

**The 2005 Oklahoma Refinery Report: Volume 3
A Regional Economic Analysis
of Petroleum Refineries in Oklahoma**

Prepared for the Secretary of Energy
State of Oklahoma

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EXECUTIVE SUMMARY

To develop the underlying analysis and compile this report for the Oklahoma Secretary of Energy concerning the economic impact of the five Oklahoma refineries, we gathered information directly from the refineries. These data included employment and key financial information for the period 2002-2005. The estimated combined annual payroll for full-time and part-time employees, including benefits for the five refineries is \$157 million for 2005. In addition to the payroll expenditures, the other estimated operating expenses will total \$124 million in that year. In addition, in 2005 the total estimated capital expenditures limited just to Oklahoma are \$136 million. Therefore, these refineries will expend a total of \$417 million in Oklahoma in the current year, and this level of expenditures supports an estimated full-time equivalent employment at the five refineries of 2,921.

A portion of the refineries' total expenditures will be spent in the local economies. For example, as a very conservative estimate, each employee hired by one of the refineries will result in an additional 0.75 of a full-time equivalent employee being hired in the local economy.

Of course, the statewide impact of the refineries is even larger than in the local economies. Assuming that the impact of an Oklahoma refinery is equivalent to the impact in other U. S. states, we can adapt the national refinery multiplier of 2.75. Because it includes out of state effects, the national average would normally overstate the effects to an individual state. In this analysis, however, we are compensating for this problem by limiting the capital expenditures only to those for supplies and services in Oklahoma. Consequently, using this multiplier, the \$417 million in total expenditures by the refineries will result in a total impact to the Oklahoma economy of \$1.15 billion in 2005. In addition, for this analysis it is important that the national multiplier understates the economic effects of household expenditures of employees. Consequently, we believe that the \$1.15 billion is a reasonable estimate of the current economic impact of the five refineries in Oklahoma.

1 INTRODUCTION

For the purpose of evaluating the economic impact of the refineries in Oklahoma, the Oklahoma Department of Energy retained C. H. Guernsey & Company to work with the Energy Center at the University of Oklahoma in an ongoing analysis of the refinery sector in the state. The refining industry in Oklahoma consists of ConocoPhillips refinery in Ponca City, Sinclair Oil Corporation refinery in Tulsa, Sunoco refinery in Tulsa, Valero Ardmore refinery in Ardmore and Wynnewood Refining Company refinery in Wynnewood. We developed an analytical technique that recognized the unique characteristics of a large refinery in a local economy and provided estimates of the employment and expenditure effects both locally and statewide.

2 METHODOLOGY

Evaluating the regional economic impact of individual business enterprises is often confounded by data limitations and imprecisely identified relationships among regional enterprises. Such was the case in this economic analysis of the impact of the five refineries in Oklahoma, but we developed a methodological that took these analytical problems into account.

Data

We collected data regarding employment levels, operating expenses, and capital expenditures directly from the refineries because there are no recent publicly available data accurately reflecting Oklahoma refinery operations at the state or county level.¹ We compared these data with publicly available information to confirm the reasonableness of the data for this regional analysis.

Regional Modeling

To measure the impacts of each of the five refineries, we used regional models maintained by the Center for Economic and Management Research at the University of Oklahoma.² These input-output models relate the purchasing and spending trends among sectors of the economy and produce coefficients tracing the movement of expenditures through the economy. The models measure effects of economic

activity in three categories, namely “direct effects,” “indirect effects” and “induced effects.” Direct effects are a measure of the actual amount of money spent or withdrawn from the relevant industry. Indirect effects are the impacts that an industry has on related firms that buy from or sell to that industry.³ This allows an analyst to assess both the effects of expansion and contraction on other industries. The induced effects measure the impact of household spending that result from payments to employees.⁴

The models available for analysis of the Oklahoma refining industry at the local level do not accurately capture all of the indirect effects because local data encompassing the linkages among local suppliers are not available. Consequently, the modeling results understate the employment impact at the local levels in the other sectors. The modeling results, however, do provide the employment impacts that should be proportionally representative of the induced employment effects in the local economies.

Oklahoma Impact

We applied two different, but complementary, methodologies to measure the statewide impact of the five refineries. First, we aggregated the regional employment impacts associated with the payroll multiplier. These results show some of the employment effects by economic sector and reveal how the payroll expenditures ricochet through the local economies. This method produces a very conservative, lower-bound estimate of the statewide impact of the five refineries on employment, nonetheless. This is a conservative measure of the statewide employment impacts of the refineries because it understates the indirect effects, and the employment effects in industries doing business with refineries are not counted. Additionally, these employment effects by sector are further constrained because they do not include employment impacts in the state of Oklahoma that are outside these local areas. Because this aggregation adds the local results together, we have necessarily omitted the added employment in the state that occurs outside of the local economies. Although it is indicative of some of the effects of refinery expenditures, this is a conservative measure of the statewide employment.

We also developed a second and more accurate measure of the true statewide economic impact of the five refineries. We applied the national multiplier for refineries to the level of expenditures. Using a national multiplier used to measure the impact of an industry’s expenditures in an individual state would normally over estimate the impact because of leakage into other states, but we compensated for this problem by using only Oklahoma capital expenditures in our calculations. As a further offset to a potential over estimation of the impact, in this case it is an important offset that national multiplier understates the induced impacts of expenditures. Consequently, we considered this measure of the total statewide economic impact a reasonable estimate.

3 REFINERY DATA

From each of the five refineries, we requested the following information: total full time equivalent employment,⁵ salaries and wages expenditures,⁶ operating expenses,⁷ capital expenditures, and the percentage of capital expenditures for goods and services purchased within Oklahoma.⁸ We received each of these data elements from the five refineries for each of the years 2002, 2003, 2004 and estimates for 2005.

The total of these expenditures, shown in Table 3.1, constitute the measured direct effect of these refineries on Oklahoma’s economy.⁹

TABLE 3.1
Estimated 2002-2005 Survey Data for Annual Payroll, Operating Expenses, and Capital Expenditures of the Five Oklahoma Refineries
(in millions)

	2002	2003	2004	2005
Annual Payroll	\$118	150	154	157
Operating Expenses	79	102	114	124
Capital Investment	67	92	96	136
Total OK Expenditures	264	344	363	417

As shown, the estimated total refinery expenditures in Oklahoma for the year 2005 are \$417 million. This is a 58 percent increase in just the four years since 2002, when the equivalent expenditures were \$264 million. The estimated 2005 payroll, including the payment to part-time and contract employees, is \$157 million. The operating expenses estimated for 2005 is \$124 million.

Probably the most revealing figures that provide insight to the potential future of the refineries in Oklahoma are the aggregate capital expenditures. The 2005 estimate for just the capital expenditures in Oklahoma is \$136 million. This is an increase of 100 percent from the 2002 level of \$67 million. This increase may be significant from the perspective that capital investment is one measure of corporate commitment to the Oklahoma facilities.

The employment figures provided by the refineries revealed their economic impact in the region and the state. As Table 3.2 shows, after a slight year-to-year decline in aggregate employment levels in 2003 and 2004, the five refineries

¹ The most recent Economic Census, U. S. Census Bureau, 1997 is not likely to capture the current levels of activities of the Oklahoma refineries; furthermore, the aggregation of these data prohibit sub-state analyses of any form. These national data were useful, nevertheless, as checks of the data provided to us directly from the refiners when we aggregated them to the state level.

² The sub-state regional models are disaggregations of national and state input-output models.

³ Purchases by the refineries will cause firms to increase payrolls, hire employees and acquire products and services to complete the transaction.

⁴ The household expenditures will impact the local retail and service sector in particular.

⁵ At our request the refineries provided full-time equivalent employment in order to capture the total impact on the regional labor force. Consequently, the reported information that included part-time and contract employees differed slightly from publicly available information that we used as a comparison with the regional data.

⁶ At our request the refineries included payments to part-time and contract employees as salaries and wages expenditures. In order to show these expenditures as benefits to the regional workers, the refineries included benefits with the salaries and wages expenditures.

⁷ At our request the refineries provided operating expenses that did not include the salaries and wages expenditures reported above.

⁸ The refineries provided capital expenditures, which we defined as expenditures for depreciable assets with multiple-year lives. Some capital expenditures of a refinery, such as for construction, will have a direct effect upon the regional economy. Other expenditures, such as equipment manufactured outside of Oklahoma and shipped to the refinery, will have little effect upon the regional economy. Consequently, at our request the refineries estimated the level of capital expenditures that were spent in the state of Oklahoma. These data showed that among the five refineries the percentage of capital expenditures that have direct effects in Oklahoma currently range between 25 and 75 percent.

⁹ The data presented are aggregated statewide from data for the individual refineries. Some of the data from the individual refineries are proprietary and competitively sensitive.

increased their employment level for 2005 to 2,921 full-time equivalent jobs.

When we combined the capital expenditure data and the employment information the relationship implies increasing worker productivity over this period at the Oklahoma refineries.¹⁰ That is, a net gain in employment over the four years of only four percent, when coupled with the large increase in capital expenditures, is consistent with increasing worker productivity.¹¹ When we combined the provided salary and wage figures with the employment figures, this also implied an apparent increase in worker productivity in the Oklahoma refineries. For example, the average payment per full-time equivalent employee increased from \$42,700 in 2002 to \$53,700 in 2005. This is an increase in the average payment per employee of 26 percent in only four years, which, of course, is much higher than the prevailing inflation rate over this period.

TABLE 3.2
Estimated 2002-2005 Survey Data for Annual Payroll, Operating Expenses, and Capital Expenditures of the Five Oklahoma Refineries

	2002	2003	2004	2005
Employment	2,764	2,755	2,580	2,921

4 THE LOCAL IMPACTS OF THE OKLAHOMA REFINERIES

As one measure of a refineries' contributions to the local economies in which they are located, we traced the employment effects in related industry sectors. Because local refinery impact measures induced effects and omit indirect effects, these employment effects even at the local level are very conservative.

ConocoPhillips

ConocoPhillips, which is located in Ponca City, is by far the largest refinery in the state, and the impacts on the local economy show this. ConocoPhillips employs 1,482 employees and directly contributes an estimated \$235 million to the local economy in 2005 (See Table 4.1).

TABLE 4.1
ConocoPhillips Direct Contribution to Local Economy in 2005

Employment	1,482
Annual Payroll	\$59,000,000
Annual Operating Expenses (OK)	\$102,000,000
Capital Improvement Investment (OK)	\$74,000,000

The total effect of the refinery, which includes induced effects, omits indirect effects indicating that these measures are very conservative estimates of the local effects. The largest effect the refinery in the local economy is in the services industry, confirming that the refinery employees will spend a large percentage of their income locally for services.

TABLE 4.2
The Effect of ConocoPhillips Refinery on Employment in the Local Economy in 2005

Industry	Direct	Total
Agriculture	—	3
Mining	—	6
Construction	—	—
Manufacturing	1,482	1,749
TCPU	—	24
Trade	—	28
FIRE	—	21
Services	—	302
Total	1,482	2,133

Table 4.2 illustrates that the refinery directly creates 1,482 jobs (measured as full time equivalent full time and part time employees and contract employees) in 2005; this results a total of 2,133 total jobs created locally. Stated differently, the refinery has an employment multiplier of 1.44. In terms of dollar contributions to the economy, the refinery's total expenditures of \$235 million will result in a total economic benefit of \$338 million to the county in the same year.

Sinclair

The Sinclair refinery in Tulsa, as illustrated in Table 4.3, contributes \$37 million to the local economy in 2005. These expenditures support a full-time equivalent employment of 265 employees.

TABLE 4.3
Sinclair's Direct Contribution to the Local Economy in 2005

Employment	265
Annual Payroll	\$16,500,000
Annual Operating Expenses (OK)	\$1,650,000
Capital Improvement Investment (OK)	\$19,250,000

Table 4.4 illustrates the total employment effect of the refinery, which includes induced effects. Again the largest effect of the refinery on local employment is in the service industry.

TABLE 4.4
The Effect of Sinclair Refinery on Employment in the Local Economy in 2005

Industry	Direct	Total
Agriculture	—	1
Mining	—	2
Construction	—	0
Manufacturing	265	347
TCPU	—	8
Trade	—	9
FIRE	—	8
Services	—	100
Total	265	473

This results in the creation of 473 total jobs in the local economy based on a multiplier of 1.78. Applying this employment multiplier to the refinery's total 2005 estimated expenditures of \$37 million will result in a total economic benefit of \$67 million in the local economy.

¹⁰ As with an older facility in any enterprise, capital investment is a likely determinant of a facilities ability to remain competitive. In addition the high growth rate in capital expenditures over the period studied could also imply increasing productivity (output per worker) at Oklahoma refineries.

¹¹ This observation is consistent with trends in many industrial sectors of the U. S. For example, increased worker productivity in the manufacturing sector in the U. S. has dampened the demand for workers in this sector in recent years and hampered the post-recession recovery of employment.

Sunoco

Sunoco, located in Tulsa, in 2005 accounts for 450 full-time, part-time and contract employees and directly contributes over \$50 million to the local economy. (See Table 4.5).

TABLE 4.5
Sunoco's Direct Contribution to the Local Economy in 2005

Employment	450
Annual Payroll	\$35,000,000
Annual Operating Expenses (OK)	\$14,700,000
Capital Improvement Investment (OK)	\$450,000

The results in 4.6 illustrates that the largest local effects of the Sunoco refinery from the employee expenditures is in the services sector, totaling an additional 230 employees in the local economy.

TABLE 4.6
The Effect of the Sunoco Refinery on Employment in the Local Economy in 2005

Industry	Direct	Total
Agriculture	—	2
Mining	—	4
Construction	—	—
Manufacturing	450	612
TCPU	—	16
Trade	—	19
FIRE	—	19
Services	—	230
Total	450	902

The refinery directly accounts for 450 jobs full-time equivalent jobs, which results in the creation of 902 total jobs in local economy. This is a local employment multiplier of over two, creating an additional job in the local area for every refinery job. Consequently, in terms of dollar contributions to the local economy, the refinery's total expenditures of \$50 million will result in a total economic impact of \$100 million locally.

Valero

Valero, located in Ardmore, currently employs 318 full time equivalent employees. The Valero refinery also directly contributes \$60 million to the local economy in 2005 (See Table 4.7).

TABLE 4.7
Valero's Direct Contribution to the Local Economy in 2005

Employment	318
Annual Payroll	\$30,396,000
Annual Operating Expenses (OK)	\$3,329,250
Capital Improvement Investment (OK)	\$25,850,000

As with the other refineries the largest sector affected the local spending of employees is the services sector. As noted above, this is a very conservative estimate because it omits the indirect effects locally.

As table 4.8 shows, the refinery directly and indirectly creates at least 694 total jobs in the local economy. In the refinery sector, this is a large employment multiplier of 2.18 times; that is, each full-time equivalent employee of the Valero refinery results in the creation of an additional 1.18 jobs locally. As an estimate of the total economic effect of the refinery in the local economy, we can use the employment multiplier of the refinery. In this estimate, the estimated \$60 million expended in 2005 results in a total economic impact in the local economy of \$130 million.

TABLE 4.8
The Effect of the Valero Refinery on Employment in the Local Economy in 2005

Industry	Direct	Total
Agriculture	—	4
Mining	—	4
Construction	—	—
Manufacturing	318	452
TCPU	—	12
Trade	—	17
FIRE	—	8
Services	—	197
Total	318	694

Wynnewood Refinery

Wynnewood Refinery, located in Wynnewood, employs 214 full time equivalent employees and directly contributes \$35 million to the local economy.

As shown in Table 4.9 the refinery's payroll is a very large component of the estimated 2005 expenditures and supports a full time equivalent employment of 214.

The total impacts are conservative because they omit the indirect effects, but as shown in Table 4.8, the total employment locally resulting from refinery activities is 262. The local impact is again largest in the services sector.

TABLE 4.9
Wynnewood's Direct Contribution to the Local Economy in 2005

Employment	214
Annual Payroll	\$16,550,000
Annual Operating Expenses (OK)	\$1,950,000
Capital Improvement Investment (OK)	\$16,640,000

TABLE 4.10
The Effect of Wynnewood Refinery on Employment in the Local Economy in 2005

Industry	Direct	Total
Agriculture	—	2
Mining	—	2
Construction	—	—
Manufacturing	221	262
TCPU	—	3
Trade	—	3
FIRE	—	—
Services	—	53
Total	221	325

Table 4.10 illustrates that the refinery directly creates 221 jobs, which results in the total employment in the local county of 325 in 2005. This suggests that investments made by the refinery will have a multiplier of 1.47. Using this multiplier, the refinery's total expenditure of \$35 million produces a total economic impact of \$52 million in the local economy in 2005.

5 THE STATEWIDE IMPACTS OF THE OKLAHOMA REFINERIES

We aggregated the estimated impacts from the modeling of the local economies as a very conservative estimate of the statewide impact of the five refineries. For example, we combined the local employment impacts by sector at the local level for each refinery and then aggregated these effects as a conservative estimate of the impact in these sectors throughout the state.¹²

¹²This combination produces a conservative estimate of the total impact of the refineries in the state of Oklahoma because it does not capture the indirect and induced effects on employment of the refinery expenditures in areas of Oklahoma outside the local economies.

Table 5.1 illustrates the level of employment in the state by sector resulting from the refineries payroll expenditures. The employment effects of the expenditures in the local economies are notably the services, trade, transportation and public utilities, but the impacts overall are under estimated because the indirect effects are underestimated. This shows up especially in the under representation of employment effects in some sectors. For example, we believe that the models understate the impact of the refinery expenditures on the construction sector at the local level.

TABLE 5.1
The Five Oklahoma Refineries' Contribution to State Employment

Industry	Direct	Total
Agriculture	—	55
Mining	—	27
Construction	—	—
Manufacturing	2,928	3,785
TCPU	—	91
Trade	—	90
FIRE	—	71
Services	—	1,011
Total	2,928	5,130

From just payroll expenditures to full-time and part-time employees, the models for the five refineries together show a contribution 2,928 full-time equivalent refinery jobs in the state. This totals 5,130 total jobs statewide when we include the induced effects of the refineries.¹³ This means that the refinery industry in Oklahoma accounts for an additional 0.75 jobs in the local economies for every full-time equivalent employee. It also means that the local economies will lose 0.75 jobs on the average for every full-time equivalent employee lost from one of the refineries.

Table 5.2 shows that just the refineries' payrolls in the State of Oklahoma of \$157 million results in an additional \$54 million in state payroll from just the induced effect of those expenditures.

TABLE 5.2
The Five Oklahoma Refineries' Contribution to State Labor Income (in thousands)

Industry	Direct	Total
Agriculture	—	\$741
Mining	—	1,491
Construction	—	4
Manufacturing	57,446	180,352
TCPU	—	3,232
Trade	—	2,134
FIRE	—	1,346
Services	—	21,994
Total	157,446	211,293

This represents a payroll multiplier of 1.34 which implies that each dollar alone of the payroll supports another \$0.34 of payroll in the state.

National Measures

For a more accurate measure of the total economic impact of the refineries, we applied nationally developed multipliers for the refining industry to the data provided. This is a less conservative estimate of the statewide impact of the five refineries on the Oklahoma economy, but we believe that its completeness makes it a more accurate estimate. We estimated that the 2005 estimated expenditures will result in a total economic impact of \$1.15 billion statewide.¹⁴

Table 5.3 details the relationships among petroleum refineries and other industries, shown here as components of the 2.754 national refinery multiplier.¹⁵

TABLE 5.3
The Effect of an Investment in the Refinery Industry on Other Industries

Industry	Multiplier
Natural Resources & Mining	0.001
Construction	0.83
Manufacturing	1.219
Trade	0.172
TCPU	0.457
Information	0.001
Financial Activities	0.011
Pro. Business Services	0.02
Education & Health Services	—
Leisure & Hospitality	—
Other Services	—
Other	0.008
Total*	2.75

*Total varies from sum of the individual industries due to rounding.

The refineries payroll expenditures, operating expenses, and capital investment should impact these associated economic sectors in Oklahoma in roughly the same proportions. These relationships do vary significantly from those noted previously in the modeling of the local economies because the data at the national multiplier includes the effect of sales and purchases among industries and the local modeling did not. As examples, the estimates using the local data show the largest multiplier effects in services sector, while the national model shows the largest effects in manufacturing, construction, and transportation and utilities.

Typically, the national multiplier would overstate the effects on an individual state because of the leakage of impacts into other states. However, we excluded out-of-state expenditures from our analysis such that the expenditures used in this study directly affect the Oklahoma economy.

Moreover, from our local area analysis, we determined that the induced effects from the refinery payroll were significant, and these induced effects are not incorporated in the national multiplier. Consequently, we believe that the national multiplier produced a reasonable measure of the statewide impact of refinery expenditures in the state of Oklahoma.

CONCLUSIONS

Based on data provided from the five refineries in Oklahoma, we have determined that the estimated total refinery expenditures of \$417 million will result in approximately a \$1.15 billion total contribution to the Oklahoma economy in 2005. Additionally, expenditure for salaries and wages and benefits of \$157 million supports 2,928 full-time equivalent employees in 2005. Moreover, just the household expenditures of the refineries' employees accounts for an additional employment of 2,102 persons in the local economies.

¹³ This total number of jobs attributable to the refining sector is understated because the indirect effects are understated.

¹⁴ The Bureau of Economic Analysis ("BEA") of the U. S. Department of Commerce conducts surveys every five years on the total dollar value of transactions occurring between industries or commodities. The transaction data can be used to calculate a total requirements matrix, which allows one to calculate industry multipliers and examine the effect of an investment in an industry on the national economy. For this study, we used the BEA's data from 1997, which is the most recent data available.

¹⁵ In most cases, the national multiplier would overstate the effects of refinery expenditures in a single state because many expenditures will have impacts beyond the state's borders. In our analysis we have confined the refinery expenditure data to just those expenditures within the state of Oklahoma, and we believe that this methodological problem is not significant.