CHAPTER XVIII. ECONOMICS

A. INTRODUCTION

The oil and gas industry makes a substantial contribution to the local economies of southwestern and central New York. The economic impacts of the oil and gas industry are broad based, and as with other industries, there are direct impacts which multiply into direct and indirect effects. As a general example, the direct social and economic impacts from oil and gas activity are the monetary gains realized by the operators, contractors, and landowners who lease their lands.

The monetary gains generated by an industry such as investment, direct and indirect jobs, salaries and revenues which in turn filter down through a wider segment of society are referred to as the multiplier effect. The multiplier effect from the oil and gas activity in New York State is 1.4. This means that in New York State for every $1 output generated at the wellhead, the total contribution to the State's economy is 1.4 dollars, reflecting the fact that indirect effects generate output in other industries in New York. Another perspective on multiplier effect is the estimate that for every dollar of output from the wellhead, an additional 21 cents is earned by persons employed by non-government industries and for every additional $1 million in oil and gas output, 7.9 new jobs are created (United States Department of Commerce, 1986). The reported earnings multiplier of 1.4 for the oil and gas industry in New York is lower than many manufacturing and service industries, partly because the industry as a whole is not labor intensive, and also because most of the companies which provide services to the industry in New York are headquartered in nearby Pennsylvania.

In 1986, New York production as well as national production, dropped significantly in response to lower oil and gas prices. Low oil and gas prices

are currently benefiting most consumers, but low oil and gas prices and declining domestic production have negatively impacted oil and gas producers, and a large portion of society that is affected indirectly by the petroleum industry. As prices continue to decline, the effects will spread outward affecting even greater numbers of people. An estimated 1.6 million jobs have been lost nationwide (Interstate Oil Compact Commission, 1986). The magnitude of this crisis is indicative of how important the oil and gas industry is to the U.S. economy.

New York, with its diverse economic base, has not suffered as much as states which rely heavily on oil and gas revenues. However, the impact remains considerable, and significant declines in drilling activity and production have occurred. Most affected by the industry slump are the oil and gas producing counties in the southwest part of the state.

1. Historical Benefits to State

The first commercial oil well in Limestone, New York, the Job Moses #1, was drilled just six years after Drake's historic discovery well in Titusville, Pennsylvania. The predominantly agricultural Southern Tier was transformed into a series of boomtowns as new fields were discovered in Cattaraugus and Allegany Counties. Before the discovery of oil, the hilly Southern Tier counties were mostly hardscrabble farms, on poor, rocky soil. Most of the timber had been clear cut, and the hillsides and streams were ravaged by the effects of erosion and siltation. Although the initial environmental impact of exploration and production was considerable, with cutting of much of the remaining timber to build derricks, it was not as damaging to this region as the early clear and cut farm practices. The contamination of local streams with oil and brine was caused not so much by early drilling practices as by early oil transport and storage practices in which streams were used as open conveyances, and early wooden storage tanks

leaked appreciably. Even the negative impacts of these practices did not persist. Today much of the once barren area is thickly forested, and there is abundant fish and wildlife.

Most of the historic production came from the Richburg and Bradford sands which extend into New York from the Pennsylvania oilfields. In 1882, New York State's oil production peaked at an all time high of 6.6 million barrels. Even after the initial boom was over, the area continued to benefit from oil activities. Oilfield employment and oil related industries such as the manufacture of nitroglycerin, engines, derricks, and storage tanks brought people and prosperity to this portion of the State. As pipelines and refineries were built, further investment and employment opportunities developed.

The oil discoveries brought services to an area which had been previously isolated from the Industrial Revolution that was transforming much of the rest of New York. Telegraph lines and railroads were built, linking the Southern Tier with the rest of the state, further encouraging investment and development. Community services improved; between 1879 and 1885, the towns acquired municipal water systems, indoor plumbing, fire departments, and telegraph service. The natural gas produced in association with the oil was also used locally for heating homes and powering industries.

B. NEW YORK PRODUCTION AND MARKET VALUE

1. Production

Although the price of oil and gas fell in 1985, the price decrease was offset by higher production. In 1985, approximately 1,071,000 barrels of oil and 33 billion cubic feet of gas were produced. Generally, oil production in New York has been declining steadily, but recent Bass Island discoveries and production offset the general decline for a few years. Bass Island wells

contributed 29.7 percent of the State's total crude oil production in 1986. The sharp decline in oil prices in 1986 led to a 20.3 percent drop in the State's production of crude oil. There were 852,564 barrels of oil produced in 1986, compared to the 1,071,280 barrels produced in 1985. Natural gas production in New York continued to increase in 1986, although at a slower rate than during the previous three years. Total gas produced in 1986 was 34.2 billion cubic feet (BCF), representing a slight increase of 1.2 BCF or 3.6 percent over 1985 production.

The number of active oil and gas operators in New York State declined 60 percent between 1984 and 1986. There were 591 oil and gas operators who reported active wells in 1986, down from 978 operators in 1984. The majority of New York State oil and gas producers are small operators. Although the maximum number of wells reported for a single operator was 1,846 wells, the average number of wells per operator is twenty.

2. Market Value

Market value of the State's 1986 oil production was approximately $13.3 million. Natural gas prices also fell in 1986, from $3.37 per thousand cubic feet (MCF) in 1985 to an average of $2.60 per MCF in 1986. Wellhead gas prices are highly variable because of the increasing variety of gas contracts, especially with regard to the large volumes of gas transported by the pipeline companies for direct sales from producers to end users. Market value of the State's 1986 gas production was approximately $87.6 million.

The combination of lower prices and decreased oil production reduced the total market value of New York State's oil and gas production to $100.09 million in 1986, the lowest level since 1982. This represents a decrease of $42.1 million, or 29.4 percent from $143 million in 1985 (Figure 18.1). Wellhead oil prices dropped precipitously during the first half of 1986 before leveling off somewhat toward the end of the year. A barrel of New York State

FIGURE 18.1

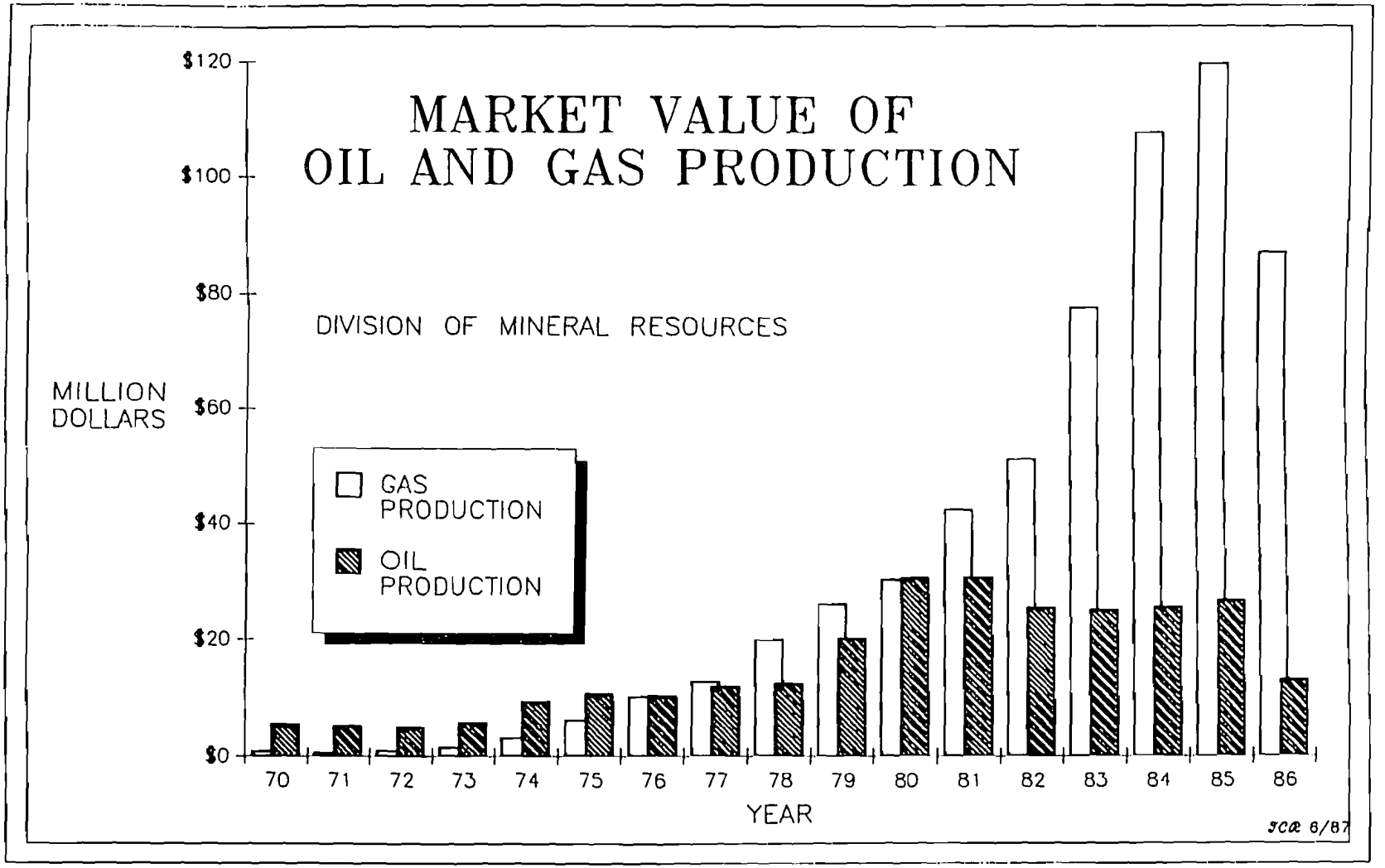

FIGURE 18.1
18-4a

crude sold in January 1986 for $26, dropped to a low of $12 by late July and early August, and rebounded to $16.50 by December 31. The average price per barrel for 1986 was approximately $15.65, compared to $25.15 in 1985.

In 1986, New York produced 5.6 percent of the gas it consumes which makes it a net importer of gas. Production has significantly increased since 1980, when New York production represented only 2 percent of the State's consumption.

C. LEASING PROCESS AND REVENUES

1. Leasing Private Lands

The first step in drilling for oil or gas involves leasing. In the case of privately owned land, the decision to lease the mineral rights is made by the landowner, who receives a stated percentage of production, usually 1/8 of the market value, in the form of royalties. State regulation is not involved at this stage. (Appendix 4 summarizes the leasing process in detail.)

The economic benefits of leasing lands for oil and gas development can be considerable, but caution must be exercised. The landowner must make sure that his property and interests are protected, and that he is aware of the implications of leasing his mineral rights. Compensation for signing a lease is usually given in the form of a bonus payment which is based on a dollar amount per acre leased. The landowner also receives delay rental payments, usually $1 or $2 per acre, for each year of the lease until a well is drilled.

With an equitable leasing contract, the landowner can enjoy many benefits: (1) royalties from production, (2) cash bonuses and delay rentals, (3) free produced gas for household use, (4) the construction of new roads if needed, or the improvement of existing roads and other facilities used by the drilling company. If provided for in the lease, all construction will be removed at the end of drilling and production, and the site restored to a compatable condition. Alternatively, provisions can be made to retain the

access roads for landowner use.

2. Private Leasing Revenues

Landowners in New York who leased their property for oil and gas production received $17.9 million in 1985, or one-eighth of the total estimated market value of $143 million. In 1986, landowner royalties were reduced to $12.7 million.

Royalty payments provide many financial benefits to individual landowners. Much of New York's production is in rural areas, so many farmers benefit from royalty income. With their high capital equipment costs and low market prices for their crops, farmers throughout the nation have been forced to sell their farms. Royalty income has helped many to span their cash flow gap and keep their land. In addition, the multiplier effects of royalty income go far beyond the benefit of helping some farmers keep their farms. Businesses in the area benefit from the money spent by individuals receiving royalties and from the dollars spent by people locally employed by the oil and gas industry.

3. Leasing Process for Public Lands

The leasing process for public lands differs from that of leasing private lands because it involves a lease which is obtained by competitive bidding. An exception to competitive bidding is made when warranted for very small parcels such as along a highway right-of-way.

The first step in leasing State land is the selection of parcels by the Department, either as a response to industry requests, or to requests by other State agencies. The Department may also issue a Call for Nominations or independently select parcels to be put up for bid, based on its assessment of their oil and gas potential. Next the Department sets target dates for the leasing and obtains conceptual approval for all oil and gas leases. After on-site inspections and a review of environmental concerns and public use

conflicts are made, the necessary documentation for SEQR is prepared. All environmental concerns and/or conflicts must be addressed or mitigated to obtain SEQR Committee approval. The status of the title and mineral rights must also be reviewed.

The Department then prepares a leasing package which includes a Legal Notice for Bidders, an advertisement for publication in industry journals, bid documents and the formal lease. The leases are awarded after the sealed competitive bids which have been submitted, are publicly opened and read on the appointed sale date.

4. Current State Land Leasing

Authorized by Title 11, Section 23-1101 of the Environmental Conservation Law, the DEC makes leases on behalf of the State for exploration, production, and development of oil and gas on State lands other than State Parks. In 1986 the Department managed 54 leases covering 48,812 acres, of which 28,192 acres were DEC Reforestation Lands, and the remaining 20,620 acres were Conservation Fund lands or other agency lands. Seventeen of the leases have been developed, utilizing 15,097 acres and accruing $307,794 in production royalties during 1986 while the remaining 33,715 undeveloped acres generated $58,035 in delay rentals and storage fees. Total revenues from the Onshore Leasing Program in calendar year 1986 were $365,829. (Figure 18.2).

1986 Leasing Revenues

	Bids	Rentals	Royalty	Storage
DEC Reforestation Areas	$ 0	$12,783	$288,896	$11,468
Conservation Fund Lands	0	2,571	0	0
Other Agency Lands	0	577	18,898	30,636
Combined Leasing Revenues	$ 0	$15,931	$307,794	$42,104
Total Leasing				$365,829

FIGURE 18.2

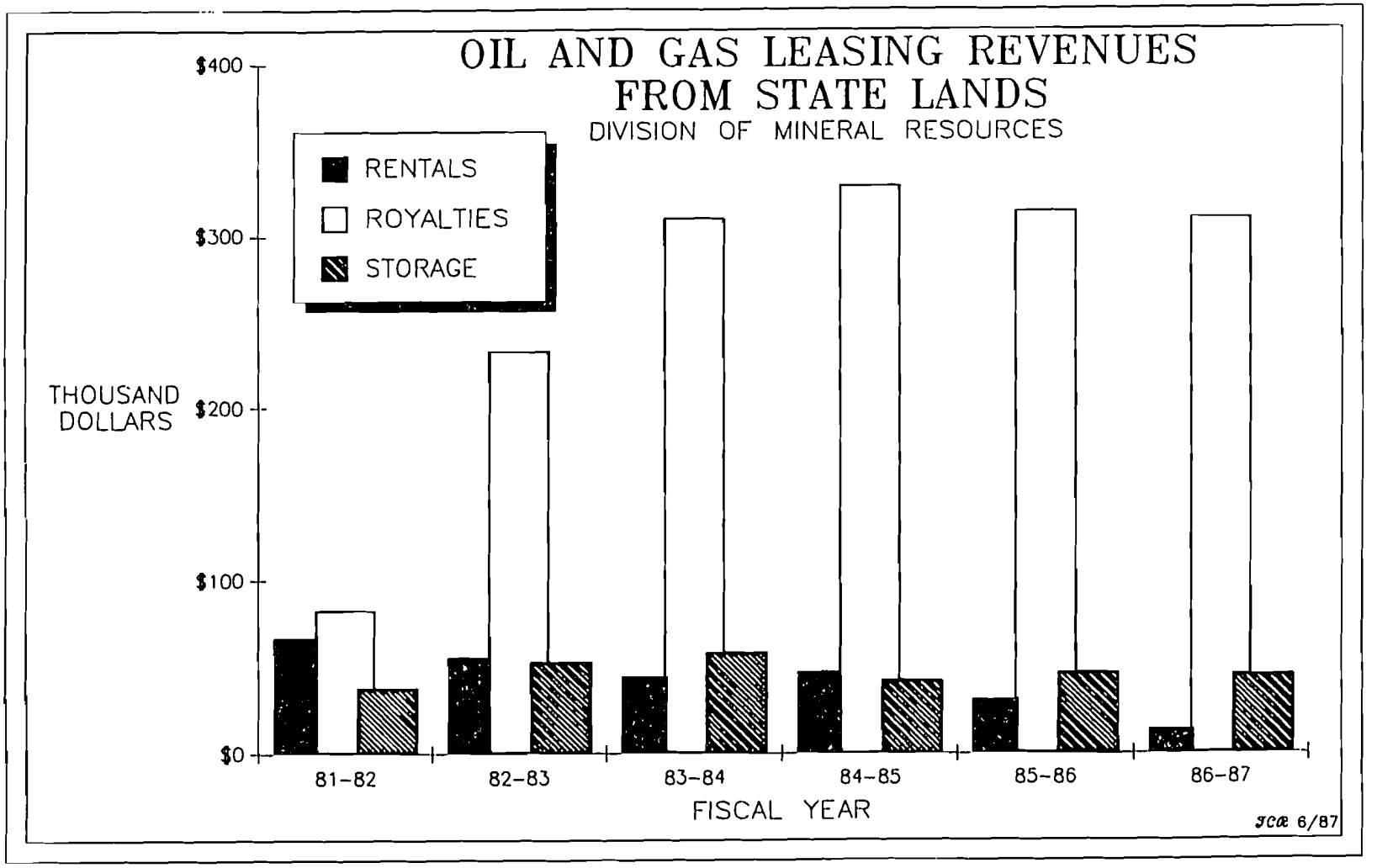

FIGURE 18.2
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5. Lake Erie Leasing

Although the lands beneath Lake Erie have proven gas potential, as evidenced by Canadian production, current low gas prices make the exploration and development of gas reserves uneconomic at this time. There has been low industry interest in Lake Erie not only because of the low gas prices, but because of the projected expense of operations under the anticipated environmental requirements. It is unlikely that a state lease sale for Lake Erie will be held in the near future unless economic conditions change dramatically. When drilling in Lake Erie becomes economically feasible, prior to any initiation of the leasing program, a public involvement process would be conducted to address the environmental impacts. Any subsequent exploration would be regulated and monitored to avoid damage and contamination to the environment. Other offshore State lands in Lake Ontario and the Atlantic coast are unlikely to become available for leasing.

6. Oil and Gas Revenues

a. Local Property Tax Revenues - The estimated real property tax revenue attributable to oil and gas production in 1986 was approximately $2.7 million, $2.3 million from gas and $.4 from oil production (Figure 18.3). The revenues generated by oil and gas royalties and taxes have had considerable impact on communities in the oil and gas producing counties. Property taxes on producing leases increase the community tax base which can result in lower taxes on the individual tax payer. The increased tax revenues are used by some local governments for community improvements such as highway equipment.

One-half of the 1985 real property tax revenues went to Chautauqua County where 1985 production was 371,715 bbls. of oil and 24,496,118 MCF of gas. Cattaraugus and Allegany were the next most productive counties, with 473,127 bbls. of oil and 3,007,521 MCF of gas and 141,515 bbls. of oil and 284,006 MCF

FIGURE 18.3

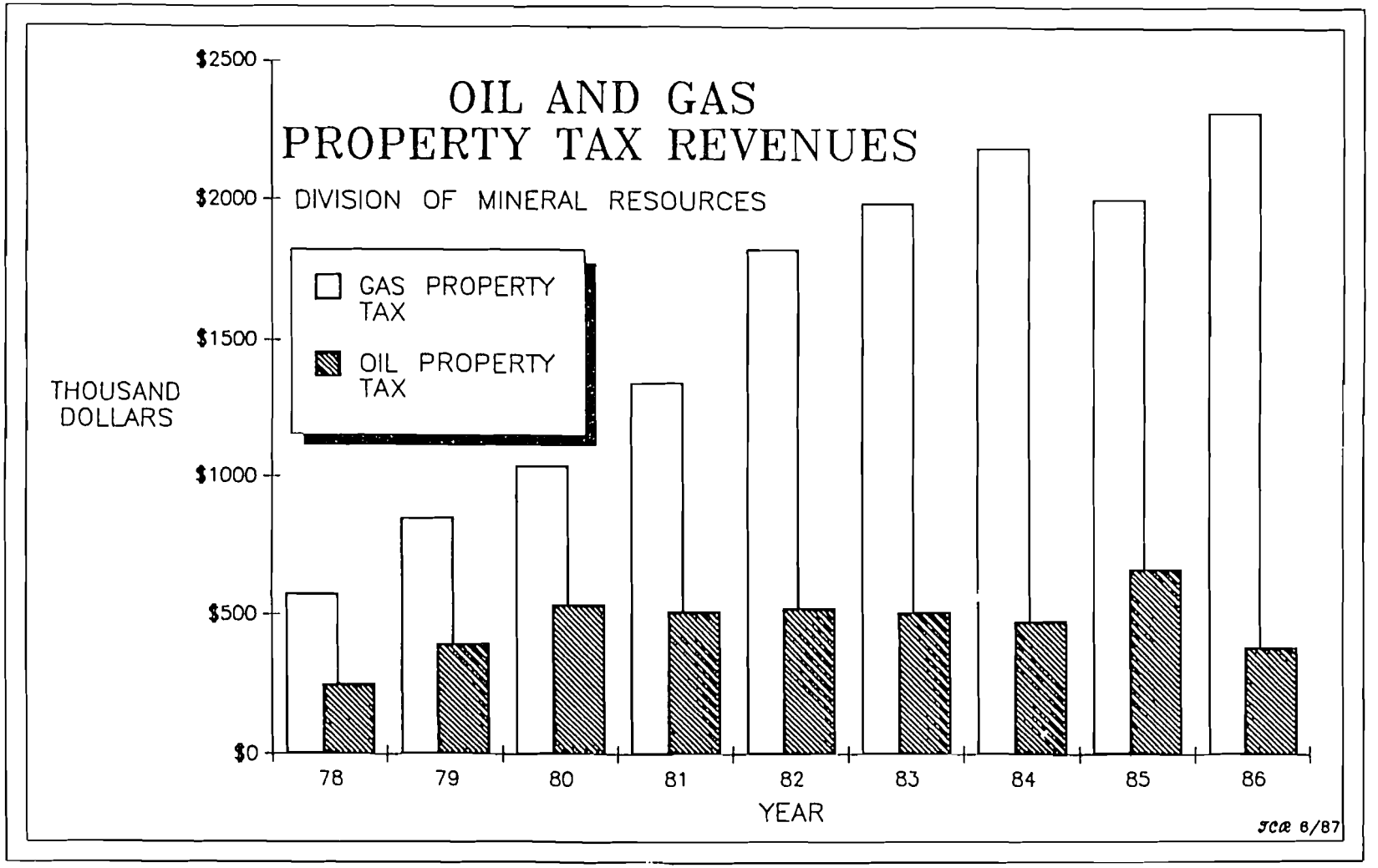

FIGURE 18.3
18-8a

of gas, respectively. In 1986, Chautauqua County again led the State in oil and gas production and revenues where 430,102 barrels of oil and 22.7 billion cubic feet of gas were produced.

b. Permit and Fee Revenues - The Department collects revenues from specific oil and gas activities stipulated in the Oil, Gas and Solution Mining Law of 1981. Permit and fee revenues decreased from $811,019 in 1984 to $270,041 in 1986 due to lower oil and gas prices and the subsequent decline in drilling. See Figures 18.4 and 18.5 for a comparison between prices and oil and gas production.

Permit fees for new oil and gas wells are dependent on the depth of the well and average between $700 and $900 per well. Revenues from each permit are deposited in the State's General Fund, except for a separate $100 fee that goes to the Oil and Gas Account. This account was established by law in 1981 for the plugging and abandonment of problem oil and gas wells. In addition, penalties for violations of the law are deposited in this Account.

The Department also collects fees for determination of a well's status under the federal Natural Gas Policy Act of 1978 (NGPA), through an agreement with the Federal Energy Regulatory Commission. Cost charges are also assessed for copies of oil and gas records under the State Freedom of Information Law (FOIL). Below is a summary of the 1986 permit and fee revenues.

1986 Permit and Fee Revenues

Oil and Gas Permit Depth Fees	**$182,050**
Oil and Gas Account Fees	**26,200**
Fines and Penalties (Oil and Gas Account)	**24,550**
Natural Gas Policy Act Fees	**30,900**
Freedom of Information Fees	**6,341**
Total Permits and Fees	**$270,041**

FIGURE 18.4

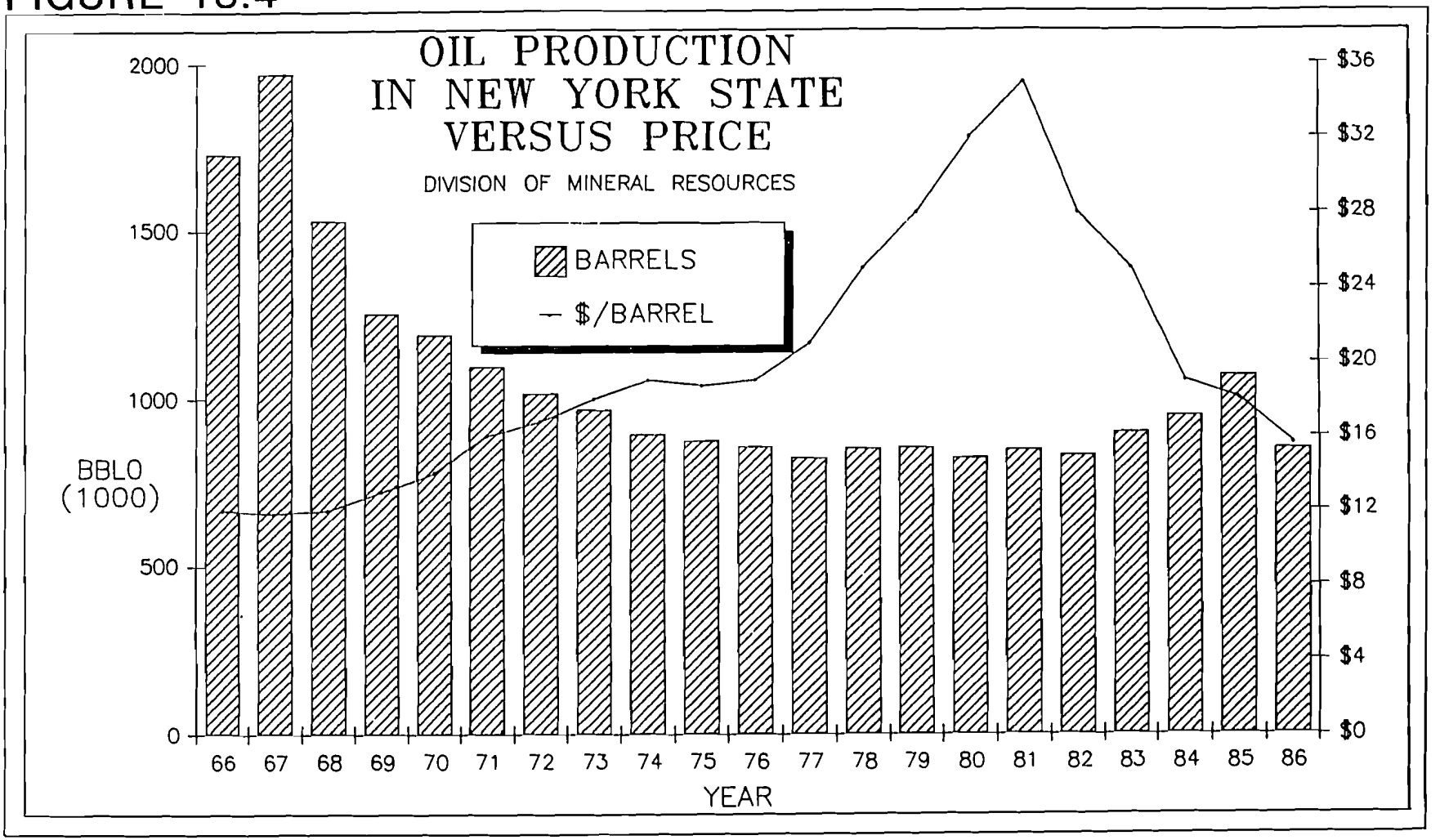

FIGURE 18.4
18-9a

FIGURE 18.5

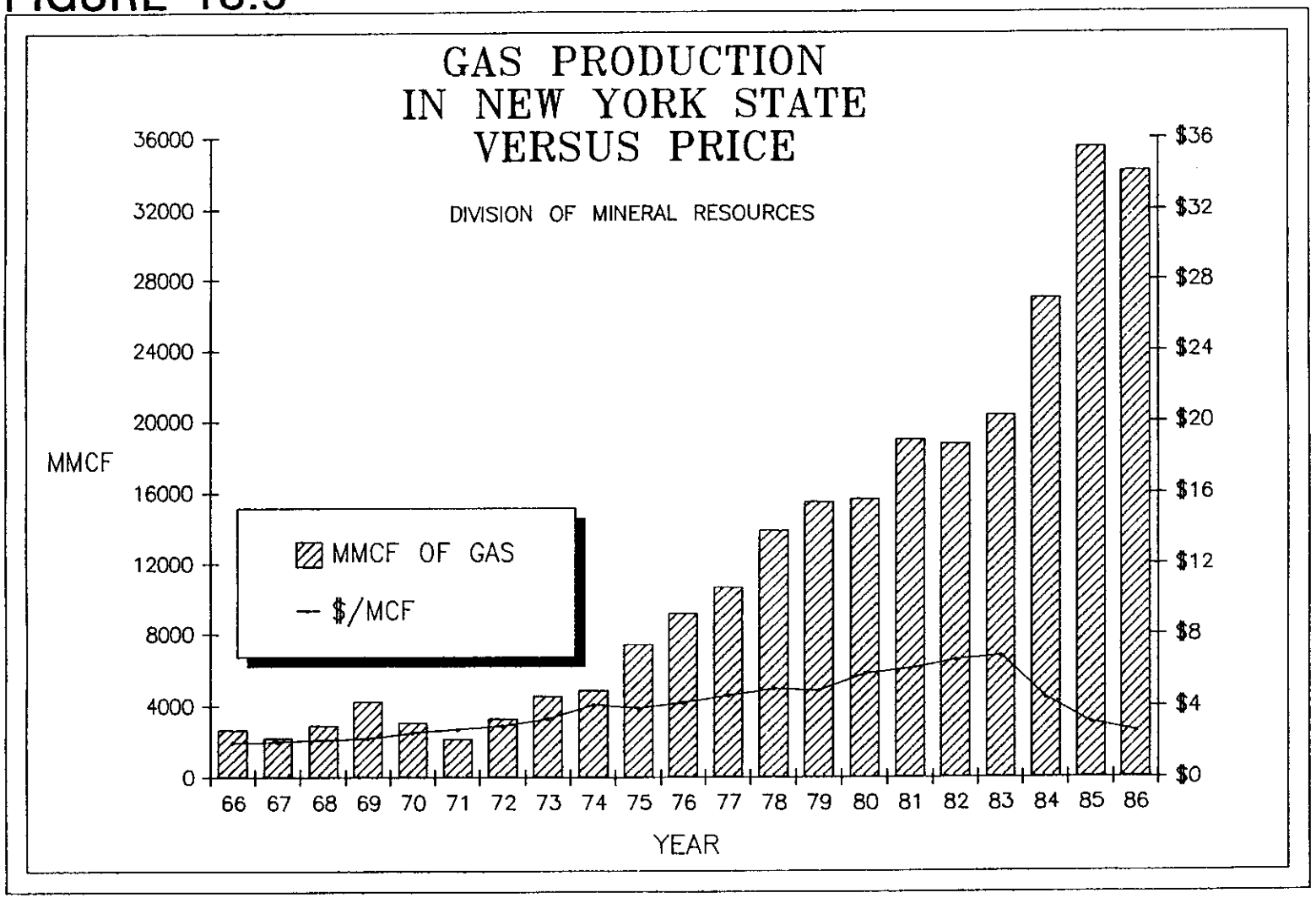

FIGURE 18.5
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D. RELATED ECONOMIC BENEFITS

1. The Value of Investment

A total drilling investment in New York State of $35 to $98 million per year is estimated if operators drill between 250 to 700 wells in a year, at an average cost of $140,000 per well.

For example in 1984, 688 wells were drilled in New York State. Assuming an average cost of $140,000 per well, the total drilling investment would be estimated at $96.3 million. Additional money spent on pipelines, tank batteries and other installations would increase total industry investment to an estimated $180 million.

Much of the investment in the oil and gas industry in New York is made through the use of limited partnerships. The limited partnership business arrangement consists of a number of limited partners (investors) and a general partner (operator). The limited partners supply the investment capital while the general partner provides the management and know-how. Limited partnerships are of particular interest to the oil and gas industries for a number of reasons. First, limited partnerships are appropriate for the pass-through of losses from oil and gas investments. Second, they are well suited for investors who wish to invest in a business, but want to protect the rest of their financial resources from potential business failure. Finally, limited partnerships offer the investor the advantage of locking out any financial partners from management of the venture. Given the willingness of investors to assume substantial risks, the rewards can be excellent. Although the Tax Reform Act of 1986 brought about significant adverse changes to the attractiveness of tax-favored investments, the special tax breaks for oil and gas were left largely intact. These breaks include the deduction of intagible drilling costs and percentage depletion. In addition, oil and gas

investments were the only investments specifically excepted from the limitations on deductions and credits from passive activities. Inasmuch as the precipitous decline in oil prices, after a decade of constant increases, has made oil and gas investments somewhat discouraging, stable or increasing prices in the near future would once again make such investments very attractive from an economic standpoint.

Whether an investment is made by a C Corporation, a S Corporation, a limited partnership, or a proprietorship, the investment policy is usually the same, i.e., the maximization of net cash flow. Several yardsticks are used to measure the worthwhileness of an investment, of which the most common are: "payback period", "rate of return on investment", and "discounted cash flow" or "DCF". When oil and gas prices were higher, an investor could expect a payback in as little as two years, and a return of as much as five times the original investment over the life of the investment (using undiscounted dollars). Given the current low level of prices, coupled with the adverse economic impact from the resulting practice of production curtailment, investors could experience longer payback periods and smaller rates of return than ever before.

2. Secondary Benefits of Oil and Gas Operations

a. Free Gas to Landowners - One of the fringe benefits for landowners can be free gas that is produced from leases on their land. This gas can be used for household purposes and light industries such as maple syrup production or fruit drying. Free gas can save the landowner hundreds of dollars a year in heating fuel costs and provide opportunities that might otherwise be unavailable. As the gas is already on the property, there are no transportation or storage costs, and the landowner can enjoy the benefits of a clean efficient fuel, not normally available in rural areas. Landowner gas

connections are not regulated by any government agencies, thus the landowner uses this resource at his risk.

b. End User Savings - When gas can be sold at the wellhead directly to the end user, the costs to the end user company are reduced. In recent years, gas producers have been receiving lower and lower prices at the wellhead, but utilities have not appreciably lowered the prices charged to the end users of natural gas because of longstanding contractual obligations based on large volumes of supply. In addition, the decontrol of petroleum pricing has allowed No. 6 fuel oil to compete favorably with natural gas. In response to this situation, many industrial plants have switched to dual fuel capacity to take advantage of low fuel oil prices.

In 1985, federal regulations were changed to allow industries (end users) to deal directly with gas producers. These regulatory changes have allowed end users to take advantage of low wellhead and spot gas market prices rather than being tied solely to fixed price contracts with a utility. The difference between the utility and wellhead price has resulted in savings to many end users of millions of dollars per year. The situation found in New York State, with widely scattered moderately low volume gas production, lends itself to the direct end user sales phenomenon.

The gas producer also benefits by having a firm marketplace for his production. The price of gas can now be directly negotiated with the end user so that both parties profit. The recent regulatory changes allow the gas producer to charge a price for gas which is determined by the supply - demand conditions of the marketplace, whereas before, the transportation company had controlled the field price.

Some of New York end users have gone a step further and have developed their own interruptable supply of gas. For example, U.S. Gypsum, faced with the high fuel costs of the early 1970's, was almost forced to close down local

plants after 70 years of manufacturing. Instead, the company developed its own gas fields and pipelines to provide an assured supply of gas for present and future needs. U.S. Gypsum now has an estimated 40 year supply of gas and has been able to expand its manufacturing capability (Rosen, 1986). Several schools and institutions such as Wells College, also have their own gas wells to ensure a secure supply of fuel for heat and power. Public institutions can apply and generally receive variances to the State's minimum spacing requirements.

Both privately owned gas such as the U.S. Gypsum fields, and locally produced gas sold directly to the end user, can have significant effect on revitalization of older industrial areas of New York. The lower prices and more reliable supplies can also provide opportunities for new industries.

c. Access Roads - When drilling operations are completed, the access roads are often left in place after site reclamation because they improve access to the area. Rig roads are built to take heavy trucks and equipment, and since the operators pay construction costs, landowners can be spared the cost of what would be an expensive road to build. Farmers can use the rig roads on their land to move farm machinery, and on state land, the roads are valuable for logging and recreation access.

3. Gas Storage Benefits

In 1986, total storage capacity of New York's underground gas storage projects was approximately 176.6 billion cubic feet, of which 91.2 billion cubic feet, or 51.6 percent, was working gas capacity.

Underground gas storage makes use of old depleted gas fields and salt caverns to store gas, injecting it when gas is plentiful and cheap, and withdrawing it during times of peak demand, usually during the winter.

Gas has been stored underground in New York State since 1916 when the

Zoar storage field, the oldest gas storage field in the United States, was activated in Erie County. At the end of 1986, there were 21 active gas storage fields in the State. Most of the storage fields are concentrated in western New York near major gas production areas and pipelines.

Underground gas storage provides many economic benefits in addition to providing prime deliverability. Gas is available in quantity at times of peak demand, thereby helping to eliminate the problems of winter shortages and the subsequent hardships which might be suffered. Generally, it is cheaper to store gas underground adjacent to high demand areas than to build sufficient pipeline capacity to assure deliverability of the same amount of gas. Also, the assurance of an uninterrupted supply to urban areas increases the investment and the development of industry.

E. IMPACTS OF LOW OIL AND GAS PRICES IN NEW YORK

Although New York State's economy is more diversified than that of major oil producing states such as Texas, low oil prices have had substantial effects on the economy of southwestern New York. Twenty-five hundred people used to be directly employed by the New York State oil and gas industry; the number was reduced to fifteen hundred in 1986. Wellhead value of oil and gas dropped $42.1 million in 1986. One of New York's largest independent companies, Berea Oil and Gas Corporation, drilled 90 wells in 1984, but stated they expected to drill only 18 in 1986 (Knudson, 1986). Other independent oil companies have fared even worse, and several have been forced into bankruptcy.

Wells are being shut-in, or permanently plugged and abandoned in higher numbers. Table 18.1, New York State Oil and Gas Statistics, shows that in 1986, 1,638 oil wells were shut-in, up from 1,400 in 1980. Four hundred, seventy-one wells were plugged and abandoned in 1986, compared to 114 in 1980. Most (99 percent) of New York's oil wells are strippers. Stripper wells are defined as producing less than 10 barrels of oil per day (BOPD). The

TABLE 18.1

NEW YORK STATE OIL AND GAS STATISTICS

ANNUAL PRODUCTION	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	PRELIMINARY 1986
OIL (1,000 BBLS)	857	824	852	855	824	849	831	902	952	1,071	853
GAS (MMCF)	9,200	10,700	13,900	15,500	15,650	19,000	18,760	20,380	27,000	33,054	34,152
NUMBER OF WELLS	8,800	8,964	9,118	12,000	13,561	14,082	14,300	13,467	13,809	14,992	14,377
OIL	5,016	4,913	5,039	5,100	5,220	5,176	5,272	4,705	4,584	4,815	4,400
GAS	1,195	1,467	1,452	1,620	2,076	2,636	2,969	3,489	4,279	4,780	5,038
SHUT-IN OIL	1,393	1,528	1,512	1,500	1,400	1,402	1,308	1,436	1,475	1,629	1,671
SHUT-IN GAS	432	292	352	520	500	726	996	995	821	890	781
STORAGE	764	764	763	763	765	822	831	839	839	841	836
PLUGGED & ABANDONED (DURING YEAR)	442	455	352	117	119	184	262	90	182	269	471
WATER INJECTION				2,500	3,500	3,038	2,924	2,093	1,811	2,037	1,651

economics of producing these stripper wells was very marginal before oil and gas prices decreased abruptly. Individual wells may only produce 1/4 to 1/2 BOPD, and some entire fields are produced only during 3 to 4 warm months of the year. Stripper production contributed 57 percent of the State's total oil production, and much of this production is extracted through secondary recovery (waterflooding). Most of the wells that were shut-in or plugged and abandoned during 1986 because of low oil prices were stripper wells.

Given an oil price of $15 per barrel, and the increasing costs imposed by regulation, it is likely that the majority of these marginal wells will be shut-in or abandoned in the near future. The situation is further complicated by the fact that most strippers are on waterflood, and it is technically risky to shut in a waterflood with the expectation of being able to produce again. When water injection is halted, reservoir conditions change, and the oil bank created by injection will continue to travel and pass existing wells. This means new wells would have to be drilled to bring a field back into production, and it would not be economically feasible in most cases. The deterioration of well casings and pumping equipment in a shut-in field add further to the potential reopening costs, particularly when the equipment is old.

In fact, some waterfloods in New York have produced with the same pumps and powerplants for over 60 years. Many of the operators in these old oilfields repair rather than replace old equipment to keep costs down. The current low prices and marginal economic conditions make it difficult for producers to buy new, non-polluting equipment. These marginal fields have been economic because of the low production costs, but the combination of increased environmental awareness and regulation with low oil prices will

probably be the end for many of New York's very old oilfields.

One reason New York stripper wells continued to operate long after those in other states became uneconomic, was because they produced Penngrade crude, which traditionally commanded premium prices for refining into lubricants and motor oils. Penngrade crude which sold for $25 bbl in May 1985 dropped to $13.50 bbl by May 1986 (Maslowski, 1986). The high quality and high price of Penngrade crude was sufficient incentive for producers to continue operating marginal strippers even when they produced far less than 10 BOPD.

Concurrently during the last decade, the demand and price paid for Penngrade crude has dropped because motor oils are no longer straight 100 percent Penngrade oils, but are blended with additives and viscosity agents. Refiners can now use lower grade oil for making lubricants which last longer. Because of the low prices, the small refineries that handle Penngrade crude are having problems making gasoline economically. One refinery in Pennsylvania, where most New York oil is refined, reported getting $.45 per gallon for gasoline in May 1986 which cost them $.52 per gallon to refine (Maslowski, 1986). Since refiners can no longer pay higher prices for Penngrade, regional producers are shutting in these stripper wells by the hundreds.

F. ECONOMIC IMPACTS ON NEW YORK EXPLORATION

A natural gas price between $3 - $3.50 per MCF is needed to drill and economically develop new gas reserves in New York State. Producers currently have little incentive to drill exploration wells with the attendant risk of a dry hole. Most recent drilling has been field development, a relatively safe investment. Because of the lack of exploration, new fields are not being found. This, however, does not mean that they are not there. The Bass Island trend, discovered in 1981, was not suspected to exist prior to its accidental discovery, and this trend is now a major oil producer. Similar trends may be

awaiting discovery. There is further potential for tight Medina sand and Ordovician Trenton production. Cambro-Ordovician potential has not been fully tested; there are undoubtedly more fields to be found.

Exploratory success in the western overthrust belt of the Rocky Mountain states has led to some interest in the 60,000 square mile Appalachain overthrust in the eastern states. The eastern overthrust belt consists of sequences of Paleozoic sedimentary rock overlain by thrusted layers of impermeable shale and metamorphic rock. Repeated episodes of intense thrust faulting can create many large hydrocarbon traps.

In New York, the eastern overthrust belt is a narrow band extending from Orange and Dutchess Counties northward along the Vermont border. Although overthrust tests in Tennessee and West Virginia have been successful, the New York portion of the structure is relatively unexplored. Many dry holes were drilled in the Western Overthrust before major production was discovered, and it is expected that when the price of oil increases, additional eastern overthrust tests will be drilled in New York.

The widespread Devonian shales in New York have considerable gas potential. In 1821, the first natural gas well in the United States was drilled to a depth of 60 feet in Fredonia, New York. Production from this well was a few thousand cubic feet per day for over 35 years. When it was shut-in, the well could no longer supply the entire town, but it was still capable of production. Long well life and moderately low but steady productivity are characteristic of the Devonian shale gas wells. Research by the U.S. Department of Energy has shown that shale gas production can be increased sevenfold by drilling the wellbore horizontally, instead of vertically, through the shale pay zone. This technique has great potential for shale gas exploration and development, but until gas prices increase, it

remains experimental.

New York has an estimated possible and probable future gas reserve potential of 4 TCF (trillion cubic feet) (VanTyne & Copley, 1984). With the finding cost estimated at $2/Mcf, there could be an investment of 8 billion dollars in New York gas development over a period of 50 years when gas is again scarce and prices rise. Given average production of 150,000 Mcf per well, an estimated 26,000 wells would be needed for full development. As more new areas of potential are discovered the future possible and probable reserves should increase.

G. IMPACTS OF ENVIRONMENTAL REGULATIONS ON THE OIL AND GAS INDUSTRY

Recently imposed New York State regulations and guidelines have added additional expenses to the oil and gas industry. These regulations and guidelines have provided badly needed environmental protection, yet they have been imposed at a time when oil and gas prices are low and the tax burden on this industry is high. The cost of recently imposed or enforced State regulations and permit conditions are detailed below:

- The Aquifer Permit Conditions (1982, revised 1985) adds an average incremental cost per well of $1,500 to $3,000. The cost can double if the well is greater than 3,500 feet deep because stage cementing tools may be required to cement the production casing to the surface. In addition, many rotary drillers had a one-time cost of $10,000 to $15,000 for retooling when aquifer conditions were first imposed.
- The new Bass Island Regulations (1986) add an average incremental cost per well of $3,000 to $4,000, but depending on the operator's former operating practices the cost might be a low as $1,500. Operating costs in the Bass Island are $500 incrementally higher per year as a result of the regulations.
- The pit liner requirement (1982) adds an average incremental cost per

well of $150 to $200.

- o The cementing and casing guidelines (1986) add an average incremental cost per well of $2,000 to $2,500. In addition, a one-time cost of $10,000 for retooling was necessary for many old oilfield and cable tool drillers.
- o The Brine Blowdown Pit Elimination program (1984-1987) costs operators an average of $200 to $500 per well. This cost can be higher when site clean-up is extensive and/or a brine tank installation is necessary.
- o In addition, with the elimination of brine blowdown pits, the alternative disposal methods for brine cost operators an average of $1.50 to $2 per barrel of brine, plus $.50 per truck tanker mile for transportation of the brine to an approved disposal site.

Not all of the above imposed permit conditions and regulations are additive. Nevertheless, some economic hardship has been imposed. These requirements have added significant environmental protection consistent with the legislative mandates of the Oil, Gas and Solution Mining Law.

While the costs of environmental regulation appear high, the costs to society of no regulation are far greater. Because it is comparatively easy to calculate the direct monetary costs of regulation in terms of added man hours, extra equipment and additional paperwork, these costs are questioned when no corresponding monetary value on the benefit of the regulation is assigned. Unfortunately, it is difficult to assign precise monetary values to aesthetic benefits such as the beauty of an unspoiled wilderness. The monetary value for improvements in such areas as clear air, clean water, and clean soil are easier to estimate and assign by using parameters such as increased property value, decreased health care costs, increased recreational and tourist use, and improved production from forestry, fishery and agriculture.

Another method used to assess the benefit of regulation is to compare the cost of compliance with cleanup costs. In the case of an oil spill which could have been prevented through routine maintenance and contained by diking, the cost of maintenance and diking would be compared to the cost of cleaning-up the obvious physical damage and pollution on the surface. Where the spill location is immediately adjacent to surface waters, estimates of longer-term less obvious costs such as the loss of fishing revenues might be appropriate to add. In a worst case scenario where surface pollution is not removed, and there is sufficient time for percolation into groundwaters, the difficult task and very high cost of restoring a contaminated aquifer must be added. Most experts in this field agree that in most cases it is much cheaper to prevent pollution than to restore the environment after it has occurred.

Environmental regulations improving the quality of air, water and land by the reduction of pollutants create direct changes in physical attributes such as visibility, odor, and taste which are readily perceived by most human beings as aesthetic benefits, but these attributes are also directly related to human health. Increased health costs are an obvious and documented effect of pollution. This fact, which was not widely recognized fifty to a hundred years ago, has been confirmed by advancing technology. Insurance companies now keep statistics and assign monetary values to the illnesses that can be attributed to pollution. It is possible to compute the health cost of chronic pollution. Examples of health costs caused by pollution include lost worker days, worker compensation, lost earnings and the increase in insurance premiums for workers in industries which handle hazardous waste. Changes in the quality of life such as increased pain, discomfort and grief are very difficult to assess, but ours is a very litigious society. The courts have awarded very large sums of money to people who can prove negative impacts on their quality of life were caused by pollution. In addition, the costs of

lawsuits brought against companies that cause pollution which result in illness and death are usually passed on to the consumer and thereby cost everyone.

H. SUMMARY

As discussed in this chapter, New York's oil and gas industry is a vital economic force on both the statewide and local levels. Oil and gas exploration and development stimulates investment, creates jobs, and generates revenues. Direct monetary gains are realized by operators and their employees, royalty owners, contractors, and support industries. Taxpayers benefit from the property taxes levied on the industry, permit and fee revenues paid to government agencies, and the overall development of their local regions.

The recent downturn in oil and gas prices and the resultant impact on the industry is well documented. The price stability experienced during the first half of 1987 has caused a feeling of cautioned optimism to surface. Lower oil and gas prices have also led to lower drilling and production costs. Decreased revenues have forced operators to better engineer their prospects and pay more attention to detail. The survivors of the downturn thus stand better prepared to develop existing reserves and explore for new sources of production.

One mandate of the Department is to foster the development of the State's resources. The other mandate is to ensure that it is done in an environmentally safe manner. These primary mandates can be compatable.