

## **Chinese Offshore Oil Production: Hopes and Reality**

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### **Abstract**

China started to develop its offshore oil resources in earnest in the early 1980s, when world oil price was high and projections about the potential of its offshore oil were extremely rosy. But as exploration and development efforts unfolded in the 1980s, disillusionment set in very quickly, given the mediocre amount of oil discoveries made. This article traces the development of the Chinese offshore oil industry from the early 1980s to 1998, with emphasis on the last ten years. Various aspects of development, including length of seismic survey lines undertaken, number of wells drilled, amount of oil discovered, amount of investments made, offshore fields developed, offshore production and revenue from oil sales are presented and analysed.

Further, the article also discusses in detail the factors that contributed to the deflation of the high hopes relating to Chinese offshore production, with a final section taking a glimpse into the future.

Oil, after coal, is the second most important energy source in China; with a consumption of 188 million tonnes of oil equivalent (toe), it accounted for 19.8% of total energy consumption in 1998. China used to be an important oil exporter in the 1980s, exporting 34 million tonnes of hydrocarbons (crude and oil products) at its zenith in 1986. For some years, oil exports accounted for 1/5 to 1/4 of total export receipts then (Chow, 1990, 1992; Kaempfer and Min, Jr, 1985). The country has become a net oil importer since 1993, with net hydrocarbon imports amounting to 29 million tonnes in 1998.

It is clear that some drastic changes occurred to the Chinese oil balance: Oil production started to stagnate in 1989, with actual output declining from 137 million tonnes in 1988 to 124 million tonnes in 1998 (Table 1). In the first half of the 1980s, the Chinese realized that their eastern onshore fields, the major producing fields, were maturing, signifying that it would be very difficult to raise oil production in the future without tapping new fields in other regions (Chow, 1991; Lang, 1997, p. 36). Consequently, they decided to concentrate efforts on developing their offshore oil resources on the one hand, and made concerted efforts to explore for and develop the oil resources in the interior western basins on the other. These two other sources were slated to be the back up producers of oil in the 1990s and beyond.

**Table 1.** Role of Oil in Chinese Energy

Year	Oil Production (Million tonnes)	Oil Exports (Million tonnes)	Oil Imports (Million tonnes)	Oil Balance (Million tonnes)	Energy Consumption (Million mtce)	Oil Share (%)
1987	134.14	33.95	2.82	31.13	866.32	17.0
1988	137.05	32.20	4.42	27.78	929.97	17.0
1989	137.65	30.71	9.27	21.44	969.34	17.1
1990	138.31	30.30	6.57	23.73	987.03	16.6
1991	140.99	30.37	10.89	19.48	1 037.83	17.1
1992	142.04	26.43	19.99	6.44	1 091.70	17.5
1993	145.24	24.39	32.96	-8.57	1 159.93	18.2
1994	146.08	23.93	25.24	-1.31	1 227.37	17.4
1995	150.04	22.58	31.48	-8.90	1 311.76	17.5
1996	157.33	24.50	38.45	-13.95	1 389.48	18.0
1997	160.43	25.42	59.26	-33.84	1 420.00	18.6
1998	123.65	19.96	49.06	-29.1	1 360.00	19.8

- Denotes net imports

Sources: Oil Production, Energy Consumption and Oil Share: State Statistical Bureau, *Statistical Yearbook of China 1999*, various pages

: Oil Exports and Oil Imports: Ministry of Foreign Economic Relations and Trade, *Almanac of China's Foreign Economic Relations and Trade*, various issues and pages

This article takes a synoptic view of Chinese offshore development since the 1980s to the present, with emphasis on the major developments in the last decade, i.e. 1987-1998. We will analyse the amount of exploration and development work undertaken, investments made, the arrangements with the foreign oil firms by which joint development was made, the discoveries and actual oil production, and the factors contributing to the deflation of high hopes to the modest levels of actual production. The drawing out of such a “big picture” might be of use to energy specialists and policy makers.

### Offshore Development Before the Mid-1980s

China possesses 18,000 km of coastline and a continental shelf of 1.3 million sq km. Offshore oil exploration started in earnest in the 1970s. With the adoption of the open door policy in 1978 and the onset of the second oil crisis in 1980, the country decided to step up its efforts in offshore exploration by inviting multinational oil firms to participate in joint development. The most commonly used form of joint development, i.e. production sharing, was adopted, in which the foreign oil company was responsible for all the expenses of geophysical prospecting and exploration up to the stage at which a field was deemed to be commercially worthy of exploitation. Development costs were borne by the host country and the foreign firm. After the oil field comes on stream, the foreign firm has the privilege of recouping its exploration outlay first, then the oil is divided between the two parties according to proportions agreed to in the original contract.

In the Chinese context, 51% of the development costs was borne by China. The oil produced is divided into three parts: 1. “cost oil” for covering production costs and repaying exploration expenses; 2. “tax oil” for paying mining royalty of 12.5% and industrial-commercial tax of 5%; 3. “profit oil” to be divided according to the contract, but the foreign firm has to pay a profit tax of 50% on the profits it makes (Zhongguo Duiwai Jingji Zhengce Zhinan, 1993, p. 850).

In the early 1980s, many rosy estimates of Chinese offshore oil potential were made, with the area hailed as the last great frontier for oil exploration. Talks of a second Saudi Arabia or North Sea abounded. The Chinese maintained that offshore oil reserves could amount to 75 million barrels; and more optimistic forecasts put potential 1990 production at 2 million barrels/day (b/d).

From north to south, the Bohai, the Yellow sea, the East China Sea, the South China Sea, the Beibuwan and the Yinggehai are all potential oil bearing areas (Fig. 1). The first round of international bidding was launched in Feb. 1982, opening up 150,000 sq km in the Pear River Mouth (part of the South China Sea), south Beibuwan, west Yinggehai and south Yellow Sea for exploration. Activities

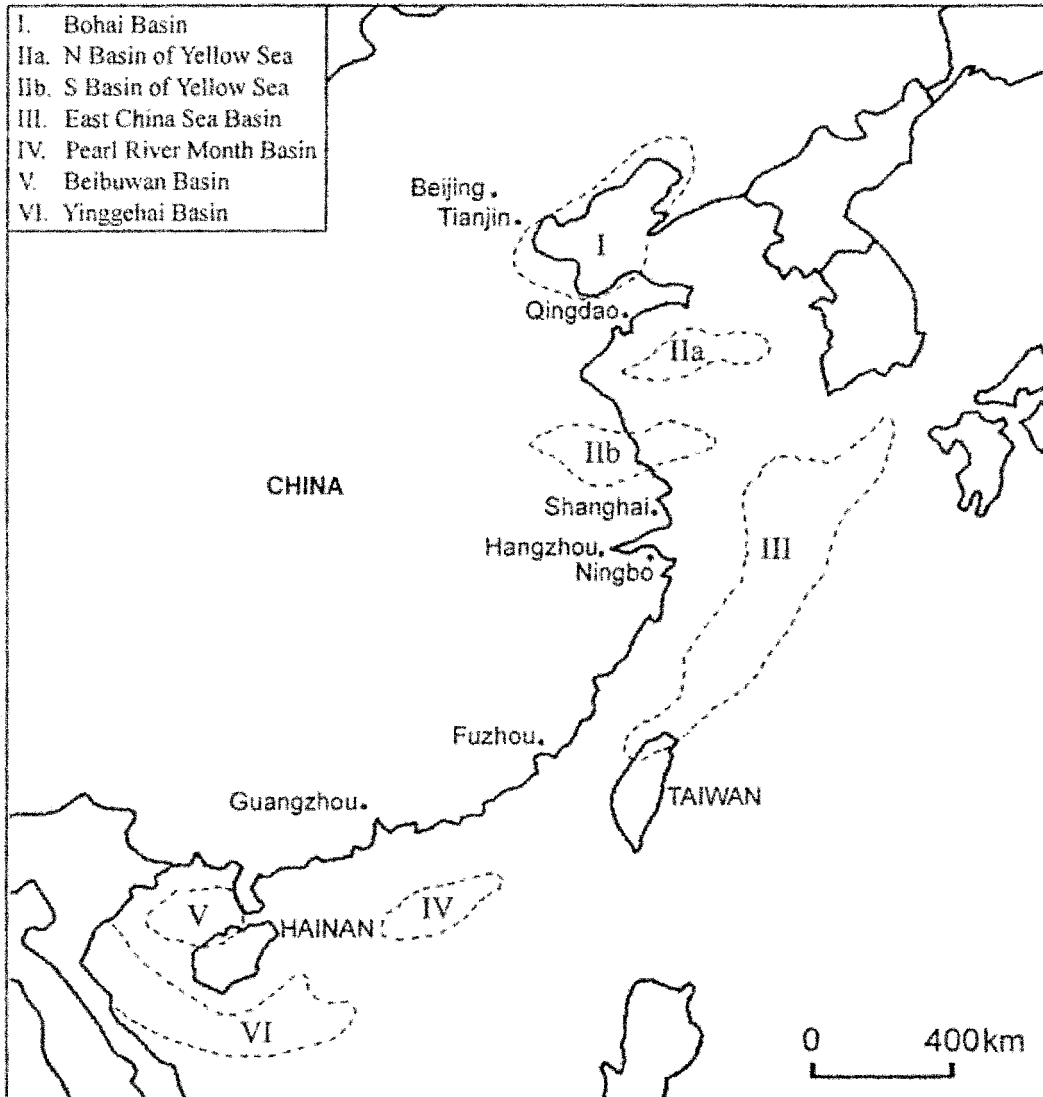


Fig 1 The Six Offshore Basins of China

**Table 2.** 1<sup>st</sup> to 4<sup>th</sup> Round of Bids

Round	Date	Area Opened Up	Area (000 km <sup>2</sup> )	Blocs	Contractual Conditions		
					Countries	Companies	Contracts
1 <sup>st</sup>	16/2/82	Peal River Mouth, S. Beibuwan, W Yinggehai and S. Yellow Sea	150	43	9	28	19
2 <sup>nd</sup>	22/11/84	E Yinggehai, Pearl River Mouth and S Yellow See	108	22	5	15	12
3 <sup>rd</sup>	3/1/89	Pearl River Mouth	32	7	1	2	2
4 <sup>th</sup>	30/6/92	E China Sea	72.8	20	7	15	18

Sources: *China Oil*, Nos.3-4, 1988, p.4

*China Economic News*, No. 25, 1992, p. 15; No. 11, 1993, p.15; No. 43, 1993, p.16; No.1, 1994, p.16

arising out of this round included 118,000 km of seismic survey lines and 83 wells being drilled, leading to the discovery of the Xijiang 24-3, Huizhou 21-1, Huizhou 33-1, Wenchang 19-1, and Lufeng 22-1 oil-and-gas bearing structures. This first round resulted in the signing of 19 contracts with 28 companies coming from 9 countries (Table 2).

A second round of bidding was launched in Nov 1984, opening up 108,000 sq km in the east Yinggehai, the Pearl River Mouth and the south Yellow Sea for exploration. Subsequent discoveries included the Lufeng 13-1 and Liuhua 11-1 oil-and-gas bearing structures. This round attracted 15 firms from 5 countries signing 12 contracts with China.

Total foreign investment under the two rounds amounted to U.S.\$600 million. 190 wells were drilled in the Bohai and the South China Sea, 55 of which discovered oil/gas, giving a success rate of 30% (for general discussion of Chinese oil industry before the mid-1980s, see Dangdai Zhongguo de Shiyou Gongye, 1988; Woodard, 1981; Kambara, 1984; World Bank, 1983, 1985; Fridley, 1990). In Oct. 1985, the Chengbei field in Bohai, a joint project with a Japanese partner, came on stream, marking the commencement of commercial offshore production.

## Offshore Development in the Past Decade

During 1987-98, the length of seismic survey lines carried out amounted to 1.044 million km (Table 3). Total number of exploratory wells sunk was 377; 224 being drilled by the Chinese alone, and 153 drilled by joint ventures. It is noteworthy that in both cases the Chinese efforts surpassed those of the joint ventures. 88 oil-and-gas bearing structures, covering 12,000 sq km, were discovered during this period.

Since 1987, the length of seismic survey lines per year done by the Chinese has persistently surpassed that of the joint ventures. On average, China drilled 15-20 exploratory and appraisal wells per year, the number being kept fairly stable from one year to the next. The government provided various incentives to encourage offshore exploration, e.g. since 1986 imports needed for oil development have been duty free; in 1987, the China National Offshore Oil Corporation (CNOOC) has been given exclusive control over the exploration, development, production and marketing of offshore oil, with the state allocating 100 million renminbi to offshore oil as capital per year. CNOOC could also borrow from domestic or international sources and was free to earn foreign exchange (Luo, 1989).

The number of oil-and-gas bearing structures discovered is closely related to the length of seismic survey lines carried out and the number of wells drilled (Table 3). The data revealed that more oil-and-

**Table 3.** Seismic Survey Lines, Wells Drilled, Oil Discovered

Year	Seismic Lines			Exploratory Wells Drilled			Oil/Gas Structures Discovered	New Additions to Reserve	Cumulative Reserves Discovered
	Self	Joint Venture	Total	Self	Joint Venture	Total			
	('000 km )								
1984	4	36	40	2	33	35	12		
1985	5	20	25	12	28	40	6		
1986	25	26	51	9	25	34	8		
1987	22	5	27	15	21	36	8		
1988	26	2	28	21	21	42	9	/	800
1989	15	7	22	16	13	29	7	50	850
1990	15	9	24	10	9	19	5	/	/
1991	15	2	17	12	9	21	4	/	870
1992	22	19	41	18	9	27	4	230	1 100
1993	36	7	43	13	6	19	7	100	1 200
1994	27	13	40	21	3	24	10	10	1 210
1995	35	40	75	16	22	38	5	40	1 250
1996	52	112	164	40	8	48	10	210	1 460
1997	81	121	202	22	15	37	13	177	1 640
1998	/	/	406	20	17	37	6	187	1 827

Sources: *Almanac of China's Economy*, 1982-1999, various pages

*China Development Report*, 1997-1998, various pages

*Encyclopedia Yearbook*, 1989-1995, various pages

gas bearing structures were discovered during 1984 to 1988 and 1994 to 1998 than 1989 to 1993. The technological level of the Chinese geophysical prospecting teams improved in the 1980s, reaching world standards in the 1990s; hence the success rate of oil exploration rose from 36% in 1987 to 73% in 1997, denoting that Chinese ability to find oil had improved during that period (Su, 1995).

The third round of international bidding was launched in Jan 1989, opening up 32,000 sq km at the Pearl River Mouth for exploration, but resulted in only 2 contracts signed with 2 companies. The fourth round, opening up 72,800 sq km at the East China Sea for exploration, was mounted in June 1992, which elicited a much more enthusiastic response from the foreign firms than in the third round because the East China Sea was opened up for the first time (Table 4). This round resulted in 18 contracts being signed with 15 companies coming from 7 countries. That more oil was discovered during 1984-88 and 1994-1998 than 1989-1993 was closely related to the exploration work done by the international oil firms after the first, second and fourth round of bids.

During 1987-1997, CNOOC invested U.S.\$4.04 billion in offshore oil, averaging U.S. \$370 million per year. Total foreign investment was U.S.\$3.7 billion, 1.5 billion for exploration and 2.2 billion for development. An annual average of U.S.\$200-300 million was invested by the foreign firms, with U.S.\$100 million each for exploration and development (China Business Review July/Aug., 1994, pp. 10-15). From 1982 to 1998, CNOOC has used U.S.\$6.00 billion of foreign funds (Table 5). It is obvious that China is dependent upon foreign investment to fund its offshore program; should the inflow of foreign investments be trimmed, it would adversely affect the industry.

**Table 4.** Number of Contracts and Agreements

Year	No. of Contracts and Agreements	Cumulative No. of Contracts and Agreements		
		Country	Company	Contracts/Agreements
1980	4	2	4	4
1981	0	2	4	4
1982	1	3	6	5
1983	18	9	31	23
1984	0	9	31	23
1985	5	12	39	28
1986	6	12	58	34
1987	5	12	45	39
1988	5	12	45	44
1989	9	12	45	53
1990	6	12	45	59
1991	7	13	49	66
1992	6	13	50	72
1993	20	15	55	92
1994	8	16	59	100
1995	9	16	62	109
1996	17	18	67	126
1997	5	18	67	131
1998	6	18	68	137

Sources: *Almanac of China's Economy*, 1982-1999, various pages

**Table 5.** Foreign Investments

Year	Annual Foreign Investments (U.S. \$ Million)			Cumulative Foreign Investments (U. S. \$ Million)		
	Exploration	Production	Total	Exploration	Production	Total
1984	490	130	620	1 300	90	1 390
1985	300	60	360	1 600	150	1 750
1986	210	60	270	1 810	210	2 020
1987	150	60	210	1 960	270	2 230
1988	150	60	210	2 110	330	2 440
1989	150	120	270	2 260	450	2 710
1990	110	150	260	2 370	600	2 970
1991	80	70	150	2 450	670	3 120
1992	90	150	240	2 540	820	3 360
1993	60	280	340	2 600	1 100	3 700
1994	140	670	810	2 740	1 770	4 510
1995	250	370	620	2 990	2 140	5 130
1996	110	140	250	3 100	2 280	5 380
1997	210	130	340	3 310	2 410	5 720
1998	/	/	280	/	/	6 000

Sources: *Almanac of China's Economy*, 1982-1999, various pages

*China Development Report*, 1997-1998, various pages

## Offshore Production

During 1982-1997, total oil-in-place discovered offshore amounted to 1.64 billion tonnes, with Bohai accounting for 0.97 billion, Pearl River Mouth 0.56 billion and Beibuwan 0.11 billion. Of the total, 0.84 billion tonnes were discovered during 1988-1997.

During 1982-1997, 21 oil/gas fields came on stream (Table 6), 9 in Bohai and 12 in the South China Sea, including Beibuwan and Yinggehai (Fig. 2). Of the 9 fields in Bohai, 5 are entirely Chinese projects and 4 being joint ventures. The 12 fields in the South China Sea consist of only 1 entirely Chinese project, the rest being joint ventures.

Offshore oil production was insignificant in the 1980s, less than 1 million tonnes per year (Table 7), which is quite easy to understand in light of the long lead time needed for offshore development.

**Table 6. Oil/Gas Fields Developed During 1985-1997**

Offshore District	Oil/Gas Field	Foreign Partner or Self	Starting Date	On Stream Date	Oil - in -place	Proven Reserve	Maximum Production
					(Million tonnes)		('000 tonnes/yr.)
Bohai	Chengbei	Japan-China Oil Corp.	1982	1985	25	/	400
Beibuwan	Wei 10-3	Total	1983	Aug. 1986	36.78	/	300
Bohai	Bozhong 28-1	Japan-China Oil Corp.	Feb. 1985	May 1989	/	/	430
Bohai	Huizhong 34-2/4	Japan-China Corp.	1988	June 1990	/	/	480
Pearl River Mouth	Huizhou 21-1	ACT	Oct. 1987	Sept. 1990	/	20	1 000
Pearl River Mouth	Huizhou 26-1	ACT	1989	Nov. 1991	45	/	1 500
Bohai	Jinzhong 20-2	Self	1989	Aug. 1992	/	13	100
Bohai	Suizhong	Self	1988	Sept. 1993	300	140	1 000
Pearl River Mouth	Lufeng 13-1	New S. China Oil Corp. of Japan	Sept. 1990	Oct. 1993	/	/	1 100
Beibuwan	Wei 11-4	Self	1988	Oct. 1993	24.50	14	800
Pearl River Mouth	Xijiang 24-3	Phillips- Pinkerton	June 1998	Nov. 1994	29.09	/	1 500
Pearl River Mouth	Huizhou 32-2	ACT	1993	1995	/	20	600
Pearl River Mouth	Huizhou 32-3	ACT	1993	1995	/	20	600
Pearl River Mouth	Xijiang 30-2	Phillips-Pinkerton	1993	1995	30	/	1 100
Bohai	Chengdao	Japan Oil Corp.	1993	March 1995	100	/	1 000
Bohai	Caofeidian	Self	Dec. 1993	May 1995	9	1	200
Pearl River Mouth	Lihua 11-1	Amoco	1993	March 1996	200	15.06	2 920
Yinggehai	Ya 13-1*	Amoco	June 1989	Jan. 1996	107.7b.cu.m	/	3.4 b.cu.m.
Bohai	Qikou 18-1	Self	1992	Nov. 1997	20	/	530
Bohai	Qikou 17-3	Self	1994	Dec. 1997	20	/	500
Pearl River Mouth	Lufeng 22-1	Occidental	1994	Dec. 1997	/	/	1 500

\* Gas field

Sources: *Almanac of China's Economy*, 1988-1998, various pages

*Studies on Chinese Communism*, No. 10, Vol 29, pp. 57-64

**Table 7.** Offshore Production, On Shore Production and World Oil Prices, 1987-1997

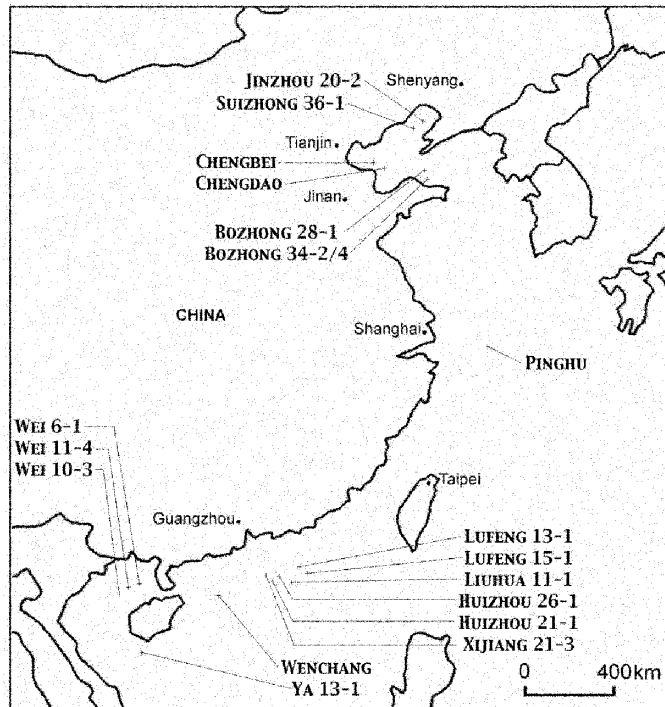
Year	Offshore Production ( '000 tonnes)				Onshore Production ( '000 tonnes)	Offshoreas % of Total Production (%)	Average World Oil Prices (U. S.\$/b)
	Total	Bohai	East S China Sea	West S China Sea			
1987	714	362	0	352	133 426	0.53	18.15
1988	752	408	60	284	136 298	0.55	14.72
1989	903	624	78	201	136 747	0.66	17.84
1990	1 260	860	140	260	137 050	0.91	22.97
1991	2 410	940	1 170	300	138 580	1.71	19.33
1992	3 870	1 010	2 580	280	138 170	2.72	19.03
1993	4 630	1 120	2 940	570	140 610	3.19	16.82
1994	6 476	1 638	3 727	1 111	139 177	4.73	15.90
1995	8 415	1 904	5 562	949	141 624	5.61	17.16
1996	15 008	2 126	11 732	1 150	142 320	9.54	20.42
1997	16 287	2 109	12 956	1 222	144 143	10.15	19.27
1998	16 274	2 654	12 552	1 068	107 380	13.17	13.07

Sources: Offshore Production and Onshore Production: *Almanac of China's Economy*, 1982-1999, various pages

*China Development Report 1997-1998*, various pages

*Encyclopedia Yearbook*, 1989-1995, various pages

World Oil Prices: IMF, *International Financial Statistics Yearbook 1999*



**Fig 2.** Selected Offshore Oil/Gas Fields in China



Production rose rapidly in the 1990s, surpassing the million tonne mark in 1990 (1.26 million tonnes), and reached 16.274 million tonnes in 1998, when it accounted for 13.17% of national oil output. This was made possible by the coming on stream of a number of important fields in the 1990s (Table 6), including Huizhou 21-1 at Pearl River Mouth with a maximum annual production of 1.00 million tonnes (on stream year: 1990), Huizhou 26-1 at the same area with a maximum annual production of 1.50 million tonnes (1991), Suizhong 36-1 at Bohai with a maximum annual production of 1.00 million tonnes (1993), Lufeng 13-1 at Pearl River Mouth with a maximum annual production of 1.10 million tonnes (1993), Xijiang 24-3 at Pearl River Mouth with a maximum annual production of 1.50 million tonnes (1994), Xijiang 30-2 at the same area with a maximum annual production of 1.10 million tonnes (1995), Chengdao oil field at Bohai with a maximum annual production of 1.00 million tonnes (1995), Liuhua 11-1 at Pearl River Mouth with a maximum annual production of 2.92 million tonnes (1996) and Lufeng 22-1 at Pearl River Mouth with a maximum annual production of 1.50 million tonnes (1997). These are the nine offshore fields with annual production of 1 million tonnes or more, which in itself is by no means regarded as a large field, showing that the Chinese offshore fields are all relatively small.

Additionally, there are only four fields with oil-in-place larger than 100 million tonnes: Suizhong 36-1 : 300 million tonnes; Liuhua 11-1 : 200 million tonnes; Qinghuangdao 32-6: 170 million tonnes and Nanbao 35-2: 110 million tonnes. Hence it can be concluded that up to the present few large offshore fields have been discovered, and most of the producing fields are relatively small.

CNOOC established different companies to take care of the management and development of the offshore basins, including the Bohai Oil Co., the South Yellow Sea Oil Co., the East China Sea Oil Co., the eastern South China Sea Oil Co. and the western South China Sea Oil Co.. Among these companies, the eastern South China Sea Oil Co., being responsible for the Pearl River Mouth area, had the lion's share of Chinese offshore production since 1991. By 1998, with a production of 12.552 million tonnes out of a total of 16.274 million tonnes, the Pearl River Mouth area accounted for 77% of total offshore output. The Bohai basin, producing 2.654 million tonnes, contributed 16%, whereas the western South China Sea Co., in control of Beibuwan and Yinggehai, produced 1.068 million tonnes, making up the rest. In short, present offshore production is dominated by the South China Sea fields.

## **Factors Contributing to Modest Offshore Production**

It is clear that actual offshore production in the 1990s fell far short of the high expectations entertained by many people in the early 1980s. What factors contributed to the deflation of such high hopes?

### **I. Complex Geological Structure**

The first factor is the complex geological structure of the offshore fields. Faulting affected many of the oil-and-gas bearing structures, exacerbating the situation and leading to the formation of small blocs of oil-and-gas bearing areas. This is an extension of the complex geological structure of the onshore fields into the offshore regions. Oil fields found in such areas are usually small and have a short life span. Because much of the oil is trapped in small pockets, it is argued that a considerable proportion of it might never be tapped.

Two examples could be cited to illustrate the point: In a joint venture with Japan in Bohai, which has a very complex geological structure, the Chinese discovered the Bozhung 28-1-1 field, which has very good prospects. Then several hundred metres away, they drilled the 28-1-4 and 28-1-6 wells, but both

were dry holes. In another instance, the Chinese drilled on the top of an old buried hill in the South China Sea, but found no oil. Then they drilled on the saddle, still no oil was discovered. Finally they drilled on the foothill and discovered a high yielding well. This pattern of discovery contradicts the rule governing the movement of oil in the oil-and-gas bearing structure: One would expect to find oil at the top of the hill, not the foothill. Oil is found in the unexpected places, but not found in the areas deemed to have good prospects. Obviously, this will hamper exploration and development (Liu, X and Liu, H., 1991; Burns, 1984, 1985).

## **II. Quality of Chinese Crude**

A second factor impeding oil production is the quality of Chinese offshore crude, which is often heavy (specific gravity greater than 0.92), viscous, with low asphalt content (generally less than 10% of crude) and low sulphur content (less than 0.8%) (Liu, W, 1988). Given its high viscosity, it is inappropriate to use the water injection method of production, instead, steam could be used, which raises the cost of production. Further, to keep the crude above its pour point to facilitate transportation, heat has to be added to it, which again boosts production costs. To make matters worse, the content of dissolved gas is low in the heavy Chinese crude, less than 10 cu.m. of gas per cu.m. of oil. Since the dissolved gas serves the purpose of driving the oil, low gas content leads to slow oil movement and low production.

The Suizhong 36-1 field in Bohai is an example par excellence of a difficult field to exploit. The viscous oil covers a large area buried in shallow layers, hence the oil field pressure is small, making it exceedingly difficult to tap. In fact, this field is deemed to be a challenge for offshore exploitation in the 21st Century (She, 1995, p.15).

## **III. Low World Oil Prices**

When China launched its first round of international bidding in 1982, oil was selling at an average price of U.S.\$32.45/b in the world market (Table 7). As the Chinese offshore program unfolded in the ensuing years, oil prices dropped unceasingly, briefly dipping to U.S.\$10/b in 1986, and recovered somewhat in the subsequent years. Yet, on average, oil prices have never achieved the heights reached in the early 1980s again.

The precipitous drop in oil prices had grave impacts on Chinese offshore development. After the first and second round of biddings, the foreign oil companies carried out their drilling work as stipulated in their contracts. By 1986, quite a few of the firms were disillusioned by the lack of discoveries in their blocs, especially the lack of large fields. The finds were mostly dry holes or small to medium fields. In the wake of the collapse in world oil prices, the foreign firms had even less incentive to invest in the Chinese offshore program. In fact, some of the firms, like Elf-Aquitaine, withdrew completely after they have completed their contractual commitments (Zhongguo Shiyou, spring 1984, p. 70). Oil majors like Amoco and Mobil also retreated or trimmed their operations drastically. This partly stemmed from the cuts in their overall exploration budgets worldwide. The deleterious effect on the Chinese program is reflected by the drastic drop in contracts signed in the second and third round of biddings compared with the first round : 12 and 2 respectively versus 19.

After 1986, foreign interests in the offshore program receded drastically : The amount of risk capital invested shrank from U.S.\$490 million in 1984 to U.S.\$60 million in 1993. Length of seismic survey lines carried out dwindled from 36,000 km in 1984 to 2,000 km in 1991. 33 well were drilled in 1984, but only 3 in 1994.

Fully aware of the changed situation, China made a number of concessions to retain foreign interests. First, the foreign firms were allowed a longer period to complete their exploration contractual obligations. Initially, blocs covering 2,000 sq km or less were given 5 years for the work, and those larger than that, 7 years. After the oil price collapse, the period was lengthened. Secondly, in cases in which the exploration results were disappointing, the company could move on to explore another area not yet covered by another company.

Thirdly, in high risk areas like the deep water zone, the foreign firm is allowed to carry out geophysical prospecting first, then decide whether to proceed or not, depending on the result of the prospecting work, in order to ensure a higher success rate of oil discovery (Hui, 1993, pp. 67-68). Fourthly, fields producing less than 1 million tonnes per year were exempted from the royalty tax, in an attempt to encourage the exploitation of small fields. The profits tax was reduced from 50% to 33%. All materials imported were duty free. Losses incurred in the exploration of one bloc could be recovered from another bloc. All these economic incentives were given in order to entice foreign participation.

Despite the drop in oil prices, China continued to put efforts in offshore development. Drilling 20-30 wells per year entails an investment of 500 million renminbi. As stated above, China is dependent upon foreign investments to spur its offshore program. Any curtailment of investment inflows will retard the program.

#### **IV. Physical Environment of Chinese Waters**

Environmental factors of the Chinese waters hinder oil development, including frozen seas in the north, typhoons and high waves in the East and South China Sea, depth of the seas, earthquakes and soft silts underlying the sea-floor.

The Bohai and Yellow Sea are occasionally affected by freezing in the winter, which often occurs during the middle of November to mid-March the following year. The seas could be frozen for 90-110 days in one stretch, with the frozen surface extending for 30-40 cm from the top (Wen Wei Pao, 10th March, 1998). Naturally, this impedes oil exploration and development.

The East and South China Sea are open seas located in the typhoon belt of East Asia. Consequently, they are affected by the typhoon : On average, the East China Sea is visited by 20 typhoons per year. Moreover, the eastern portion of the East China Sea and the deep parts of the South China Sea are also plagued by high waves, with 30% of the waves taller than 8 ft. These adverse environmental factors undoubtedly impede the offshore program. To cite one well known tragedy, it could be noted that the drilling ship "Java Sea", while drilling in the Ledong 30-1-1 well area in the South China Sea, was sunk by typhoon number 8316 in Oct 1983, leading to the death of 81 crew members (Ruan, 1984). Relatedly, the Liuhua 11-1 field in the Pearl River Mouth area was handicapped by the frequent visits of typhoons and deep waters, which rendered its exploitation difficult and deferred its coming -on-stream date.

The depth of the seas could also be a problem. The Bohai, with an average depth of 18 m, and the Yellow sea, having an average depth of 44 m on the continental shelf, present little problems. But the East China Sea ---average depth 1,500 m --- and the South China Sea, with most waters deeper than 4,000 m, are faced with considerable difficulties. It is much more expensive to tap oil in the deep waters than shallow waters. In fact, the eastern portion of the East China Sea, the Pearl River Mouth Area and the eastern part of the South China Sea all belong to the third - level technological zone area (Williams, 1975), which signifies that these seas are difficult and expensive to exploit because of their depth (He,

1984). In fact, given the depth of the South China Sea, it is contended that its oil prospects are not as good as the East China Sea.

In view of the higher cost in tapping the deeper waters, it can be noted that in 180-200 m deep seas --- by no means considered as deep seas in offshore development --- only fields with 100 million tonnes oil-in-place and wells producing at least 300 tonnes/day for 5-8 years could be economically exploited. But most of the Chinese finds are medium to small fields, hence they are not commercially viable to be tapped.

Most of the Chinese offshore seas are within the West Pacific active earthquake zone. The Bohai is especially vulnerable to earthquakes. The Tangshan earthquake in 1976 damaged the oil exploration work going on then (Cao, 1989, p. 70).

Lastly, the major Chinese rivers like the Yellow River, the Yangtze and the Huai carry a large amount of silt into the eastern seas every year. The shallow coastal seas are underlain by a layer of soft silt, usually 2-7 m thick. This retards oil exploration in the sense that the soft silt could lead to the slipping of the submersible drilling ships.

## **V. Conflicts Over Sovereignty**

In the 1982 U.N. Law of the Sea Treaty, each coastal state is entitled to claim 12 nautical miles of territorial sea, 200 nautical miles of exclusive economic zone and the resources lying in the seabed of the continental shelf adjoining the state. Hence, conflicting claims over the sovereignty of certain offshore oil resources are unavoidable (Glassner, 1996, pp. 515-544).

China laid claim to wide stretches of the Yellow Sea, the East China Sea, and the South China Sea. Its claim includes Taiwan, the Diaoyus, the Pescadores, the Pratas, the Macclesfield Bank, the Paracels, and the Spratly Islands (Fig. 3). Apart from historical reasons, the Chinese argued that the Yellow Sea, the East China Sea and the South China Sea are underlain by deposition coming from the major Chinese rivers like the Yellow River, the Yangtze and the Pearl River (Qin, 1995; Liao, 1996, p. 80).

In the Yellow and the East China Sea, China has overlapping claims with S. Korea, Japan and Taiwan over certain parts of the seas. In 1972, S. Korea tried to develop the offshore resources of the Yellow Sea by co-operating with Gulf Oil in an area also claimed by China. The operation ceased after Chinese objection. Also in the 1970s, Taiwan laid claims to wide stretches of the East China Sea and signed contracts with U.S. oil firms to explore the East China Sea basin by carrying out geophysical prospecting. In the 1980s, S. Korea and Japan agreed to co-operate in the exploration for oil in the seas adjacent to the two countries: They explored in the northern rim of the East China Sea basin. China objected, and drilled the Longjing No.1 well in a location south of the Korea-Japan exploration site. Thereafter, exploration activities by all parties in the area ceased.

Conflicts over sovereignty in the South China Sea are especially acute. In 1968, the Economic Commission for Asia and the Far East reported the discovery of a long narrow ridge on the continental shelf of the South China Sea, pointing to the possibility of rich oil reserves. Some estimates put the reserves at 20 billion tonnes, surpassing that of Kuwait which has the third largest reserves in the world (Chen, Q, 1992). Since none of the islands or reefs is more than 200 nautical miles from land, hence overlapping claims over the islands are bound to occur, which is easily understandable in light of the fact that a state owning an island could claim a territorial sea and exclusive economic zone around it.

In 1977, Vietnam declared a 200 nautical mile exclusive economic zone in the South China Sea, and claimed historic sovereignty over the Spratly Islands and Paracels. Now, Vietnam occupies 30 islands in



**Fig 3.** Islands in the South China Sea

the Spratly Islands, including Wanan Tan, Xiwei Tan and the Nanhua Reef. In 1978, the Philippines included almost all islands of the Spratly and 240,000 sq km of the adjacent seas into the Palawan District, claiming sovereignty over it. At present, the country occupies 8 islands in the Spratlys, including Zhongye and Mahuan (Liao, 1996, pp. 83-84). Practically all of the islands and semi-submerged reefs have been occupied by the adjacent states, and the latter have all enacted mining acts and drawn up blocs to attract foreign participation in oil development.

The case of Vietnam is worth recounting. In 1988, the country drew up 185 blocs, covering almost all of the southern portion of the South China Sea, and invited bids from the international oil firms. Contracts were signed with companies from the U.S., Japan, Malaysia, Russia, Canada, the U.K. etc. 60 wells were drilled (Zheng, 1996, p. 201). In the late 1980s, the country discovered the Daxiong oil-field in the Wanan Basin, which produced 3,400 tonnes/day. From 1985-92, its offshore oil production grew from zero to 5.4 million tonnes per year, when it overtook rice to become the leading export commodity of the country.

In 1996, Indonesia signed a U.S.\$3.5 billion contract with Exxon to look for hydrocarbons in the South China Sea, intruding into the seas surrounding the Spratly Islands. It would seem that China had not objected to the project, probably because the area explored rightly fell under Indonesian sovereignty.

China has had a number of conflicts with Vietnam and the Philippines in relation to the South China Sea. In 1974, China got into a military conflict with Vietnam and established its control and sovereignty over the Paracels. In 1988, China again clashed militarily with Vietnam over the Chigua Reef in the

Spratly Islands. In April 1994, CNOOC co-operated with an international oil firm to look for oil in Wanan Bei in the Spratlys, with the Chinese navy providing protection to the exploration team. Vietnam retaliated by carrying out geophysical prospecting in Wanan Tan to disrupt the Chinese effort (Qin, 1995).

The conflict was only temporarily resolved after President Jiang Zi-min visited Vietnam in Nov 1994.

### Future of Offshore Production

Chinese offshore production has fallen short of expectations. Output is estimated to be maintained at about 20 million tonnes per year in the next few years. By 2005, production could rise to 30 million tonnes, with 10 million tonnes coming from Bohai and the rest from the South China Sea fields. By 2000, offshore oil is slated to account for 13% of total oil output, rising to 19% by 2010 (State Statistical Bureau, 1997, p. 96; Zhang, G., 1993). Given that oil consumption exceeded domestic production by 29 million tonnes in 1998, which could widen to 100 million tonnes by 2010, it is clear that offshore production cannot materially alter the oil balance of the country. In recent years, it has helped to arrest the decline in total production, offsetting the dip in onshore output. In the future, it could play the same role, yet it would be difficult to boost total production substantially by jacking up offshore production.

The economics of offshore production up to the present has not been encouraging : During 1990 to 1997, total sales of offshore oil amounted to 55 billion renminbi, and CNOOC has been given the right to market offshore oil according to international prices (Table 8). Up to 1997, China and the international oil firms had invested a total of U.S.\$9.2 billion (76 billion renminbi) in the offshore program, which exceeds the sales receipts mentioned above. As a result, CNOOC carried debts to the amount of U.S.\$1.4 billion and 4.0 billion renminbi in 1995 (State Statistical Bureau, 1996, 1997, 1998; Hui, 1989, pp. 129-130). Of course, the economic situation could improve substantially in the future when the existing fields continue to produce year after year, and the initial investments got amortized. During

**Table 8.** Sales of Offshore Oil, 1988-1997

Year	Total Sales ( '000 tonnes)	Domestic (%)	Exports (%)	Sales Receipts (Billion Renminbi)	
				Annual	Cumulative
1988	705	66.2	33.8	/	/
1989	934	29.7	70.3	/	/
1990	1 162	/	/	0.84	1.403
1991	2 390	68.2	31.8	2.74	4.143
1992	3 923	75.4	24.6	3.11	7.253
1993	4 440	78.0	22.0	3.53	10.783
1994	6 472	80.2	19.8	6.55	17.333
1995	8 150	83.6	16.4	8.88	26.213
1996	15 140	64.1	35.9	13.97	40.183
1997	16 040	64.0	36.0	1.49	55.083
1998	16 000	70.8	29.2	/	/

Sources: *Almanac of China's Economy*, 1988-1999, various pages

*China Development Report* 1997-1998, various pages

*Encyclopedia Yearbook*, 1989-1995, various pages

1988 to 1998, on average 65-80% of offshore oil was sold domestically, with 15-30% being exported each year. Part of the oil was exported because under the production sharing arrangement, the foreign partner is paid for by means of the oil produced (Chen, F., 1989, p. 47).

To be impartial in assessing future offshore prospects, it should be noted that the degree of exploration carried out so far is relatively low ; with more extensive exploration in the future, it is highly likely that more hydrocarbons will be found. It was reported that in the U.K. portion of the North Sea, during 1967-71, 43 exploratory wells were drilled, with 8 discovering oil/gas, giving a success rate of 18.6%. In the basin deemed with the best prospects, 234 wells were sunk, with 85 finding oil/gas, giving a success rate of 36.3%. In the Pearl River Mouth area of the South China Sea, during 1983-96, 47 geological structures were explored, with 9 discovering oil, yielding a success rate of 19.1%. In the Huizhou Basin of the Pearl River Mouth area, 6 out of 11 exploratory wells yielded oil, giving a success rate of 55%. These figures seemed to support the contention that the prospects for finding oil in the Chinese offshore seas are no worse than in the U.K. North Sea. In fact, the total area of the 6 Chinese offshore seas is 3 times as large as the U.K. North Sea, yet the number of wells drilled is only one-seventh of that of the latter. Confining the discussion to China, it could be noted that the density of exploratory wells drilled onshore is 10 times that of offshore, which attests to the low degree of offshore exploration so far.

Consequently, the Chinese pointed out that it is too early to conclude categorically what the real prospects of offshore production are. Large fields with oil-in-place exceeding 100 million tonnes like Suizhong and Liuhua have been discovered; hence the contention that no or few large fields will be found in the Chinese offshore areas might be refuted in the future.

Up to the present, the Chinese strategy is to develop the more favourable offshore areas first, thereby concentrating their efforts in the Bohai and the Pearl River Mouth area. Only in relatively recent years have they started to explore in the Yellow sea and the East China Sea. In the latter area, a number of significant discoveries was made in the Pinghu and Pingbei development zone (Hui, 1995). The Pinghu oil-field was scheduled for completion in 1998. In the Yellow sea, only two wells saw oil/gas, and no commercial discoveries were made so far. Naturally, in the wake of more exploration, new oil/gas resources will be discovered in the offshore seas. The East China Sea, with a depth smaller than the South China Sea, holds especially promising prospects.

Offshore production could be boosted if conflicts over sovereignty are resolved. This will allow the opening up of vast stretches of the Yellow Sea, the East China Sea and the South China Sea for exploration. In 1992, in the ASEAN meeting in Manila, the ASEAN Declaration adopted the principle of joint development of the resources in the Spratly Islands, and to resolve the issue of sovereignty by peaceful dialogue among the states concerned. Yet, in view of the conflict between China and the Philippines over the structures on the Mischief Reef, it is difficult to see how the overlapping claims issue could be resolved in the foreseeable future. The row between China and Japan over the sovereignty of the Diaoyu islands does not bode well for the resolution of conflicts in the East China Sea either.

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