

# the Southwest ECONOMY

FEDERAL RESERVE BANK OF DALLAS

ISSUE 4 – 1995

## The Energy Industry: Past, Present And Future

The energy industry figures prominently in many states' economies. In Texas, for example, the energy industry produces about 12 percent of gross state product. For Wyoming, the figure exceeds 25 percent.<sup>1</sup>

Because the United States is an energy-importing country, its economy is hurt by rising oil prices. In fact, the economies of 41 states and the District of Columbia suffer when oil prices rise. Nine states—Alaska, Colorado, Kansas, Louisiana, New Mexico, North Dakota, Oklahoma, Texas and Wyoming—benefit from rising oil prices. In six of these states—Alaska, Louisiana, New Mexico, Oklahoma, Texas and Wyoming—the response to an oil price change is much stronger than in the average state. In fact, oil price movements in the 1970s and 1980s had such pronounced effects on

economic activity in some of these states that observers proclaimed energy “the tail that wagged the dog.”

Since the early 1980s, however, state economies have become less sensitive to and more alike in their responses to changes in oil prices. These changes are the result of trends in the energy industry that are likely to continue throughout the 1990s.

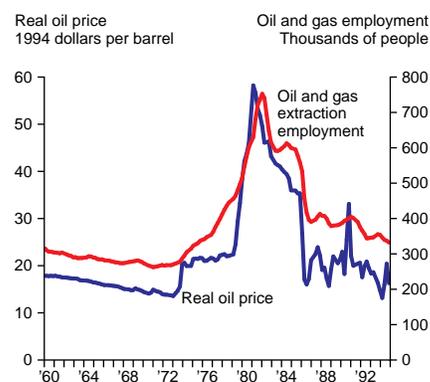
### Forces Shaping the Energy Industry

Several forces have shaped the U.S. energy industry's recent history. The most apparent are prices, which are determined by world oil market conditions, and resource depletion. Government regulation, taxes and technology have also affected the industry.

The past 25 years have brought four price shocks, three long-lasting and one rather short-lived. The first shock came in 1973 after the Organization of Petroleum Exporting Countries (OPEC) announced production cutbacks and an embargo of oil supplies to the United States in retaliation for U.S. support of Israel in the Arab-Israeli war. By January 1974, world oil prices had more than tripled.

The Iranian revolution led to another sharp increase in world oil prices in 1979. The subsequent

**Chart 1**  
Real Oil Price and U.S. Oil and Gas  
Extraction Employment



Iran-Iraq war continued to exert upward pressure on prices. Prices climbed to \$39 per barrel by 1981.

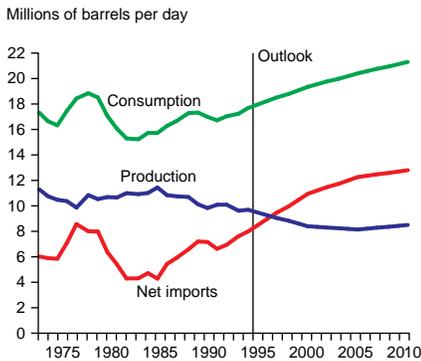
Over the next few years, however, increased prices led to fuel-switching, energy conservation and increased oil production outside of OPEC. A loss of market share exacerbated by slow world economic growth led to a breakdown of OPEC solidarity. World oil prices plummeted to \$11 per barrel in 1986. In recent years, oil has generally traded in a range from \$17 to \$20 per barrel, with a brief spike to \$30 per barrel during the 1990-91 Persian Gulf war.

I N S I D E

Can Currency Boards  
Prevent Devaluations and  
Financial Meltdowns?

—  
Just Say Yes to Chile

**Chart 2**  
U.S. Petroleum Production,  
Consumption and Net Imports



Although current oil prices are near \$20 per barrel, real (inflation-adjusted) oil prices are just above preshock 1973 levels. Chart 1 shows how closely employment in oil and gas extraction tracks oil prices. As the price of oil rises and falls, so does U.S. employment in oil and gas extraction.

The United States has produced oil for more than a century, and U.S. fields are considered mature. Peak production was in 1970 when output reached 9.6 million barrels per day. Since then, resource depletion has led to a general decline in domestic production. The general decline was interrupted from the mid-1970s to mid-1980s as oil prices increased and production from the North Slope of Alaska began.

Because the United States has mature oil fields, production is from a large number of small wells. In 1991, the United States had more than 600,000 wells, with an average production of 12 barrels per day. In contrast, Saudi Arabia had 1,400 wells with an average production of nearly 6,000 barrels per day. With mature fields, the outlook for U.S. production is continued decline, at a rate of about 2 percent per year.

The demand for oil responds to its price and to economic growth. Oil consumption surged in the 1970s as the economy expanded (*Chart 2*), but higher oil prices reduced consumption in the early 1980s. Since 1985, economic growth and lower oil prices have contributed to

a general increase in oil consumption, although usage dipped slightly in 1991. The Federal Reserve Bank of Dallas predicts that continued economic growth, coupled with moderate price increases, will stimulate oil consumption over the coming decades.

With rising oil consumption and declining domestic production, the United States has been importing a greater percentage of the oil it consumes. Oil imports are expected to surpass domestic production in the next few years. Although oil imports have been rising, the ratio of energy consumption to gross domestic product (GDP) has been declining over time, reducing worries about U.S. dependence on foreign energy sources.

In the U.S. market for refined products, output in domestic refineries has closely tracked consumption in the U.S. market. This tight relationship may not be maintained in the future. The U.S. Department of Energy (DOE) expects that current environmental regulations will prevent much expansion of domestic refining as the U.S. market expands. Instead, DOE expects new refineries to be built in the Caribbean region, where environmental restrictions are less stringent. In contrast, some energy industry analysts believe

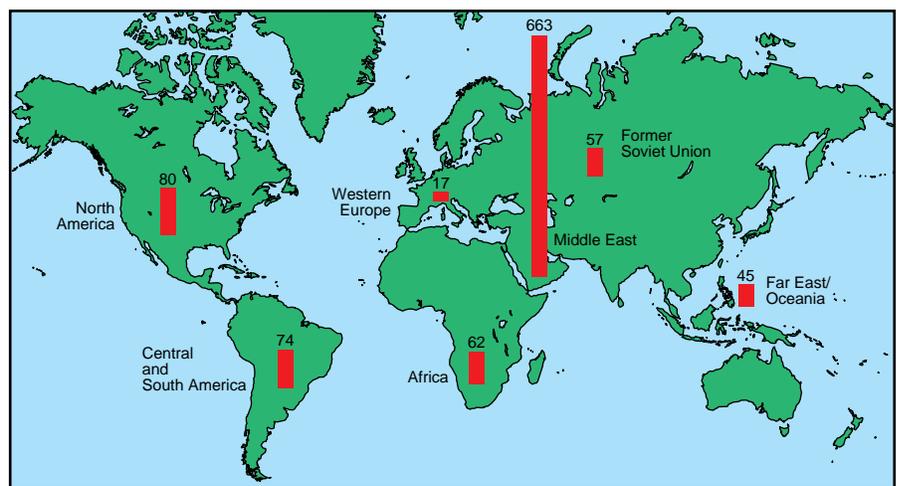
domestic refineries will retain a constant share of the U.S. market. The principal factors in this differing outlook are weaker demand growth and the relatively higher cost of transporting products compared with crude oil.

One reason for concern about rising oil imports is dependence on oil from politically unstable parts of the world. World oil reserves are approximately 1,000 billion barrels (*Map 1*). OPEC countries hold 770 billion barrels or (77 percent) of these reserves. Within OPEC, 66 percent of world reserves are in the Middle East. North America has 8 percent of world reserves. At 50 billion barrels (or 5 percent), Mexico has the seventh largest reserve base in the world, and the former Soviet Union has about 6 percent of world reserves.

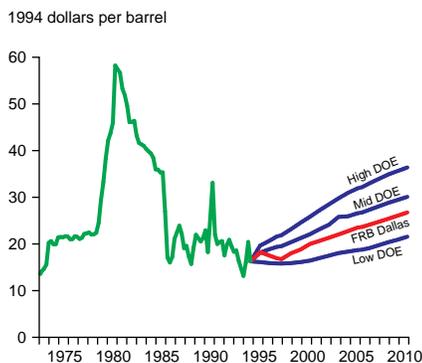
As the reserve levels suggest, much world oil production comes from OPEC—more than 40 percent in 1994. As world oil consumption grows and resources are depleted elsewhere, OPEC's share of world oil production will grow over time. In recent years, however, non-OPEC supplies have surged, particularly in the North Sea. Lower taxes and improved technology have kept North Sea oil production higher than many analysts anticipated.

**Map 1**  
World Reserves

Billions of barrels



**Chart 3**  
Real Oil Price Outlook



That is not the case for the former Soviet Union, where output has been declining. Physical and institutional problems suggest that no reversal of this downward trend is likely until 2000. In the United States, the decline in oil production is unlikely to reverse, unless the drilling restrictions in environmentally sensitive areas, such as the Alaska National Wildlife Reserve and California coast, are eased.

The dynamics at work in the energy industry make it difficult to predict oil prices. Nevertheless, Chart 3 presents several forecasts: three from the U.S. Department of Energy (DOE) and one from the Federal Reserve Bank of Dallas. All these forecasts abstract from a political disruption. The Dallas Fed forecast expects oil prices to be soft for the next five years and to remain in a range between \$17 to \$20 per barrel (1994 dollars) through 2000. This outlook is consistent with the futures market, and it reflects current excess capacity and the return of Iraqi oil to international markets by 1997.

The Dallas Fed forecast relies on the expectation that OPEC will reach full capacity around 2000, as world oil demand grows and non-OPEC supply declines. After that, the forecast predicts oil prices will generally rise, reaching about \$27 per barrel in 2010. Higher oil prices seem necessary to overcome political and economic obstacles to obtaining the investment needed to expand

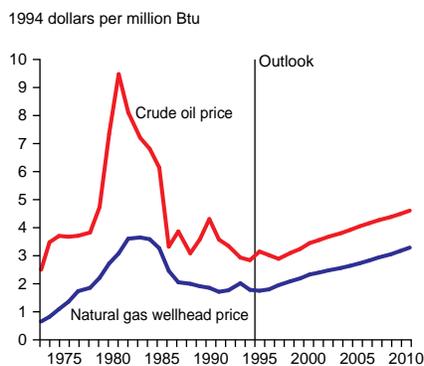
OPEC capacity. The Dallas Fed price outlook falls below the Department of Energy's midrange forecast. We expect that oil prices lower than those forecast by DOE will attract the required investment.

The uppermost and lowest forecast lines reflect the Department of Energy's reasonable upper and lower bounds for oil prices. Major technological breakthroughs or a lack of demand growth could lead to prices below the range shown here, but the probability of a sustained price below the lower bound is quite small.

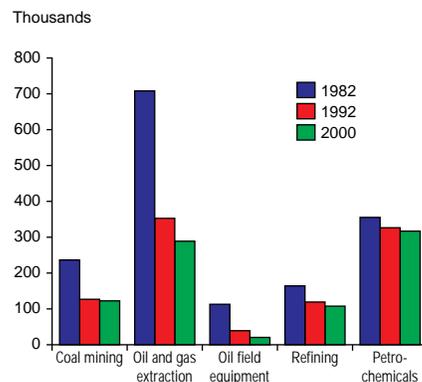
It would be surprising to see prices sustained above the Department of Energy's upper bound. The upper bound path is reminiscent of the typical forecast made in the 1980s when increasing scarcity meant oil prices were expected to escalate from their current levels at some real interest rate. Such a price path forecast typically fails to take into account technological improvement and the effect of higher prices in stimulating supply and curtailing demand. Nonetheless, supply disruptions could lead to temporary excursions above the range.

As shown in Chart 4, the movements in natural gas prices mirror those of oil. Research by Yücel and Guo (1994) shows that oil and natural gas prices move together over long periods of time, while natural gas prices remain below oil prices for an equivalent amount of

**Chart 4**  
Real Natural Gas Wellhead and Crude Oil Prices



**Chart 5**  
U.S. Energy-Related Employment



energy.<sup>2</sup> Natural gas prices did not move fully with crude oil prices in the 1970s because price controls restricted the movement of well-head prices for natural gas. Looking forward, the relatively flat outlook for oil prices suggests a similar outlook for natural gas prices.

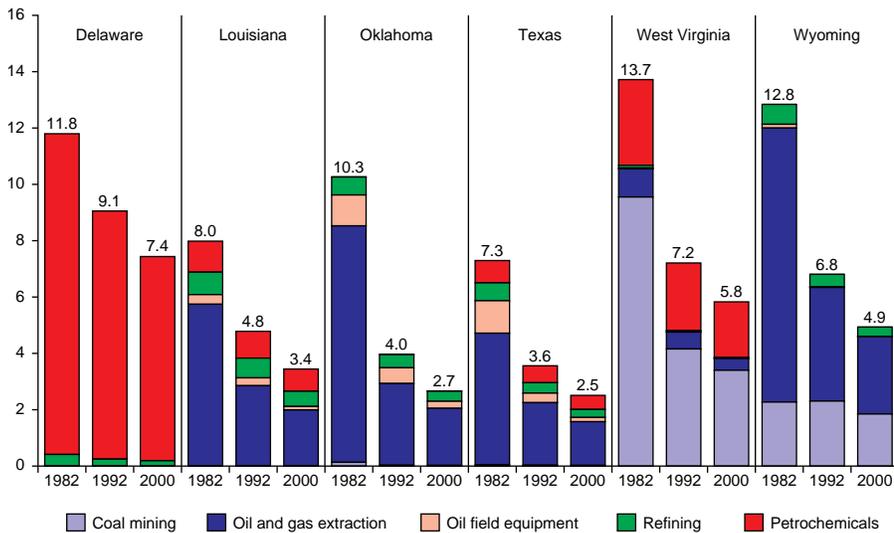
### Implications of Changes in the Energy Industry

Our research indicates that changes in the energy industry can affect how regional economic activity responds to oil prices.<sup>3</sup> Changes in the response to oil prices could alter the regional flavor of the debate over U.S. energy policy. In the past, debate over energy policy had a regional tone. Energy-producing states favored policies, such as restrictions on oil imports, that would increase domestic prices. Energy-consuming states favored policies, such as price controls, that would reduce domestic prices. Dallas Fed research indicates that the grounds for these regional divisions may be lessening.

In the 1970s and early 1980s, the U.S. energy industry grew to keep pace with increasing demand and sharply rising oil prices. As Chart 5 shows, in 1982 five key energy industries—coal mining, oil and gas extraction, oil field equipment, petroleum refining and petrochemicals—accounted for 1.6 million jobs (0.8 percent of total U.S. non-farm employment).

**Chart 6**  
Energy-Related Employment for Select States

Percent of total non-agricultural employment



The decline and later collapse of oil prices in the 1980s touched off a drastic downsizing of oil and gas extraction and related services. Coal prices also fell, and coal mining was reduced. Continued adjustment to earlier increases in oil prices, more stringent government regulation and productivity gains led to falling employment in refining and petrochemicals.

By 1992, employment in the five key energy industries had fallen by more than 600,000 jobs. More than 350,000 jobs were lost in oil and gas extraction alone. At the same time, U.S. nonfarm employment grew by 23 percent. By 1992, the share of total nonfarm employment represented by the five key energy industries was halved to 0.9 percent. Projections suggest that by 2000, employment in the five key energy industries will further decline while total nonfarm employment expands.

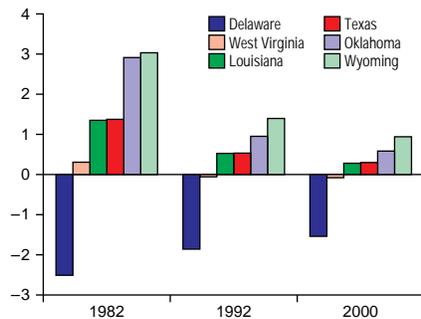
While energy-related industries have been shrinking, individual state economies have increasingly diversified away from energy-intensive and energy-producing industries. Since the early 1980s, nearly every state has become less dependent on the five key energy industries. Chart 6 illustrates the point for select

energy-intensive states. From 1982 to 1992, employment in the five key energy industries declined in each of the nine states. The Dallas Fed projects the trend will continue throughout the 1990s but at a slower rate.

Chart 7 depicts the implications of continued diversification away from energy-intensive and energy-producing industries. The estimates underlying this chart take into account how higher oil prices would affect each of the five key industries, as well as the rest of each state's economy. From 1982 to 1992 and 2000, the effects of the same percentage increase in oil prices on each state diminish. States also are

**Chart 7**  
Employment Response to a 10-Percent Oil Price Increase

Percent change



becoming more similar to each other and the national average in their response to oil price changes. However, as the chart shows, the rate of change is slowing.

The Dallas Fed projects that the response to oil prices in Alaska, Delaware, Louisiana, New Mexico, Oklahoma, Texas and Wyoming will remain substantially different from the national average. Energy is and will continue to be an important difference between the nation and these energy-intensive states.

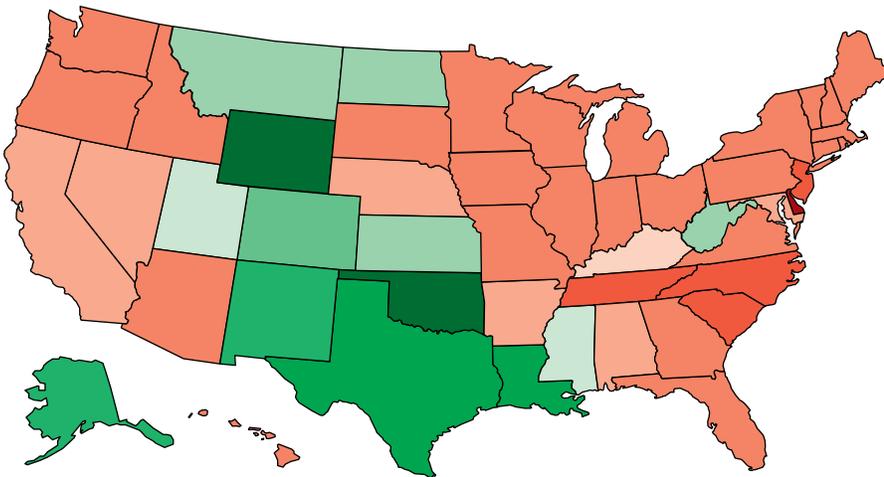
### The Changing Environment For U.S. Energy Policy

The next three maps extend our analysis nationwide to examine the economic environment for U.S. energy policy (*Maps 2, 3 and 4*). On each map, red indicates states that are hurt by rising oil prices. The darker the red, the greater the impact. Delaware is the state hurt most by rising oil prices. Green indicates states that are helped by rising oil prices. The darker the green, the greater the gain. In 1982, Oklahoma and Wyoming benefited most from rising oil prices.

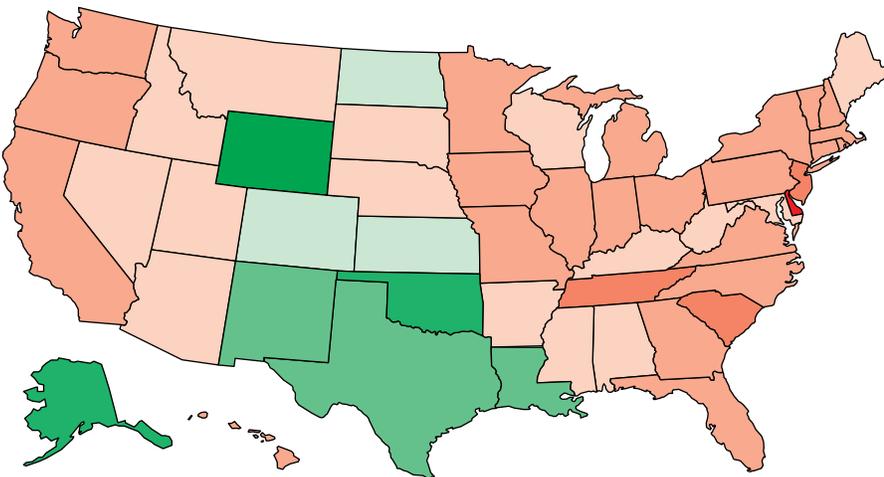
The pattern depicted in Map 2 illustrates why regional divisions have developed in the debate over energy policy and why the resolution of conflicts may have tended to favor consumers over producers. As the map shows, 13 states would have been helped by higher oil prices in 1982. The other 37 and the District of Columbia would have been hurt.

Between 1982 and 1992, as Map 3 shows, Utah, Mississippi, West Virginia and Montana diversified away from energy production to the extent that they no longer benefit from higher oil prices. The map also shows that the states have become less sensitive and more similar in their response to oil prices. These changes suggest that the grounds for regional divisions in the debate over energy policy have lessened since the early 1980s.

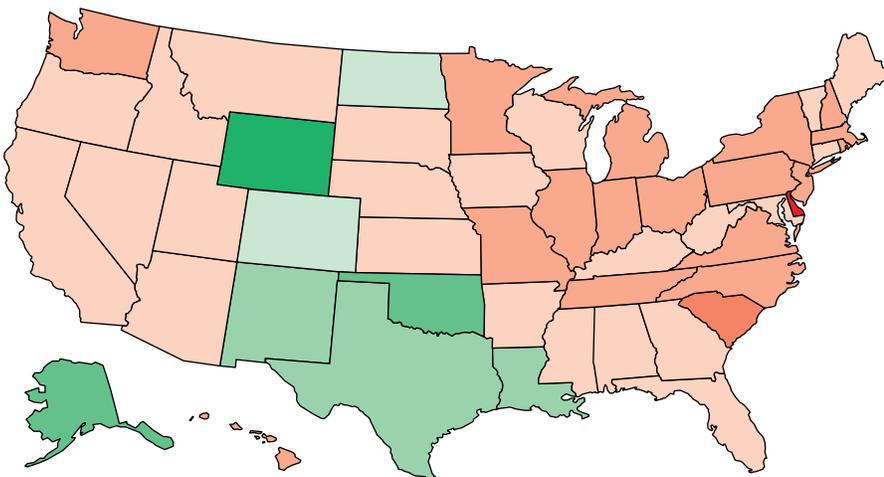
**Map 2**  
Oil Price Sensitivity, 1982



**Map 3**  
Oil Price Sensitivity, 1992



**Map 4**  
Oil Price Sensitivity, 2000



As shown on the map for 2000 (*Map 4*), the Dallas Fed projects Kansas will no longer be helped by higher oil prices and that states generally will continue to become less sensitive to and more alike in their response to oil price movements. These changes suggest the grounds for regional divisions in the debate over energy policy are likely to diminish further in the 1990s.

### Conclusions

Market fundamentals suggest that oil prices are unlikely to rise or fall sharply for a sustained period during the next decade. Political events could lead to temporary deviations from this outlook. Natural gas prices will move in concert with oil prices but will remain below oil prices for equivalent amounts of energy. Regulatory constraints could hinder the growth of the domestic refining industry as the U.S. market for refined products expands.

Since 1982, state economies have become less sensitive and more similar to each other in their response to oil price movements. The convergence suggests that the grounds for regional divisions in the debate over national energy policy have lessened since the early 1980s. These trends are likely to continue in the 1990s but at a slower pace.

— Stephen P. A. Brown  
Mine K. Yücel

### Notes

- <sup>1</sup> These percentages were true for 1991, the most recent year for which data are available.
- <sup>2</sup> See Mine K. Yücel and Shengyi Guo, "Fuel Taxes and Cointegration of Energy Prices," *Contemporary Economic Policy* 21 (July 1994): 33–41.
- <sup>3</sup> See Stephen P. A. Brown and Mine K. Yücel, "Energy Prices and State Economic Performance," Federal Reserve Bank of Dallas *Economic Review*, Second Quarter, 1995.