history of production for 4 well in the FPSO Angra d. Reis, as well as the exponential curve fitted, which presents the month decline rate.

Since there are few years of production, in order to estimate the annual decline rate, it was used the monthly data, determined the monthly decline rate and estimated the annual rate as the monthly rate multiplied 12 times. This proxy is the best estimate of the annual decline rate of wells in pre-salt.

Table 3 consolidates the results for the most representative wells in Lula and Sapinhoá. Also, it was estimated a proxy of annual decline rate for each FPSO, field and the average of all wells in Lula and Sapinhoá. All the estimates for group of wells were calculated as a weighted average, considering the number of months with data as the weight.

Considering the method described, the average annual decline rate found for Lula is 9.9%, for Sapinhoá is 10.9% and for all the wells considered is 10.2%.

These results are based on the available data and an affected by lots of uncertainties. It is not possible, watching only the production data of the well, to identify if the decline observed is due to the reservoir behavior or reflects an operational restriction.

Anyway, this study will consider the value 10.2% as the average decline rate of a typical well in the pre-salt. In the final analysis, there will be evaluate, in a sensitive analysis, two more scenarios 5% and 15% of decline rate.

Again, it is noticed that the wells with short history, less samples, present values distant from the average behavior. The weighted average by number of months balanced the overall average.
Figure 10. Example of decline analysis for wells in FPSO Angra d. Reis, Lula.

Figure 11 presents an estimative of a standard curve of production for a typical well and for a typical module of production (considering 12 wells, optimized chronogram to stabilize productivity in a 150 Mbbbl/day FPSO capacity), as well as the average curve of production per well for a typical module.

These curves were generated with the following process:
1. For the typical well, first year production rate was considered as the average of the distribution “ALL(e)” presented in Figure 9. The average of the following years were estimated applying the annual decline rate presented in Table 3 (Typical Well).
2. For the typical module, it was considered 12 wells, starting producing in an optimized chronogram. The first six wells started every four months and from the 7th to the 12th well, it starts as soon as there is FPSO capacity due to decline of previous wells (Module 12 Wells).
3. Finally, the total production curve for the module was converted in an average per well curve (Typical Module).

In Figure 12, chart 1 shows, for every five years, the evolution of the frequency distribution for production per well in a typical module of production. This chart 1 was built based in the following premises:
1. Frequency distribution “ALL(e)”, presented in Figure 9, was adapted and is the weighted sum of FD “Rng2” and “Rng3”. The adaptation was to eliminate the range “Rng1”, because those data were considered outliers.
2. For the first year:
   a. Lognormal average and standard deviation for “Rng1” and “Rng2” were determined from database.
   b. The distance of the averages of “Rng1” and “Rng2” to that of “ALL(e)”, in numbers of standard deviation of “ALL(e)” was estimated.
3. For the following years:
a. the average of “ALL(e)” was considered as the result of the decline rate applied to the average of the first year;
b. the average of the “Rng2” and “Rng3” were determined adding, to the “ALL(e)” average, in each year, that distance of the first year;
c. The standard deviations were considered equal to the first year;
d. Lognormal distribution “Rng2” and “Rng3” for the following years were estimated;
e. Finally, “ALL(e)” for the following years is again the weighted sum of “Rng2” and “Rng3”.

4. It was plotted the average of the distribution (a) “Rng2”, upper red line, (b) “ALL(e)”, dashed red line in the middle, and (c) “Rng2”, dashed lower red line.

Table 3. Proxy of annual decline rate per well in Lula and Sapinhoa.

The frequency distribution for petroleum price was built based on key specialized Institutes estimates (Petrobras, 2016). In Figure 12, chart 2 presents a lognormal distribution of price, with mode around 50 US$/bbl and range from 20 to 120 US$/bbl that was considered to generate random values of price to the Monte Carlo simulation.
Through a Monte Carlo simulation, using random choices of (i) average well production and (ii) price, it is generated a probabilistic distribution, per year, of the percentage of sharing between Oil Companies and Government at PSC for Brazil, for a typical well.

Figure 13 shows the synthesis of the risk analysis performed for de percentage of sharing. The idea is to reproduce the elements of the table that determines the criteria of sharing, based in the average production per well and price.

![Figure 11. Curve of production for a typical well and for a typical module.](image)

![Figure 12. Probabilistic distribution of the sharing percentage to the government, per year.](image)

There are three main charts in Figure 12:

5. In the top right, the chart 1 shows the evolution of the probability distribution for production per well for a typical module of production, based on a decline rate per well, described in Figure 11;
6. In the bottom left, the chart 2 presents a lognormal distribution of price, with mode around 50 US$/bbl and range from 20 to 120 US$/bbl;

7. In the bottom right, the chart 3 presents the result of a Monte Carlo simulation, that shows the value in Table 2 of percentage of Surplus in Oil for the Government resultant from sorted random values of price (item 1) and of average production per well (item 2);

8. Every vertical curve in chart 3 is the probability distribution for each year( 1st, 5th, 10th, 15th, 20th, 25th and 30th) of the percentage of sharing to the Government, built by the Monte Carlo simulation(item 3);

9. Notice that the probability distribution for percentage of sharing in chart 3 has its values (10% to 42%) in the vertical axis and the frequency (0 to 50% in each year presented) in the horizontal axis.

Figure 13 presents the forecast for the average of probabilistic distribution of the sharing percentage to the Government, per year, considering three different options of decline rate for the production per well.

Figures 13 shows, for the three scenarios of decline rate (5%, 10% and 15%), some key learnings. In the first 5 years, there are few differences of the sharing percentage, beside, in all the periods, the differences in the sharing percentage between decline rate of 10% and 15% is less than 2.5 and the significant difference between decline rate of 10% and 15% occurs in between the 10th and the 25th year.

![Probabilistic Distribution of % Sharing in PSC](image)

Figure 13. Average of probabilistic distribution of the sharing percentage to the government, per year, as a function of decline rate of well production.

**Conclusions.**

The results of this work may be used in future studies of the fiscal system of PSC in Brazil, in order to make a risk analysis of the bid to the action of Pre-salt Fields in Brazil. One of the key learnings resultant from the analysis performed is that well production may be represented by a bimodal probability distribution, with peaks on 13.5 and 25 Mbbl/day.

Since Lula Field presented more production samples (539) than Sapinhoá (196), the total frequency distribution is more determined by Lula field.

There are specificities in the frequency distribution by fields and by production unity/location, but an overall distribution of all data seems to be a good representation of production per well for forecast.

The average production for a typical well was fitted by two lognormal distributions in the range from 5 to 50 Mbbl/day.
Based on (a) chronogram of well introduction and (b) decline rate per well, the evolution of the probability distribution for average production per module in the time was constructed for a typical module of production with 150 Mbbl/day capacity.

The behavior of the probabilistic distribution of the sharing percentage to the Government, per year, resultant from the Monte Carlo simulation was determined. For the production decline rate of -10\%, the average of the distribution vary from 42\% to 27\% in 30 years.

Three scenarios of decline rate (5\%, 10\% and 15\%) were considered. In the first 5 years, there are few differences of the sharing percentage, in all periods, the differences in the sharing percentage between decline rates of 10\% and 15\% is less than 2.5\% and the significant difference between decline rate of 10\% and 15\% occurs in between the 10th and the 25th year.

**Nomenclature**

Angra d. Reis FPSO Cidade de Angra dos Reis
ALL FD for all samples in the database
ALL(e) FD, lognormal fit, for samples in the range of production between 1 to 42 Mbbl/day
ANP National Agency of Petroleum
d Annual decline rate
FD Frequency Distribution
FPSO Floating Production Storage and Offloading
Ilha Bela FPSO Cidade de Ilha Bela, Sapinhoá field
Itaguaí FPSO Cidade de Itaguaí, Lula field
Lula FD for samples in Lula field until Jun/2016
Lula_young FD for samples in Lula field in the first 42 months of production
Mangaratiba FPSO Cidade de Mangaratiba, Lula field
Maricá FPSO Cidade de Maricá, Lula field
Mbbl/day Thousand barrels per day, Lula field
Paraty FPSO Cidade de Paraty, Lula field
PSC Production Sharing Contract
“Rng1” FD, lognormal fit, for samples in the range of production between 1 to 4 Mbbl/day
“Rng2” FD, lognormal fit, for samples in the range of production between 4 to 19 Mbbl/day
“Rng2” FD, lognormal fit, for samples in the range of production between 19 to 42 Mbbl/day
Sao Paulo FPSO Cidade de Sao Paulo, Sapinhoá field
Sapinhoá FD for samples in Sapinhoá field until Jun/2016
Saquarema FPSO Cidade de Saquarema, Lula field

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