<table>
<thead>
<tr>
<th>Year</th>
<th>Crude Oil &amp; NGL</th>
<th>Natural Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>76,532 (billion bbl)</td>
<td>24,704 (billion bcf)</td>
</tr>
<tr>
<td>2016</td>
<td>78,800 (billion bbl)</td>
<td>25,400 (billion bcf)</td>
</tr>
<tr>
<td>2017</td>
<td>79,500 (billion bbl)</td>
<td>26,100 (billion bcf)</td>
</tr>
<tr>
<td>2018</td>
<td>80,800 (billion bbl)</td>
<td>26,800 (billion bcf)</td>
</tr>
<tr>
<td>2019</td>
<td>82,100 (billion bbl)</td>
<td>27,500 (billion bcf)</td>
</tr>
<tr>
<td>2020</td>
<td>83,400 (billion bbl)</td>
<td>28,200 (billion bcf)</td>
</tr>
</tbody>
</table>

*Note: Data Source: Petrobras.*
Additional information on Petrobras

Alternate production estimate for 2008

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil (thousand bbl/d)</th>
<th>Gas (million cf/d)</th>
<th>Total (thousand m3)</th>
<th>Stationary production units</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1,821</td>
<td>701</td>
<td>1,713</td>
<td>625</td>
</tr>
</tbody>
</table>


Table 1.1 is based on information from Wood Mackenzie’s Pathfinder Database; www.woodmacresearch.com

2008:
- Brazil: 786.1
- Campos Basin: 442.4
- Santos Basin: 269.0
- Other Basins(1): 74.8
- South America (excluding Brazil): 1.9
- North America: 13.2
- Equity and non-consolidated affiliates: 8.2
- Africa: 8.2

Total: 2,099.4

Note: gas production in error (663 Mcf in all of 2017%). CAI: judging from the Boe stats, the units are meant to be Bcf.

Table note 2: Natural gas production figures are the production volumes of natural gas available for sale, excluding flared and reinjected gas and gas consumed in operations.

PERFORMANCE SCHEDULE

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAI</td>
<td>293</td>
<td>304</td>
<td>346</td>
<td>354</td>
<td>448</td>
</tr>
<tr>
<td>Energy consumption (TJ/year)</td>
<td>174,762</td>
<td>174,413</td>
<td>174,320</td>
<td>177,277</td>
<td>176,673</td>
</tr>
<tr>
<td>Greenhouse gas emissions (metric tons of CO2 equivalent)</td>
<td>58.1</td>
<td>59.9</td>
<td>57.6</td>
<td>57.8</td>
<td>41.1</td>
</tr>
<tr>
<td>Carbon dioxide emissions, CC (metric tons)</td>
<td>11</td>
<td>14</td>
<td>16</td>
<td>22</td>
<td>97</td>
</tr>
<tr>
<td>Methane emissions - CC (metric tons)</td>
<td>19</td>
<td>20</td>
<td>18</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>Nitrous oxide emissions - CC (metric tons)</td>
<td>80</td>
<td>23</td>
<td>31</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>Atmospheric emissions - MB (metric tons)</td>
<td>2.52</td>
<td>2.45</td>
<td>2.45</td>
<td>2.45</td>
<td>2.45</td>
</tr>
<tr>
<td>Atmospheric emissions - MB (metric tons)</td>
<td>151.76</td>
<td>150.9</td>
<td>145.7</td>
<td>138.9</td>
<td>138.7</td>
</tr>
<tr>
<td>Other atmospheric emissions - MB (metric tons)</td>
<td>17.31</td>
<td>17.22</td>
<td>17.71</td>
<td>17.22</td>
<td>17.51</td>
</tr>
<tr>
<td>Freshwater withdrawal (million m³)</td>
<td>170.8</td>
<td>216.5</td>
<td>195.2</td>
<td>176.0</td>
<td>187.3</td>
</tr>
</tbody>
</table>

ENERGY CONSUMPTION BY THE PETROBRAS SYSTEM

- Direct energy: 173,910, 129,215, 147,927
- Indirect energy: 746,596, 779,041, 745,164

HISTORICAL OIL PRODUCTION (Brazil)


Petrobras energy consumption, Terajoules, excludes flaring


Oil & Gas Oxy_Shell.xls

USGS map

Comment: Rick Heede:
petrobras.com / history: In October 1953, after Law 2.004 was passed, Petrobras was allowed to be incorporated to undertake oil sector activities in Brazil on behalf of the Union. Petróleo Brasileiro S/A - PETROBRAS commenced its activities with the collection it inherited from the old National Oil Council (Conselho Nacional do Petróleo, CNP), which, however, preserved its inspection function for the sector. The oil exploration and production operations, as well as the remaining activities connected to the oil, natural gas, and derivative sector, except for wholesale distribution and retail via service stations, were a monopoly Petrobras held from 1954 to 1997.

History (Wikipedia, en.wikipedia.org/wiki/Petrobras): Petrobras standard model for its land oil pump, popularly known as Wooden Horse (Cavalo de Pau in Portuguese) in UFRN, Natal, Brazil. Petrobras was created in 1953 during the government of Brazilian president Getúlio Vargas, with the support of both the ruling parties and the opposition alike in Congress. Petrobras commenced its activities with the collection it inherited from the old National Oil Council (Conselho Nacional do Petróleo, CNP), which, however, preserved its inspection function for the sector. The oil exploration and production operations, as well as the remaining activities connected to the oil, natural gas, and derivative sector, except for wholesale distribution and retail via service stations, were a monopoly Petrobras held from 1954 to 1997. During this period, Petrobras became the leader in derivative marketing in Brazil, and, thanks to the company’s performance, it was awarded the Offshore Technology Conference (OTC) in 1992, one of which it was granted again in 2001. After 40 years of exploration, production, refining and transportation of Brazil’s oil, Petrobras started to compete with other foreign and domestic companies in 1997. The Brazilian government created the National Petroleum Agency (Agência Nacional de Petróleo, ANP), responsible for the regulation and supervision of activities in the petroleum industry, and the National Council of Energy Policies, a public agency responsible for the development of public energy policy.

In 2003, commemorating its 50 years, Petrobras doubled its daily production of oil and natural gas, surpassing the mark of 2 million barrels (320,000 m³). On 21 April 2006, Brazilian president Luiz Inácio Lula da Silva started production on the P-50 oil platform, in the Albaoca East Field at Campos Basin, which gave Brazil self-sufficiency in oil production. In 2009, Petrobras announced a market capitalization plan to finance its future investments in ultra-deep oil exploration. The share offering in the BM&F Bovespa Stock Exchange took place in September 2010, becoming the largest market capitalization in history, with R$ 120.4 billion (US$ 69.97 billion) in shares issued. Petrobras was established as a state-owned oil and natural gas monopoly in 1954. Significant discoveries – mostly offshore in the Campos Basin – since the 1980s and more recently in deeper waters in “pre-salt” formations (that is, underneath the salt deposits) has allowed Brazil to become self-sufficient (and a net exporter) in petroleum since 2008. The Brazilian government is also creating another state-owned oil company Petrosal, is introducing production-sharing agreements (IOCs have operated in Brazil, but typically on a contractual basis).


Cell: M9
Comment: Rick Heede:
World bank, 2008b, page 309: "Petrobras is a state-controlled company created pursuant to Law No.2.004. A majority of the voting capital must be owned by the Brazilian federal government, a state or a municipality. The Brazilian government controls 58% of Petrobras' shares." Older datum.

Cell: D11
Comment: Rick Heede:
Production statistics for PetroBras include domestic and international natural gas production. Data from PetroBras website, in million cf per day. Domestic production in 2004 was 1.591 Bcf/d, and international 0.565 Bcf/d.

Cell: D12
Comment: Rick Heede:
Total net worldwide crude oil plus natural gas liquids produced by each company or state-owned enterprise. Where data is available, we list net production. Crude production includes natural gas liquids (NGL) unless noted.

Cell: H12
Comment: Rick Heede:
Natural gas is typically reported as dry gas; natural gas liquids are reported under crude oil. Carbon dioxide is normally removed from the gas flow at the production site (see "Vented Carbon Dioxide"). "SCF/d" = standard cubic meters per day, "CFId" = cubic feet per day. Net production typically excludes a number of diverted gas streams. Quantities and fractions vary; ExxonMobil's exclusions are probably typical of the industry: "Net production available for sale quantities are the volumes volumes used for gas lift, gas injections and cycling operations, quantities flared, and volume shrinkage due to the removal of condensate or natural gas liquids production."


Cell: F18
Comment: Rick Heede:
Petroleo Brasileiro S/A - PETROBRAS data is in very close agreement with the PetroBras data for 1987-1999. The Brazilian government controls 58% of Petrobras' shares.

Cell: E53
Comment: Rick Heede:
OGJ100 production data is in very close agreement with the PetroBras data for 1987-1999.

Cell: J54
Comment: Rick Heede:

Cell: D24
Comment: Rick Heede:

Cell: E53
Comment: Rick Heede:
OGJ100 production data is in very close agreement with the PetroBras data for 1987-1999.

Cell: JS4
Comment: Rick Heede:

Cell: E24
Comment: Rick Heede:

Cell: D76
Comment: Rick Heede:
Petrobras reported gas production data is roughly twice the EIA estimated production for Brazil (445 Bcf in 2010). Oil & Gas Journal OGJ 100 estimates are ~5 percent higher than Petrobras own data (935 Bcf in 2010). Oil production, on the other hand, are in agreement across all three sources.

Cell: E80
Comment: Rick Heede:
Petrobras production data 2000-2016 as Excel file.

Cell: H80
Comment: Rick Heede:
Petrobras production data 2000-2016 as Excel file.

Cell: E83
Comment: Rick Heede:
Petrobras (2018) Form 20 F for 2017, page 42. Oil production in Mb per year.

Cell: H83
Comment: Rick Heede:

Cell: L83
Comment: Rick Heede:
Petrobras (2018) Form 20 F for 2017, page 42. See table below. The units appear to be in error, listed as 662.8 mmcf per year (Mcf), in 2017, not Mcf per day. Assuming that the units are meant to be 662.8 Bcf, this is still 33% below 2016 production of 1,171 Bcf.

OilGasOxy_Shell.xls
Verify units, and whether significant gas producing assets were divested.
CAI: judging from the Boe stats, the units are meant to be Bcf.

Cell: E84
Comment: Rick Heede: