

Oil and natural gas extraction data

Richard Heede
 Climate Mitigation Services
 File started: 11 January 2005
 Last modified: April 2013

Copyright Climate Mitigation Services

Petroleo Brasileiro (Petrobras), Brazil

yellow column indicates original reported units 55.6% SOE

www.petrobras.com Rio de Janeiro

Production / Extraction data



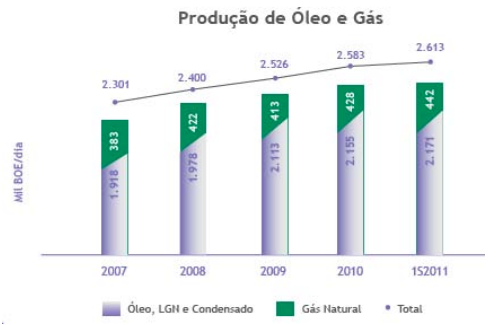
Year	Crude Oil & NGL			Natural Gas			Background data	
	Net production	Net production	Net production	Net production	Net production	Net production		
	Thousand bbl /d	Million bbl /yr	Million tonnes/yr	Thousand SCM/d	Million SCM/d	Billion cf/yr		



15	
16	1950
17	1951
18	1952
19	1953
20	1954
21	1955
22	1956
23	1957
24	1958
25	1959
26	1960
27	1961
28	1962
29	1963
30	1964
31	1965
32	1966
33	1967
34	1968
35	1969
36	1970
37	1971
38	1972
39	1973
40	1974
41	1975
42	1976
43	1977
44	1978
45	1979
46	1980
47	1981
48	1982
49	1983
50	1984
51	1985
52	1986
53	1987
54	1988
55	1989
56	1990
57	1991
58	1992
59	1993
60	1994
61	1995
62	1996
63	1997
64	1998
65	1999
66	2000
67	2001
68	2002
69	2003
70	2004
71	2005
72	2006
73	2007
74	2008
75	2009
76	2010
77	

Data: petrobras.com thousand bbl /day	Petrobras oil & NGL million bbl /yr	Data: petrobras.com bbl per day
3	2.0	2,663
5	1.0	5,482
11	4.0	10,921
27	10.0	27,298
51	18.7	51,133
64	23.3	63,961
80	29.3	80,261
95	34.6	94,903
91	33.2	90,911
98	35.7	97,746
91	33.2	90,944
94	34.3	93,988
116	42.4	116,173
146	53.3	146,141
160	58.5	160,231
172	62.9	172,199
164	59.9	164,088
170	62.1	170,206
166	60.8	166,475
170	62.1	170,053
177	64.6	177,051
171	62.6	171,485
166	60.7	166,201
160	58.2	159,564
160	58.5	160,185
165	60.4	165,401
181	66.1	181,026
213	77.8	213,087
259	94.7	259,351
329	120.1	328,931
468	170.6	467,516
557	203.2	556,777
589	215.1	589,425
588	214.8	588,368
577	210.6	577,100
617	225.1	616,844
654	238.6	653,628
647	236.1	646,730
653	238.4	653,101
668	243.9	668,291
693	252.9	692,832
716	261.4	716,161
809	295.3	809,052
869	317.3	869,308
1,004	366.6	1,004,280
1,132	413.1	1,131,836
1,376	502.3	Petrobras stats
1,422	519.1	
1,570	573.2	
1,862	679.6	
1,830	667.8	
2,009	733.3	
1,920	700.8	
2,044	746.1	
1,967	718.0	
2,034	742.4	
2,051	748.6	

Data: petrobras.com Million SCM/day	Petrobras gas Bcf/yr
0.17	2.2
0.17	2.2
0.23	3.0
0.43	5.6
0.82	10.6
1.17	15.1
1.46	18.8
1.44	18.6
1.40	18.0
1.27	16.3
1.34	17.3
1.80	23.2
2.07	26.6
2.35	30.3
2.60	33.5
3.32	42.8
3.36	43.3
3.09	39.8
3.23	41.6
3.08	39.7
3.89	50.2
4.24	54.7
4.28	55.1
4.74	61.1
5.08	65.4
5.00	64.4
5.81	74.9
6.56	84.6
8.10	104.5
11.00	141.8
13.39	172.6
14.54	187.4
15.38	198.3
15.81	203.8
15.47	199.4
16.25	209.4
16.32	210.4
17.16	221.1
18.17	234.2
19.31	248.9
20.30	261.6
21.30	274.5
24.16	311.4
25.92	334.1
28.52	367.7
31.39	404.6
38,585	Petrobras stats
41,121	
43,955	
54,282	
58,139	
59,820	
61,154	
61,956	
68,136	
66,862	
69,076	
Compare EIA stats	890.4



CARBON DIOXIDE - CO₂ EMISSIONS millions of tons



METHANE EMISSIONS - CH₄ thousand tons



Total emissions: direct + indirect. The result reflects the reduction in natural gas flaring at UD-RIO and UD-BC, of E&P.

NITROUS OXIDE EMISSIONS - N₂O tons



Total emissions: direct + indirect.

Petrobras (2011) Sustainability Report 2010, page 85.

Total	na	12,879	na	na	13,276
--------------	-----------	---------------	-----------	-----------	---------------

Additional information on Petrobras

Alternate production estimate for 2008

	Thousand bbl /d	Million bbl /yr	Million cf/d	Bcf/yr
2008	1,921	701	1,713	625

Source: Hults, & Thurber, 2012, Introduction, Table 1.1, page 24, in Victor et al, eds, 2012, *Oil and Governance*.
Table 1.1 is based on information from Wood Mackenzie's Pathfinder Database; www.woodmacresearch.com

PROVED OIL, NGL, CONDENSATE AND NATURAL GAS RESERVES ANP/SPE CRITERIA

billion boe

2006	12.3	2.7	15.0
2007	12.4	2.4	15.0
2008	12.5	2.4	15.1
2009	12.4	2.3	14.9
2010	13.4	2.4	16.0

Oil, LNG and Condensate Natural Gas

Petrobras' oil & gas reserves 2006-2010, 2011 SustRpt, page 39.

Hydrocarbon Production by Geographic Area

	2010				Total (mboe/d)
	Oil (mmb/d) (5)	Synthetic Oil (mmb/d) (4)	Nat. Gas (mmcf/d) (1)	Synthetic Gas (mmcf/d) (1)(4)	
Brazil:					
Roncador field(2)	343.4	0.0	161.2	0.0	370.3
Other	1,657.1	3.6	805.3	1.9	1,795.2
Total Brazil	2,000.5	3.6	966.5	1.9	2,165.5
International:					
South America (outside of Brazil)	80.2	0.0	553.3	0.0	172.4
North America	1.3	0.0	8.9	0.0	2.8
Africa	56.5	0.0	0.0	0.0	56.5
Total International	138.0	0.0	562.2	0.0	231.7
Total consolidated production	2,138.5	3.6	1,528.7	1.9	2,397.2
Equity and non-consolidated affiliates:(3)					
South America (outside of Brazil)	7.5	0.0	4.2	0.0	8.2
Worldwide production	2,146.0	3.6	1,532.9	1.9	2,405.4



Petrobras' international operations, 2011 SustRpt, page 9.

Petrobras 2011 SEC Form 20-K, page 72.

Oil production includes LNG and production from extended well tests.

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

Petrobras energy consumption, Terajoules, excludes flaring

PERFORMANCE SCHEDULE	2006	2007	2008	2009	2010
Environment					
Oil & Oil Product Leaks (m³)	293	386	436	254	668
Energy consumption (terajoule - TJ)	576,762	574,145	604,333	527,717	716,673
Greenhouse gas emissions (million tons of CO ₂ equivalent)	50.43	49.88	57.6	57.8	61.1
Carbon dioxide emissions - CO ₂ (million tons)	46	45	54	52	57
Methane emissions - CH ₄ (thousand tons)	190	206	188	235	196
Nitrous oxide emissions - N ₂ O (tons)	997.23	919.5	1,215	1,241	1,360
Atmospheric emissions - NOx (thousand tons)	233.54	222.65	244.50	222.04	227.75
Atmospheric emissions - SOx (thousand tons)	151.96	150.9	141.79	135.39	133.73
Other atmospheric emissions - includes particulate matter (thousand tons)	17.11	15.22	16.71	19.30	17.51
Fresh water withdrawal (million m³)	178.8	216.5	195.2	176.0	187.3
Water effluent disposal (million m³)	164.3	172.8	181.14	197.2	172.6

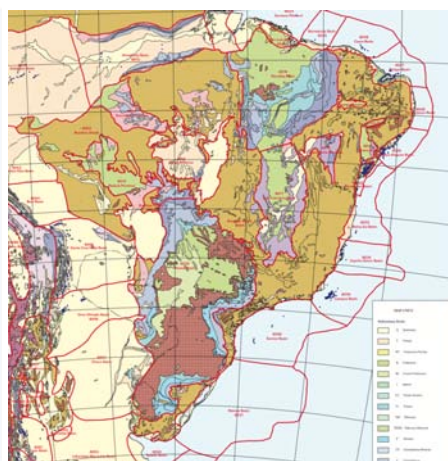
Petrobras (2011) Sustainability Report 2010.

ENERGY CONSUMPTION BY THE PETROBRAS SYSTEM	2010	2009	2008
Direct energy			
Diesel fuel	37,919	34,205	27,292
Fuel oil	65,844	81,670	129,539
Natural gas	423,183	298,603	429,622
Refinery gas	74,599	88,006	68,262
Residual gas	5,920	0	0
LPG	937	1,773	9,762
FCC Coke	67,962	70,841	78,413
Others	431	1,906	2,275
Total direct energy	676,795	577,004	745,164
Indirect energy			
Steam acquired	13,953	9,198	12,185
Electric energy acquired	25,925	17,868	33,411
Total indirect energy	39,878	27,066	45,596
TOTAL	716,673	604,070	790,760

Petrobras (2011) Sustainability Report 2010, page 83

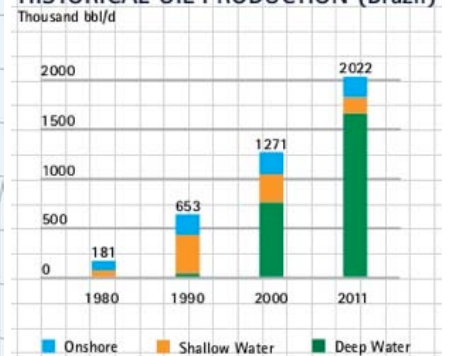


Petrobras 2011 SEC Form 20-K, page 33.



USGS map

HISTORICAL OIL PRODUCTION (Brazil)



www.investidorpetrobras.com.br/en/investor-s-center/fact-sheet.htm

Cell: J9

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. Petr leo Brasileiro S/A - PETROBRAS commenced its activities with the collection it inherited from the old National Oil Council (Conselho Nacional do Petr leo, 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 Get lio 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 Petr leo, 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 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 (Ag ncia Nacional do Petr leo, 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 In cio Lula da Silva started production on the P-50 oil platform, in the Albacora 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 Petrossal, is introducing production-sharing agreements (IOCs have operated in Brazil, but typically on a contractual basis).

de Oliveira, Adilson (2012) "Brazil's Petrobras: strategy and performance," in Victor et al, eds, Oil & Governance, pp. 515-556.

Cell: M9

Comment: Rick Heede:

The Federal Govt owns 55.6 percent of voting shares. Petrobras.com Capital Ownership Breakdown, accessed Apr12.

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.

World Bank (2008b) A Citizen's Guide to National Oil Companies, Part B: Data Directory, World Bank, Washington, & Center for Energy Economics, Bureau of Economic Geology Jackson School of Geosciences University of Texas, Austin, 764 pp.

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").

"SCM/d" = standard cubic meters per day. "cf/d" = 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 withdrawn from ... natural gas reserves, excluding royalties and volumes due to others when produced, and excluding gas purchased from others, gas consumed in producing operations, field processing plant losses, 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."

ExxonMobil Corporation (2004) 2003 Financial and Operating Review, www.exxonmobil.com, p. 55.

Cell: F18

Comment: Rick Heede:

Petrobras.com data on crude oil production 1954-1999. CMS note Jan10: this dataset not found (for update). April 2013: no historic production data found on petrobras.com (except 2007-2012 data used below).

Cell: I18

Comment: Rick Heede:

PetroBras data from petrobras.com converted from thousand cubic meters per day. Does not include company international production for 1954-1999 (although other company data for gas 2000-2004 does include international production).

Cell: D24

Comment: Rick Heede:

Minor production variance reported in de Oliveira (2012), page 524: 57,000 bbl per day in 1958.

de Oliveira, Adilson (2012) "Brazil's Petrobras: strategy and performance," in Victor et al, eds, Oil & Governance, pp. 515-556.

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:

Good agreement with OGJ100 data for 1988-1990, 1994, 1996, and 1997 only.

Cell: D66

Comment: Rick Heede:

Production statistics for PetroBras include domestic and international crude Oil & NGL production. Data from PetroBras website, in thousand bbl per day. Domestic production in 2004 was 1,493

Petrobras

thousand bbl /d, and international 169 thousand bbl /d.

Jan10 update 2004-2008: in 2008, domestic "oil" production totaled 1,855,000 bbl per day, plus 124,000 bbl per day internationally. No mention of including condensate production.

Cell: H66

Comment: Rick Heede:

Petrobras natural gas production from excel spreadsheet covering oil and gas production 2000 to 2010.

Cell: D73

Comment: Rick Heede:

Petrobras oil production 2007-2010 (also 2011-2012) from "Operational Highlights;" downloadable spreadsheet xls. Accessed April 2013. No earlier production data appears available. This data revises production for 2007 through 2010 shown in the chart at right.

www.investidorpetrobras.com.br/en/operational-highlights/production/crude-oil-and-oil-products-production-sales-import-and-export/crude-oil-and-oil-products-production-sales-import-and-export.htm

Cell: I76

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.