

**MINISTRY OF ENERGY**

**AND**

**ENERGY INDUSTRIES**

**TRINIDAD & TOBAGO**

**NATURAL GAS RESERVE AUDIT**

**SUMMARY REPORTS**

- **As at December 31, 2016**
- **As at December 31, 2017**
- **As at December 31, 2018**

**20 November 2019**

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## Definitions:

The reserves and resources as presented in the following reports are defined as follows: –

- (i) Reserves are remaining quantities of known hydrocarbons expected to be produced from a known accumulation at a given date under stated definitions and economic conditions.
- (ii) Proven reserves are those quantities of hydrocarbon which by analysis of geological and engineering data can be estimated with reasonable certainty to be commercially recoverable under current economic conditions and operating methods.
- (iii) Probable reserves are estimated based on data similar to that utilised in computing proven reserves but technical or commercial uncertainties preclude such reserves as being classified as being proven.
- (iv) Possible reserves are suggested by structural and/or stratigraphic extrapolation beyond areas classified as probable based on geological and geophysical interpretation.
- (v) Prospective Resources (referred to here as Exploration Resources) are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations y application of future development projects.

## The Audit Process

The audits of the Non-Associated Natural Gas Reserves of the Republic of Trinidad and Tobago commenced and were completed on the dates in Table 1

*Table 1: Start and End Dates for the audits of the Non-Associated Natural Gas Reserves*

<b>Gas Reserves Audit</b>	<b>Commencement</b>	<b>Completion</b>
As at 31 December 2016	March 12, 2018	August 31 2018
As at 31 December 2017	March 12, 2018 <sup>^</sup>	August 31 2018
As at 31 December, 2018	March 18, 2019	August 31 2019

<sup>^</sup> commenced, simultaneously with the 31 December 2016 audit

They began with onsite reviews of the data supplied by the operating companies. The MEEI provided data for the Open Areas, while the National Gas Company Limited (NGC) and the MEEI provided the supply/demand outlook. Members of staff from the MEEI were assigned to manage the project as well as to provide quality assurance and to assist in data gathering.

## Summary Report of the results of the Non-Associated Natural Gas Reserve Audit as at year-end 2016

The MEEI now wishes to advise on the unrisksed results of the Non-Associated Natural Gas Reserve Audit as at year-end 2016 as shown in Table 2.

Category	31/12/2015 (TCF)	31/12/2016 (TCF)	Reserve Change 2015 to 2016 (TCF)	Comments
<b>Proven</b>	<b>10.60</b>	<b>9.92</b>	<b>-0.68</b>	<b>Decrease by 6.4%</b>
<b>Probable</b>	<b>5.27</b>	<b>5.38</b>	<b>0.11</b>	<b>Increase by 2.1%</b>
<b>Possible</b>	<b>4.93</b>	<b>4.72</b>	<b>-0.21</b>	<b>Decrease by 4.3%</b>
<b>Exploration Resources</b>	<b>43.05</b>	<b>42.85</b>	<b>-0.20</b>	<b>Decrease by 0.5 %</b>

*Table 2: Country's Unrisksed Non-Associated Natural Gas Reserves (TCF) as of 31/12/2016*

The volumes of gas sales produced during 2016 was 1.2 Trillion Cubic Feet (TCF), which represented an average rate of 3.3 billion cubic feet per day (Bcf/d). The 2016 proven reserves dropped by 0.68 TCF or 6.4% from the 2015 figure. Revisions based on planned offshore compression and better production performance led to upward revisions of 0.53 trillion cubic feet that resulted in a reserves replacement ratio of 44% as shown in Figure 1. It should be pointed out that the reserves to production (R/P) ratio based on gas utilization in 2016 of 1.2 trillion cubic feet on a proved (1P) basis is 8.2 years. Further, most companies base their projects on a proved plus probable (2P) reserves basis and as such, using a similar expected production rate the 2P reserves to production ratio is 12.6 years.

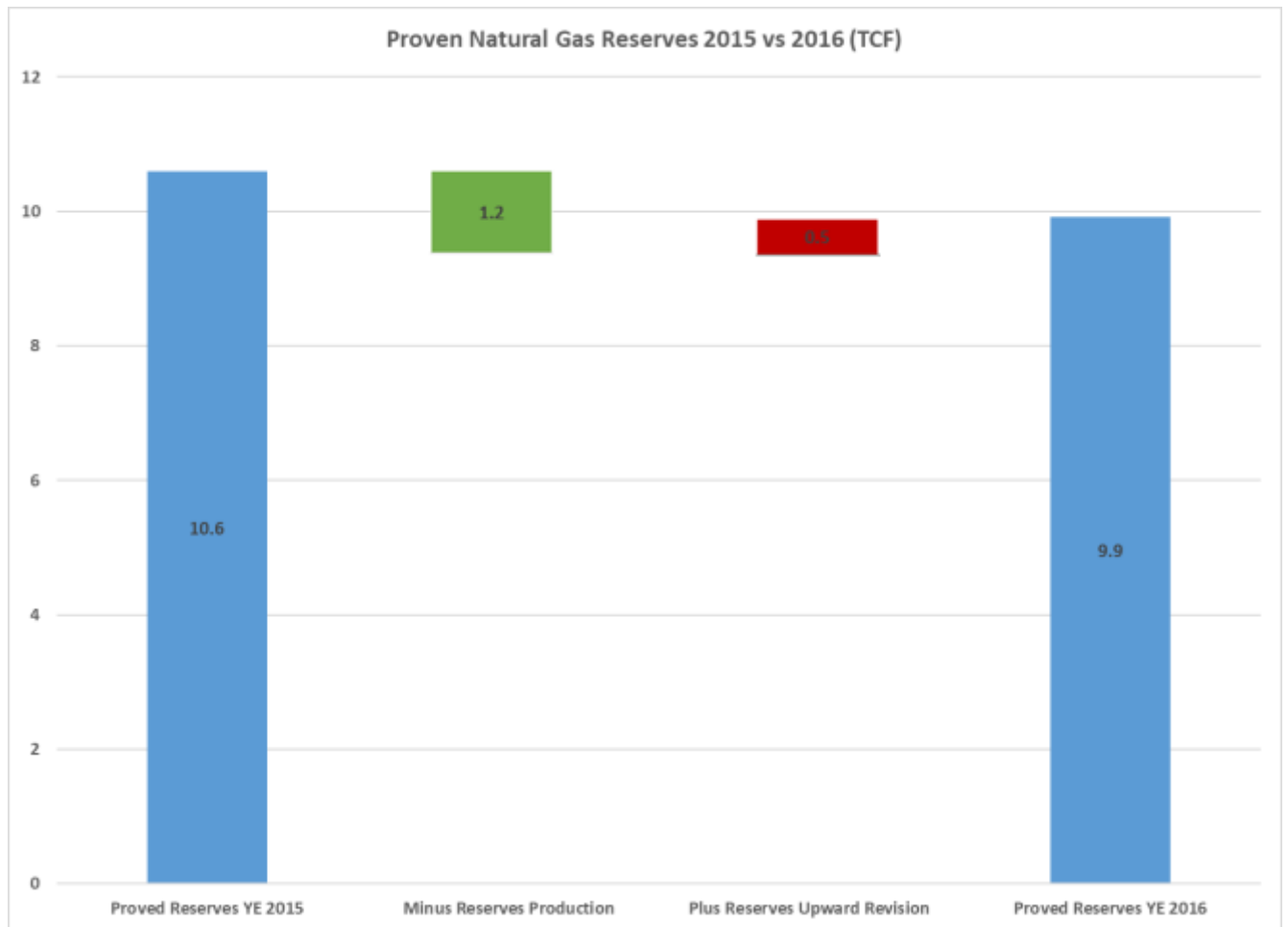


Figure 1:-- *Proven reserves in 2015 vs 2016 showing the net result of revision in reserves and production*

## Summary Report of the results of the Non-Associated Natural Gas Reserve Audit as at year end 2017

The MEEI now wishes to advise on the unrisks results of the Non-Associated Natural Gas Reserve Audit as at year end 2017 as seen in Table 3 below:

<b>Category</b>	<b>31/12/2016 (TCF)</b>	<b>31/12/2017 (TCF)</b>	<b>Reserve Change 2016 to 2017 (TCF)</b>	<b>Comments</b>
<b>Proven</b>	<b>9.92</b>	<b>10.52</b>	<b>0.60</b>	<b>Increase by 6.0%</b>
<b>Probable</b>	<b>5.38</b>	<b>6.13</b>	<b>0.75</b>	<b>Increase by 13.9%</b>
<b>Possible</b>	<b>4.72</b>	<b>5.39</b>	<b>0.67</b>	<b>Increase by 12.5%</b>
<b>Exploration Resources</b>	<b>42.85</b>	<b>57.59</b>	<b>14.74</b>	<b>Increase by 34.4%</b>

*Table 3– Country’s Unrisks Non-Associated Natural Gas Reserves (TCF)*

The volume of gas sales produced during 2017 was 1.1 Trillion Cubic Feet (TCF), which represented an average rate of 3.1 billion cubic feet per day (Bcf/d). The 2017 proven reserves increased by 0.60 TCF or 6.0% from the 2016 figure. Revisions based on new drilling data and better production performance led to upward revisions of 1.74 trillion cubic feet that resulted in a reserves replacement ratio of 152 % as seen in Figure 2. The reserves to production (R/P) ratio based on gas utilization in 2017 of 1.1 trillion cubic feet on a proved (1P) basis is 9.2 years. Further, most companies base their projects on a proved plus probable (2P) reserves basis and as such the 2P reserves to production ratio using a similar expected production rate is 14.6 years.

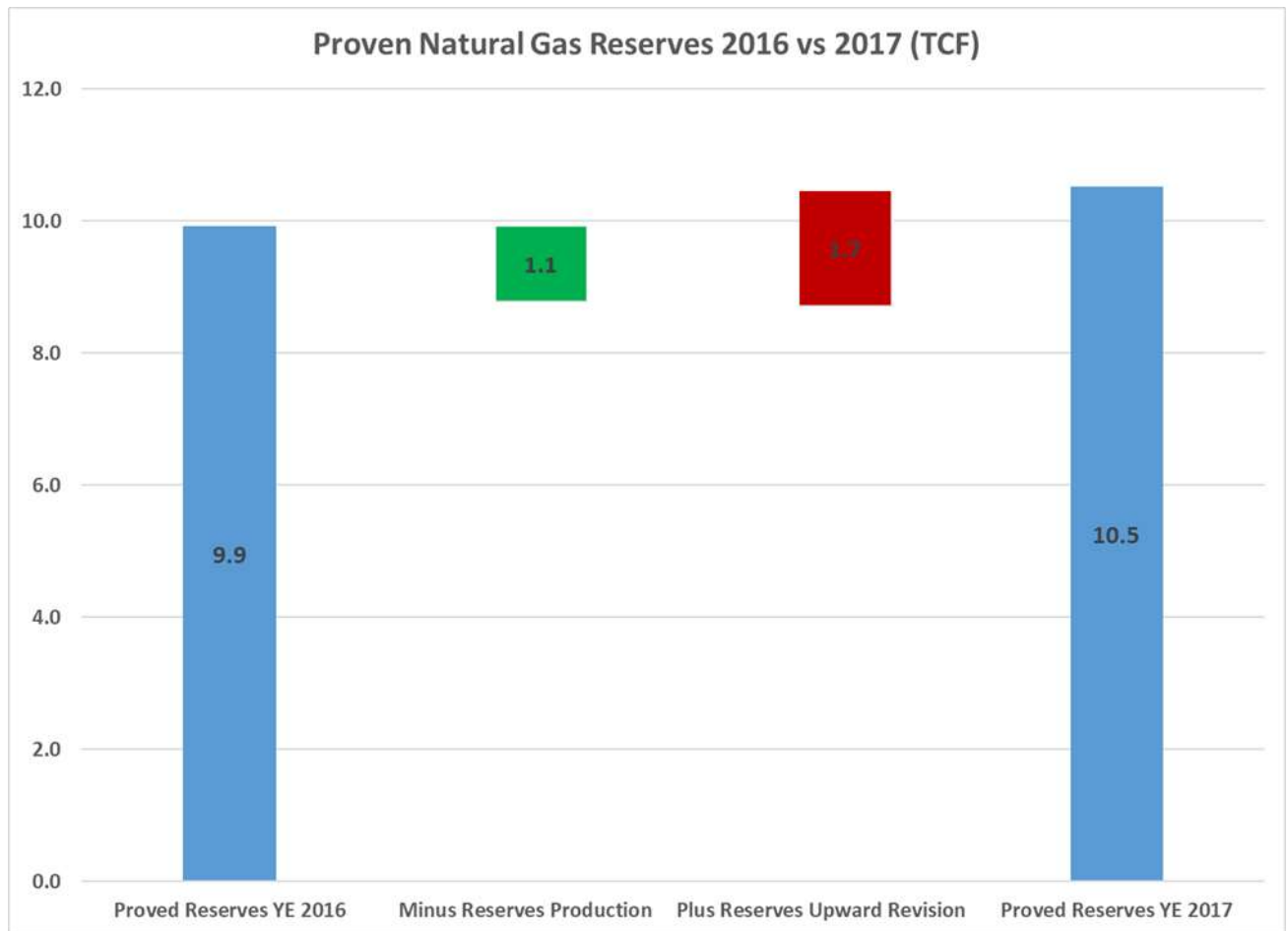


Figure 2- Proven reserves in 2016 vs 2017 showing the net result of revision in reserves and production

In 2017, bpTT operated assets had both upward and downward revisions, but the overall impact was an upward revision. The Trinidad Region Onshore Compression (TROC) Project became operational in the second quarter of 2017, and resulted in reserve adjustments for fields located in the Mahogany and Amherstia hubs.

The Cassia field reserves increased mainly due to the successful drilling and completion of the Banyan -2 well located in the TP61 western fault block area of mutual interest (AMI) between bpTT and EOG. In September 2017, the Juniper field came on production and volumes were added due to remapping.

In March 2017, the Macadamia-1 exploration well was successfully drilled, and the volumes added to the SEQB/Macadamia field. bpTT also had success with the Savannah exploration well and these volumes together with the Cassia adjustment had the greatest impact on bpTT's



reserves. For EOG operated assets, four new wells were put on production in the Osprey field and five new wells were drilled in the Sercan field area while the Toucan-8 volumes were moved to Sercan field. The net impact of changes in the Toucan and Sercan field was an addition to EOG's reserves. In 2017, Shell acquired the Manatee field, Chevron's only asset in Trinidad. Shell also acquired Centrica's assets in Block 22 and NCMA-22. In 2016, DeNovo acquired Centrica's assets in Block 1a and 1b. Perenco also acquired the assets which were operated by Repsol.

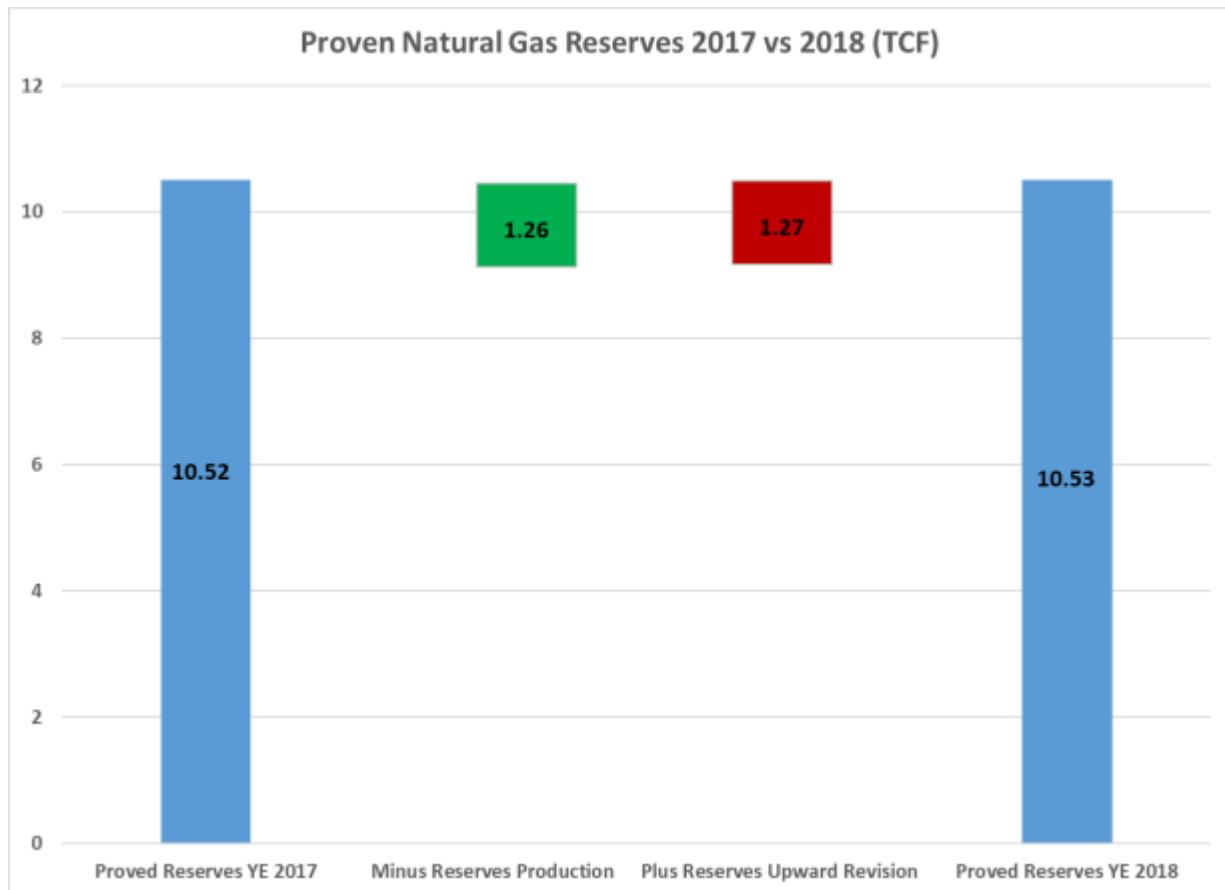
## Summary Report of the results of the Non-Associated Natural Gas Reserve Audit as at year end 2018.

The MEEI now wishes to advise on the unrisks results of the Non-Associated Natural Gas Reserve Audit as at year end 2017 as seen in Table 4 below:

<b>Category</b>	<b>31/12/2017 (TCF)</b>	<b>31/12/2018 (TCF)</b>	<b>Reserve Change 2017 to 2018 (TCF)</b>	<b>Comments</b>
<b>Proven</b>	<b>10.52</b>	<b>10.53</b>	<b>0.01</b>	<b>Increase by 0.1%</b>
<b>Probable</b>	<b>6.13</b>	<b>6.47</b>	<b>0.34</b>	<b>Increase by 5.6%</b>
<b>Possible</b>	<b>5.39</b>	<b>6.51</b>	<b>1.12</b>	<b>Increase by 20.7%</b>
<b>Prospective Resources</b>	<b>57.25</b>	<b>53.00</b>	<b>-4.25</b>	<b>Decrease by 7.4%</b>

*Table 4 – Country’s Unrisks Non-Associated Natural Gas Reserves (TCF)*

The volume of gas sales produced during 2018 was 1.3 Trillion Cubic Feet (TCF), which represented an average rate of 3.5 billion cubic feet per day (Bcf/d). The 2018 proven reserves increased by 0.01 TCF or 0.1% from the 2017 figure. Revisions based on new drilling data and better production performance led to upward revisions of 1.27 trillion cubic feet that resulted in a reserves replacement ratio of 101 % as seen in Figure 3. The reserves to production (R/P) ratio based on gas utilization in 2018 of 1.3 trillion cubic feet on a proved (1P) basis is 8.3 years. Further, most companies base their projects on a proved plus probable (2P) reserves basis and as such the 2P reserves to production ratio using a similar expected production rate is 13.5 years.



*Figure 3- Proven reserves in 2017 vs 2018 showing the net result of revision in reserves and production*

In 2018 the Trinidad Region Onshore Compression (TROC) Project, which became operational in the second quarter of 2017, continues to result in reserve adjustments for fields located in the Mahogany and Amherstia hubs. The Kapok field reserves increased, which was mainly due to better well performance and the movement of the TP93 Sparrow FB 1/2 reservoir from the Parang field to the Kapok field. In the Mahogany field, reserves were added due to remapping and better well performance. In the Immortelle field, the reserves increased also due to better well performance and compression adds. Poor performance in the Mango wells had a downward effect on reserves however. BHP's success with the Bongos and Victoria exploration wells added proved reserves but most of these discoveries' volumes were assigned to probable and possible reserves. Ryder Scott remapped BHP's Delaware and Ruby fields for the year-end 2018 evaluation and added proved reserves in both fields. BHP had an exceptional reserve replacement ratio in 2018 as a result of these additions. For Shell operated assets, five new wells were put on production in the Dolphin field, and these wells added proved reserves based on well performance and revision of the Original Gas-in-Place (OGIP). Perenco put forward a plan

to develop the non-associated gas volumes in the Teak-D platform area of the Teak-Samaan-Poui fields. Upon evaluation, Ryder Scott estimated the remaining proved reserves in the Teak-D platform area and these reserves increased Perenco’s reserve booking for year-end 2018. In November 2018, DeNovo started the production of its Iguana field. Based on mapping updates and well performance revisions, there was some reduction in Iguana’s proved reserves. For the EOG operated assets, there was an increase in the Sercan field based on better than expected well performance in the Sercan-1, Sercan-2, and Sercan-3 wells.

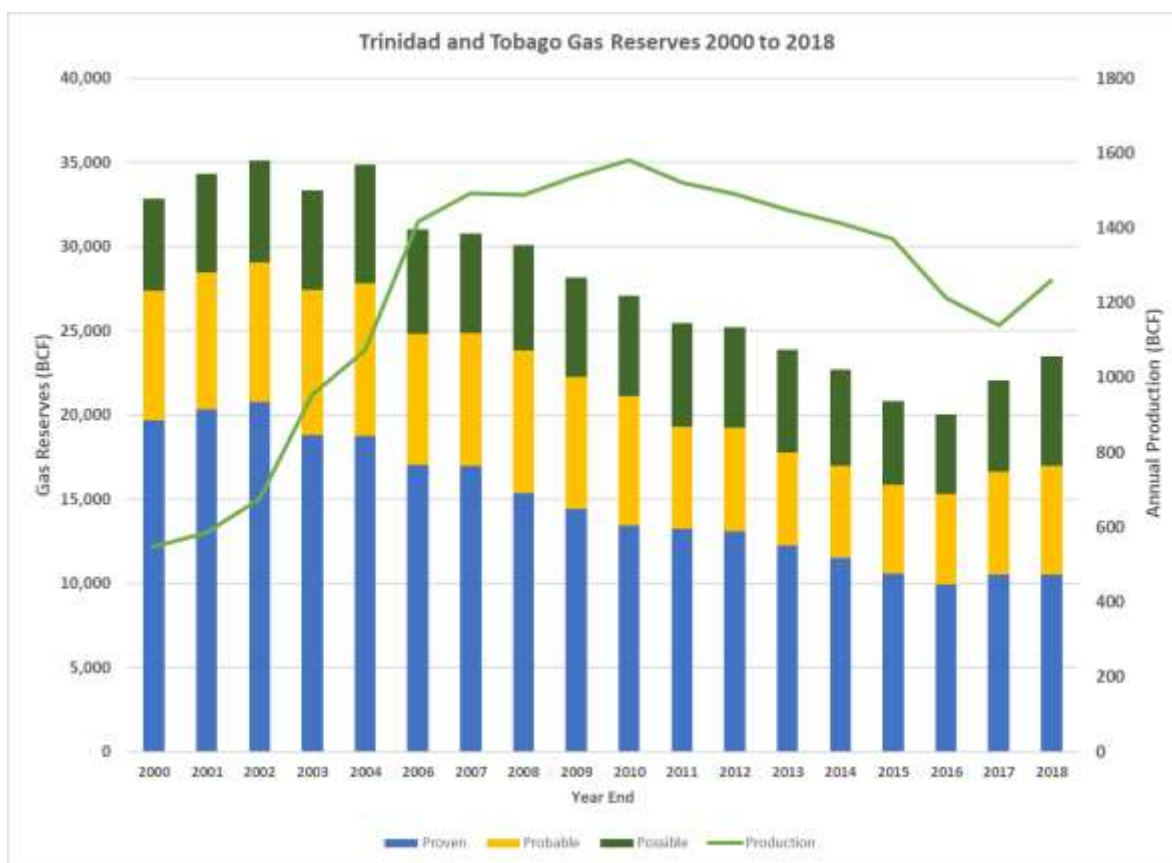


Figure 4– Historical Audited Non-Associated Natural Gas Reserves 2000 to 2018 (Unrisked)

Figure 4 shows that the country’s reserves increased from 2000 to 2002 together with new installed capacity and additional demand. However, the exploration for new reserves from the post 2004 period were insufficient to meet the continued increases in demand. Thus we are currently in a situation where demand outstrips supply and where most gas fields and upstream gas processing facilities are being used at their maximum safe operating capacity. There was a notable reduction in production after 2010 as fewer new fields were brought online to maintain

the supply plateau. A 152% Reserve Replacement ratio resulted in a rise in the country's reserves in 2017. Proved reserves remained essentially unchanged between 2017 and 2018, while production trended upward. Note that no audit was done in 2005.