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**HOT AIR OVER THE ARCTIC?  
AN ASSESSMENT OF THE WEFA STUDY OF THE ECONOMIC IMPACT  
OF OIL DRILLING IN THE ARCTIC NATIONAL WILDLIFE REFUGE**

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## EXECUTIVE SUMMARY

More than a decade ago, the American Petroleum Institute commissioned WEFA, an economic consulting firm, to produce an analysis of the economic impact of oil production in the Arctic National Wildlife Refuge. This analysis projected that in a high production scenario, the oil from the refuge would lead to the creation of 750,000 jobs in the United States. WEFA's projection of 750,000 jobs has been widely cited in the debate over opening the Refuge to oil drilling.

This study examines the WEFA analysis, and finds that it seriously overstated the job creation potential from oil production in the Arctic Refuge due to three erroneous assumptions.

1) According to the most recent estimates from Energy Information Agency (EIA), WEFA's high production scenario overstates the size of potential oil production in the Refuge relative to world oil supplies by a factor of three. Adjusting the projections to keep them in line with the EIA estimates would reduce projected job creation by two-thirds.

2) The WEFA study assumes that the offsetting reduction in oil production by other oil suppliers, as a result of falling oil prices, will be far less than is generally estimated by oil industry analysts, including WEFA itself. If other oil producers cut back production in response to lower prices in a manner that is consistent with conventional estimates, then the WEFA projection for job creation would be reduced by another 40 percent.

3) The WEFA study assumes that the economy will be far more affected by an oil price decline attributable to oil produced in the Refuge, than it is to oil price declines caused by other factors. Substituting WEFA's own estimate of the general responsiveness of job creation to oil price declines, instead of the estimate that is specific to the oil produced in the Arctic Refuge, lowers the projection of job creation by approximately 75 percent.

When these adjustments are taken together (these reductions are multiplicative, not additive), the projection of jobs resulting from oil produced in the Arctic Refuge falls to less than 50,000. This number of jobs is fewer than what the economy generated in an average week over the years 1997 through 2000.

It is also important to recognize that the new jobs projected in this model are not held by people who had been desperately seeking work. As with most long-term economic models, there is no involuntary unemployment in the WEFA model. The job growth resulting from oil production in the refuge is due to the fact that it is projected to raise the real wage very slightly (less than 0.1 percent). This means that people who opted not to work at the current real wage (e.g. \$10.00 an hour), decide to work at the slightly higher real wage they will be able to earn as a result of the oil from the Refuge (e.g. \$10.01 an hour).

Finally, as noted in the WEFA study, any gain in jobs would be temporary. The peak production is projected to last less than 10 years. After 20 years, production is projected to be very insignificant. After that point, the nation will be able to draw no further economic benefits from oil production in the Refuge. However, it will have permanently lost a reserve that could be tapped in the event of an emergency. Of course, any environmental damage caused by drilling in the Arctic Refuge may last long after the oil is depleted.

## INTRODUCTION

A key issue in the Congressional debate over opening the Arctic National Wildlife Refuge to oil drilling is the potential impact of the oil in the refuge on the U.S. economy. One of the studies that has been frequently cited in this context is a 1990 analysis done by the WEFA Group for the American Petroleum Institute.<sup>2</sup> Advocates of opening the refuge have frequently cited the projection in one of the scenarios in the study that, at its peak production level, developing the oil in the refuge will create more than 750,000 jobs in the United States. Given its importance in the debate over developing the Arctic Refuge, and the time that has passed since the original study was completed, it is worth assessing the plausibility of this estimate of job creation.<sup>3</sup>

Before getting into the specifics of the WEFA study, it is worth briefly explaining the basic logic of the methodology that the study uses, since there is much confusion on this issue. The model used by WEFA, like most economic forecasting models, assumes that the economy generally operates at full employment, in the sense that workers who want a job at the prevailing wage can find one. In this model, the unemployed are not workers who literally cannot find a job, but rather people who opt not to work at the wage rate they see in the market. The oil in the Arctic Refuge creates jobs by effectively raising the real wage, through lowering the price of oil. At a higher real wage, more people decide to work, and therefore the economy has more jobs.

This means that the 750,000 additional jobs shown in the study's most cited scenario, corresponds to 750,000 people opting to work as a result of the increase in the real wage resulting from the drop in oil prices. For example, if the oil from the refuge raises the real wage by 1.0 percent (a considerable overstatement of the effect projected in the WEFA study), then workers who opted to remain unemployed when offered a real wage of \$10.00 per hour, opted to work, now that they can receive \$10.10 per hour.

It is important to distinguish this labor supply story from a labor demand story, in which the direct employment from drilling the oil creates the job gains. While it is true that oil production in the Arctic Refuge will directly create jobs, the standard assumption is that these job gains are largely offset by job losses elsewhere. For example, the construction workers who will be employed in constructing new pipelines and other facilities are primarily workers who

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<sup>2</sup> *The Economic Impact of ANWR Development*, 1990, Bala Cynwyd, PA: The WEFA Group.

<sup>3</sup> Several earlier studies have examined the WEFA analysis, see Congressional Research Service 1992; Goodstein, 1994; and Tellus Institute, 1993.

otherwise would have been building oil facilities or other structures outside of the Arctic Refuge. Similarly, some number of workers will be employed in operating the drills. But these workers will be displacing coal miners, who will lose jobs as power plants and other facilities switch from coal to oil, as a result of the drop in oil prices caused by production in the Arctic Refuge.

The model used by WEFA, like the vast majority of economic forecasting models, assume that all these demand side effects net out. The only way that employment can rise is if the real wage rises. The rise in the real wage depends entirely on the extent to which the oil in the refuge leads to a reduction in world oil prices. The increase in employment that results will in turn depend on the responsiveness of employment (or labor supply) to the decline in oil prices. These items will be the focus of this analysis.

## **KEY ASSUMPTIONS OF THE WEFA STUDY**

There are three key assumptions in the WEFA study which are questionable in light of the economic developments of the last decade and other information: These assumptions concern:

- 1) the size of the world's oil supply in the period during which the oil from the Arctic Refuge comes on line;
- 2) the supply response of other oil producers to the drop in world oil prices resulting from production in the Arctic Refuge; and
- 2) the sensitivity of employment and economic output to the drop in oil prices resulting from production in the Arctic Refuge.

These issues will be considered in turn.

### **World Oil Supplies**

The assumption used in this study on the first point has been shown to be far off the mark. Its estimate of world oil production during the period when the oil in the Arctic Refuge is being developed is far below what current evidence indicates is plausible. The WEFA study estimated that world oil production would be 55.03 million barrels per day (MBD), when the fields in the refuge hit their peak production.<sup>4</sup> The most recent projection from the Energy Information Agency (EIA) puts world oil production nearly twice as high, at 102.6 MBD, when

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<sup>4</sup> This figure is taken from the projection for world oil demand in 2005 in the baseline, no ANWR, scenario.

oil production from the Arctic Refuge would approach its peak in 2015, if it were authorized in the near future.<sup>5</sup>

Part of this difference is attributable to the fact that the WEFA study assumed that the oil from the Wildlife Refuge would first be coming on line by the end of the nineties. Even if Congress were to immediately approve oil production, no significant amounts of oil would be drawn from the Arctic Refuge until 2010. However, most of the difference is attributable to the fact that oil has proven to be more plentiful than WEFA had assumed in its 1990 study.

Regardless of the cause of the difference between the WEFA assumption and the current projections from the EIA, the implications are the same – the oil drilled out of the Refuge will have a far smaller impact on world prices than is implied by the assumption used by WEFA. According to the latest projections from the EIA, the oil production from the Wildlife Refuge is expected to peak between 1.0-1.35 MBD.<sup>6</sup> Taking the mid-point of this estimate, the peak production from the Arctic Refuge would be approximately 1.15 percent of world oil production.

This is less than half as large as the average share assumed in the WEFA study. In the low production scenario, WEFA assumed that the peak production from the Arctic Refuge would be 1.6 percent of oil world supplies (0.81 MBD from the Arctic Refuge). In its high production scenario, WEFA assumed that the oil produced in the Arctic Refuge would be equal to 3.45 percent of world's supply. The fact that more recent estimates show that the expected amount of oil produced in the Arctic Refuge relative to world supplies will be less than half as large as was assumed in the WEFA study, implies that the impact on oil prices will also be less than half as large.

The fact that world oil supplies are far larger than was assumed by WEFA in its 1990 study also means that the price is much lower. The central, or base, estimate in the WEFA analysis assumed that the price of a barrel of oil would average \$46.86 (in 2001 dollars) when oil production from the Arctic Refuge hits its peak in 2005.<sup>7</sup> By contrast, in a recent study of the economic impact of the Kyoto Agreement, WEFA projected that in 2015 (when production in the Refuge would reach its peak, assuming immediate approval of drilling), the price of a barrel of oil would be just \$25.12 (in 2001 dollars).<sup>8</sup>

Lower oil prices will also reduce the economic impact of the oil produced in the Refuge. Since prices are far lower than what WEFA had assumed (even its low price scenario assumed that oil would cost \$34.30 per barrel in 2005), the impact of a price reduction of a fixed percent will be far smaller than WEFA had projected. For example, a 5 percent reduction on the price of a barrel of oil would save consumers \$2.34 per barrel, given the assumption on oil prices in the

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<sup>5</sup> Energy Information Agency, 2001, Table D6. World Oil Production by Region and Country, Reference Case, 1990-2020, Washington, D.C.: EIA, [http://www.eia.doe.gov/oiaf/ieo/tbld6\\_d10.html#d6](http://www.eia.doe.gov/oiaf/ieo/tbld6_d10.html#d6) .

<sup>6</sup> This estimate appears in *Potential Oil Production From the Coastal Plain of the Arctic National Wildlife Refuge, Updated Assessment*. Washington, D.C.: Energy Information Agency, [http://www.eia.doe.gov/pub/oil\\_gas/petroleum/analysis\\_publications/arctic\\_national\\_wildlife\\_refuge/html/anwr101.html](http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/arctic_national_wildlife_refuge/html/anwr101.html)

<sup>7</sup> Prices have been converted in 2001 dollars using the CPI-RS as a deflator.

<sup>8</sup> This figure appears in *Global Warming: The High Cost of the Kyoto Protocol, National and State Impacts*. 1998.

WEFA study. By contrast, a 5 percent price reduction based on the more recent projections from WEFA implies a saving to consumers of just \$1.26 per barrel.

To sum up this discussion, correcting the assumptions in the 1990 WEFA study to make them consistent with the latest estimates of the amount of accessible oil in the Arctic Refuge, and current projections for world oil supply, reduces the potential impact of oil produced in the Arctic Refuge by two thirds compared with the high production projection in the WEFA analysis. This means that the projected decline in world oil prices would be only one-third as large as projected by WEFA, and the projected increase in jobs would be only one-third as large.

### **Supply Responses of Other Producers**

The second key assumption in assessing the economic impact of oil production in the Arctic Refuge is the response of other suppliers to the drop in oil prices that would result from oil production in the refuge. There are two distinct sources of supply response. The first is the response of the OPEC cartel. The OPEC nations have attempted to restrict the supply oil in order to raise its price and increase their revenue from oil sales. It is possible that OPEC producers will respond to the oil production in the Refuge by significantly cutting back their own production, leaving world supplies, and therefore world prices, little changed.

The second source of supply response is from the marginal producers throughout the non-OPEC world (including producers in the United States), who find that it is no longer profitable to produce oil, after the production from the Arctic Refuge depresses world prices. It is necessary to consider both sources of supply response in order to assess the impact that oil production in the Refuge will have on oil prices.

The WEFA study assumed that both OPEC and non-OPEC producers will not change their production very significantly in response to a decline in world oil prices. In its high production base case, WEFA assumes that the world oil prices will fall by 10.5 percent in 2005, when production from the refuge hits its peak. This drop in oil prices is projected to cause OPEC to lower its production by just 1.4 percent, from 30.77 MBD to 30.33 MBD. The decline in production among non-OPEC producers is even less, a fall-off of 1.2 percent, from 26.46 MBD to 26.13 MBD.

This implies extremely low elasticities of supply for both OPEC and non-OPEC producers. In the case of OPEC producers, the percentage reduction in supply was just 13 percent of the percentage reduction in price, for an elasticity of 0.13. The supply response for non-OPEC producers was just 0.11 percent as large as the percentage reduction in price, implying an elasticity of 0.11.

It is easy to find estimates of oil supply elasticity that are considerably higher than the ones in this WEFA study. For example, a recent WEFA paper notes that it had been conventional to assume oil supply elasticities of 0.3, but this assumption had vastly under-estimated the actual increase in world oil supplies in recent decades.<sup>9</sup> To be conservative (and therefore error on the

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<sup>9</sup> Lynch, Michael, C. 2001, "Forecasting Oil Supplies: Theory and Practice." Paper prepared for the *Quarterly Review of Economics and Finance* (Forthcoming). It is also worth noting that WEFA's analyses of the economic impact of the

side of a large price impact of oil production from the Arctic Refuge), this 0.3 estimate of supply will be used in this analysis.

The WEFA study also includes an implied estimate of demand elasticity. In the low price scenario, which is the closest to the path of oil prices currently projected by EIA, an 8.3 percent decline in oil prices was associated with a 1.1 percent increase in oil demand, for an implied elasticity of elasticity of world oil demand of  $-0.13$ . This estimate is far lower than standard estimates of demand elasticity (and will therefore lead to a much higher estimate of the price impact of production from the Arctic Refuge); it will be accepted for purposes of this analysis.

With these estimates of supply and demand elasticity and updated estimates of the potential production in the Arctic Refuge, it is possible to estimate the reduction in oil prices that will result from opening the Refuge to oil production. As noted earlier, the most recent estimates from the EIA imply that the oil from the Refuge will increase world supply by 1.15 percent at its peak production level in 2015. Using the supply and demand elasticities discussed above, this would imply a decline in world oil prices of approximately 2.7 percent. This price impact is slightly more than one fourth the 10.5 percent price decline estimated in WEFA's base high production scenario, and just less than half the 5.6 percent price decline estimated in the base low production scenario.

In short, correcting the WEFA assumption on supply elasticity -- to bring it more in line with other generally accepted estimates of elasticity -- reduces the projected impact on world oil prices, of the oil potentially produced in Arctic Refuge, by just over 40 percent. Correcting this WEFA assumption would also reduce the potential job creation resulting from this oil by more than 40 percent.

It is important to note that these adjustments are multiplicative -- correcting the assumption on the potential importance of the Arctic Refuge oil to world oil supplies implied that jobs gains would be only one third as high as projected in WEFA's high production scenario. Correcting the WEFA assumption on supply elasticities implies that the job gains will be less than 60 percent of the WEFA projection. When the two corrections are applied together, the implied job gains are less than 20 percent (58.1 percent multiplied by 33.3 percent) of the projection in the WEFA analysis.

### **Sensitivity of Employment to Changes in Oil Prices**

Perhaps the most questionable assumption in the WEFA study is its assumption on the responsiveness of employment and output to changes in oil prices. The 10.5 percent decline in the price of oil that was projected in the high production base scenario was projected to lead to an increase in employment of 735,000 jobs or 0.6 percent. The increase in GNP was projected to 0.7 percent. This implies that the sensitivity of employment with respect to changes in oil prices is approximately -5.7 percent, while the sensitivity of output is approximately -6.7 percent. Since fluctuations in oil prices of this magnitude are quite common (oil prices fell below \$15 per barrel

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Kyoto agreement appear to assume a much higher elasticity of oil supply. In the context of the Kyoto agreement, a higher elasticity of supply implies that less of the burden of carbon taxes would be borne by oil producers, and more will be paid by consumers.

in 1999 and then rose to over \$30 per barrel in 2000), an impact of this magnitude seems implausible, since it would imply that the economy is enormously unstable. In other words, WEFA's assumption about the sensitivity of employment to changes in oil prices would imply that a doubling of oil prices would lead to a drop in employment of 5.7 percent, a loss of more than 7 million jobs.

Fortunately, it is not necessary to look far for an alternative estimate of the sensitivity of employment and output to oil prices. The WEFA study includes alternative scenarios for high, low, and middle paths of oil prices. In the high price path, oil prices are assumed to rise much more over the twenty year projection period than in the base, or middle, path. The low price path assumes that oil prices will rise much less rapidly than in the base scenario. The difference in employment and output levels in these scenarios provides an alternative basis for assessing the sensitivity of these measures to oil prices. Using the projections for 2005 and setting the base, scenario as 100, the WEFA projections provide the following comparisons:

	Oil Prices	Employment	Implied Sensitivity of Employment with Respect to Oil Prices
Base	100	100	
Low Price	73.2	100.4	-1.5 percent
High Price	126.3	99.7	-1.1 percent

**Source: WEFA 1990**

In these WEFA projections, a 26.8 percent decline in oil prices from the base to the low price scenario, is associated with a 0.4 percent increase in employment and a 0.5 percent increase in output. The increase of prices in the high price scenario of almost the same size has a slightly smaller impact. These figures imply an elasticity of employment with respect to oil prices of -1.5 and -1.1 percent, in the low and high price scenarios, respectively. (The elasticities of output in these two scenarios are 1.9 and 1.5 percent, respectively.) The sensitivity of employment and output to oil prices in this part of the WEFA projections is approximately one fourth of the sensitivity implied by the direct impact of the oil from the Arctic Refuge.<sup>10</sup>

Using these elasticities, it possible to generate a range for the employment gains attributable to oil production in the Refuge, based on the earlier estimate that it would reduce the price of oil by 2.7 percent. The high estimate is based on the greater sensitivity to oil prices shown in the low price scenario, while the low estimate is based on the sensitivity implied by the changes in the high price scenario.

**Reduction in Oil Prices      Increase in Jobs      Increase in Output**

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<sup>10</sup> The WEFA projections lead to the interesting situation where the high price, high production scenario has a higher level of employment than the low price, no production scenario, even though the price of oil in the former case is projected to be \$37.75 in 2005 (in 1988 dollars), while it is projected to be just \$24.82 in the low price, no production, scenario.

High Elasticity Estimate	-2.7 percent	53,400	0.05 percent
Low Elasticity Estimate	-2.7 percent	39,200	0.04 percent

To put these figures in context, the United States produced over 3 million jobs in the four years from 1997 through 2000, this translates into a rate of job creation of more than 8000 per day. The job creation that results from the oil produced in the Arctic Refuge, in the high estimate above, will be less than 7 days worth of growth over this four year period. The job creation in the low estimate would be less than 5 days of job growth. As far as the implicit gains in income due to lower oil prices, the benefit for an average family with an income of \$50,000 would be approximately \$25 a year in the high estimate, and \$20 per year in the low estimate.

It is important to remember that even these gains are transitory. The peak levels of production can be maintained for less than a decade before they start to trail off as the oil is depleted. After 20 years of production, the impact will almost be far too small to measure. The fact that these gains are transitory is an important point to consider in assessing merits of drilling in the Arctic Refuge. Once the oil is drained from this area, it is a resource that is permanently lost to the nation. Even if the drilling is carried through in a manner that does no lasting damage to the environment, it will still deprive future generations of a valuable resource. As long as the oil in the Arctic Refuge stays in the ground, it is a resource that can be drawn upon in the event of a national emergency. This reserve will no longer exist after the oil has been drained. At a time when the nation has made paying down the national debt a priority, out of a concern for the well-being of future generations, it would be a peculiar decision to deprive future generations of this oil reserve, even if there were no risk of permanent environmental damage.

**CONCLUSION**

The WEFA projection that oil from the Arctic National Wildlife Refuge can lead to the creation of 750,000 jobs rests on clearly wrong or implausible assumptions. First, updated data on world oil supplies and the potential reserves in the Arctic Refuge show that the oil produced from the region will be just one-third as large, measured as a share of world production as was assumed in the high production scenario in the WEFA analysis. This correction alone, by reducing the projected impact of the oil produced in the Arctic Refuge on world oil prices, would cut the projected job impact by two thirds.

Second, the assumption on the response of other oil producers to the drop in oil prices resulting from production in the Refuge was shown to be far lower than standard estimates. While the WEFA analysis assumed that elasticity of oil supply with respect to price was just 0.13, it is more standard to use estimates of elasticity of 0.3, or higher. This correction reduces the impact on world oil prices of the oil produced at the Refuge, by more than 40 percent. It would reduce the projected impact on job growth by the same amount.

Finally, it was shown that the WEFA analysis assumed an extraordinary sensitivity of employment and output to oil prices. Fortunately, the model provided an alternative basis for constructing estimates for the sensitivity of these variables to oil prices in the construction of its “low price” and “high price” scenarios. The measures of sensitivity that were derived by comparing these alternative scenarios were between one fourth and one fifth the size assumed in the WEFA analysis when it directly projected the impact of the oil produced in the Refuge.

The following table lists each of the adjustments noted above.

### **Corrected Assumptions in WEFA Analysis of the Gains from Oil Production in Arctic Refuge**

<b>WEFA High Production Projection of Job Growth</b>	<b>-- 750,000</b>
Refuge production as a share of world oil production (High production scenario)	-- 3.45 percent
Corrected	-- 1.15 percent (source: EIA, see text)
<b>Reduction in Projected Employment Impact</b>	<b>-- 500,000 (-66.7 percent)</b>
Elasticity of oil supply with respect to price	-- 0.13
Corrected	-- 0.3 (source: WEFA study, see text)
<b>Reduction in Projected Employment Impact</b>	<b>-- 110,000 (-41.9 percent)</b>
Sensitivity of Employment to Changes in Oil Prices	-- 5.7 percent
Corrected	-- 1.3 percent (source: WEFA 1990, see text)
<b>Reduction in Projected Employment Impact</b>	<b>-- 93,700 (-77.2 percent)</b>
<b>Corrected Projection of Job Creation</b>	<b>-- 46,300</b>

As was noted above, this corrected projection of job growth is equal to between five and seven days job growth during the years 1997 through 2000. Economic impacts of this magnitude are almost too small to be noticed, given the size of the U.S. economy. It should also be noted that the additional job holders projected by the WEFA model are not workers who are desperately in search of employment. Employment increases in this model because the model projects that there will be a small increase (less than 0.1 percent) in the real wage. The people who are projected to hold jobs as a result of the oil from the Arctic Refuge are people who opted not to work at a lower real wage, but then chose to take a job as a result of an increase in the wage being offered. In other words, the projected job growth is attributable to workers who would choose not to work at a wage of \$10.00 per hour, but at a wage of \$10.01 an hour decide to work.

It is also important to note that these gains are transitory. It is projected that the peak levels of production will only be maintained for a decade. After that the production will trail off,

so that the gains will be considerably smaller. Once the oil is depleted, the nation will have forever lost an oil reserve which it otherwise could tap in a national emergency. In the event that the oil production results in lasting damage to the region, then the losses to future generations will be even larger.