S T A F F R E P O R T

RESULTS OF THE DELPHI VIII SURVEY OF OIL PRICE FORECASTS

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CONTENTS

Page

PURPOSE

The purpose of this report is to present the results of the Energy Commission staff's 1995 Delphi survey on future oil prices. The following narrative discusses a brief background of the Delphi survey method, a description of the panel, a description of the survey, and a summary of the results of the survey.

BACKGROUND

Since 1982, the California Energy Commission (Commission) has conducted surveys of oil price forecasts using the Delphi technique as one of its forecasting tools. Prior to 1982, the Commission staff compiled and analyzed various crude oil price forecasts in the literature and selected a representative forecast to use as the official Commission forecast. In the Delphi survey process currently used by staff, a panel of experts is selected and each panelist's opinions regarding future changes in oil prices and related economic variables are systematically polled through a series of questionnaires. The results of the initial survey round are compiled, averaged, summarized and sent back to survey panelists who are then given an opportunity to modify their previous responses. The results of the second round are used as the basis for the staff oil price forecast.

The Delphi survey method was chosen because it incorporates a number of features that make it particularly attractive to the Commission compared to earlier methods. Specifically:

- The forecast survey responses can be precisely tailored to the Commission's 20-year planning period. Forecasts developed by other institutions generally address shorter or disparate periods.

- The flexibility of the survey method allows it to be shaped to address oil price issues important to the Commission.

- The survey methodology imposes a common response format on panelists. This permits consistent, systematic statistical treatment of survey responses to arrive at a representative result.

- The survey makes it possible to consult with and incorporate the views of a relatively large number of geographically dispersed experts.

- The expertise possessed by panelists tends to ensure that each viewpoint is based on a knowledgeable assessment of market fundamentals.

- The broad institutional representation among panelists provides a wide range of viewpoints.

- The anonymity guaranteed to survey panelists encourages candor.

PANEL DESCRIPTION

Panel selection involved a two-part process. First, a list of prominent national and international oil companies, educational institutions, financial institutions, professional firms and governmental bodies

was prepared (including the names of respondents to prior Delphi surveys). Second, individuals responsible for preparing and evaluating oil price forecasts in these institutions were invited to participate in the survey panel.

In order to encourage candor, participation was solicited with the understanding that panelist identities and individual responses would not be disclosed. This year's panel consisted of 21 experts from government, academia, consulting firms, industry and financial institutions. Five panelists were from outside the United States.

SURVEY DESCRIPTION

The crude oil forecast represents the average price of an internationally traded oil, rather than a premium oil such as West Texas Intermediate. Using this method, the panel was asked to provide three oil price forecasts: low, most likely and high. In addition, the panel was asked to consider and rank various factors that could affect the price of oil.

For purposes of this survey, the definitions for low, most likely and high oil price forecasts are:

- Low price forecast: 90 percent of all possible price paths would lie above the estimated low price path.

- Most likely price forecast: the expected annual average price of internationally traded crude oil.

- High price forecast: 90 percent of all possible price paths would lie below the estimated high price path.

A copy of the 1995 survey is presented in Appendix A.

SURVEY RESULTS

Crude Oil Prices

Figure 1 shows the average of the panel's low, most likely and high oil price paths. The forecasts are: $19.93 per barrel (1993 dollars) by the year 2016 for the most likely price path, $13.33 for the low path, and $30.00 for the high path.

Since the Commission has been conducting the Delphi survey, the forecasts have shared the trait of having upward trends. The trajectory of price growth, however, continues to flatten gradually with repeated surveys over time. As shown in Figure 2, Delphi VIII is no exception to this trend. For the year 2012, for example, the Delphi VIII forecast of $19.35 is almost $6.50 less than Delphi VII. If compared to Delphi VI, the difference is almost $14.00 less!

Rates of Change

Although the responses varied greatly for the most likely forecast, the average rate of change declined over the long term (Figure 3). For example, for the year 2000 the highest rate was 5.26 while the lowest was -4.50. By the year 2005, however, most surveys reflected a rate of between zero and 3.50 percent (only two respondents indicated a negative number).

A similar pattern exists for the high case rates. While there are extremes in the estimates (from a low of -1.01 to a high of 16.30), the average rate over the long term shows a slight decline. The low case, on the other hand, shows an extremely small increase over the long term with the rates leveling off by the year 2010.

Factors Affecting Price

The panel was asked to consider the following factors in their high and low forecasts:

- Collapse of or adherence to production quotas by the Organization of Petroleum Exporting Countries (OPEC)
- Political climates in the Middle East, former Soviet Union and Mexico
- Size of worldwide oil resources
- Impact of either additional or relaxed environmental restrictions of U.S. oil resources
- Increased or decreased subsidies for oil exploration and developments
- Oil demand in industrialized countries
- Oil demand in developing countries
- Success or failure of actions to encourage conservation
- Impact of GATT on world oil trade

Panelists' estimates of the importance of these factors for the Delphi VIII forecast are compared to factors from the Delphi VII forecast in Tables 1 and 2.

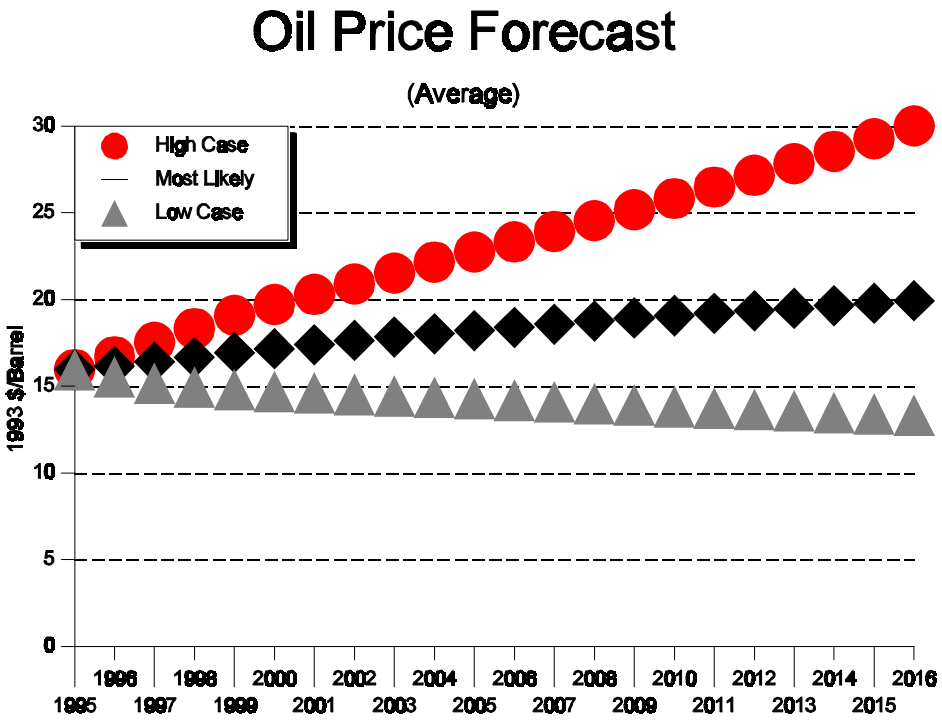
According to the respondents, the most important factor driving the high price case will be increased oil demand from developing countries. If demand grows faster than production capacity, oil supply markets will tighten, driving up prices worldwide.

Other key factors in this forecast for higher oil prices are:

- Long term adherence by OPEC to strict production quotas
- Continuing military conflict and/or political instability in the Middle East
- Greater oil demand in industrialized countries
- The impact of political instability on the production and export of oil from the former Soviet Union

The low price forecast shows a gradual decline of the price of oil over the next 20 years. This possible decline was attributed to several factors. Additional supplies could come from a variety of sources: the possible collapse of the OPEC production quota system, larger than estimated reserves, technological gains, Iraq resuming full production, and increased exports from the former Soviet Union. This increase in supply combined with lower demand in both developing and industrialized countries could result in lower oil prices.

Figure 1



YEAR	CASES (1993 $/BARREL)		
	HIGH	LIKELY	LOW
1995	$15.96	$15.96	$15.96
1996	$16.70	$16.15	$15.53
1997	$17.53	$16.41	$15.18
1998	$18.32	$16.66	$14.97
1999	$19.08	$16.94	$14.82
2000	$19.71	$17.16	$14.70
2001	$20.29	$17.39	$14.62
2002	$20.90	$17.63	$14.53
2003	$21.52	$17.84	$14.45
2004	$22.16	$18.02	$14.37
2005	$22.74	$18.20	$14.28
2006	$23.31	$18.39	$14.20
2007	$23.91	$18.58	$14.10
2008	$24.54	$18.76	$14.01
2009	$25.17	$18.93	$13.92
2010	$25.82	$19.07	$13.83
2011	$26.48	$19.21	$13.75
2012	$27.15	$19.35	$13.66
2013	$27.83	$19.49	$13.58
2014	$28.54	$19.64	$13.49
2015	$29.26	$19.78	$13.41
2016	$30.00	$19.93	$13.33

Figure 2

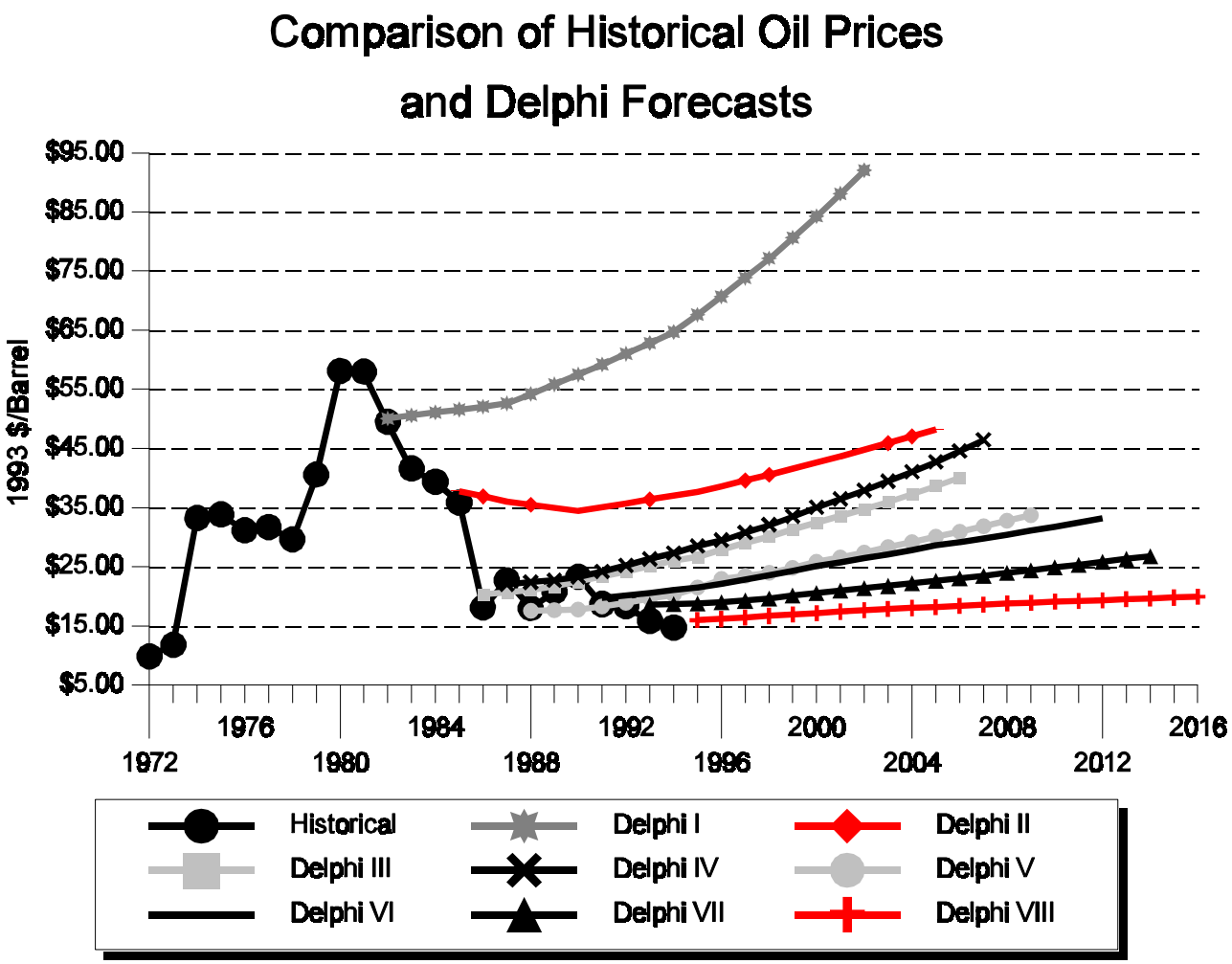
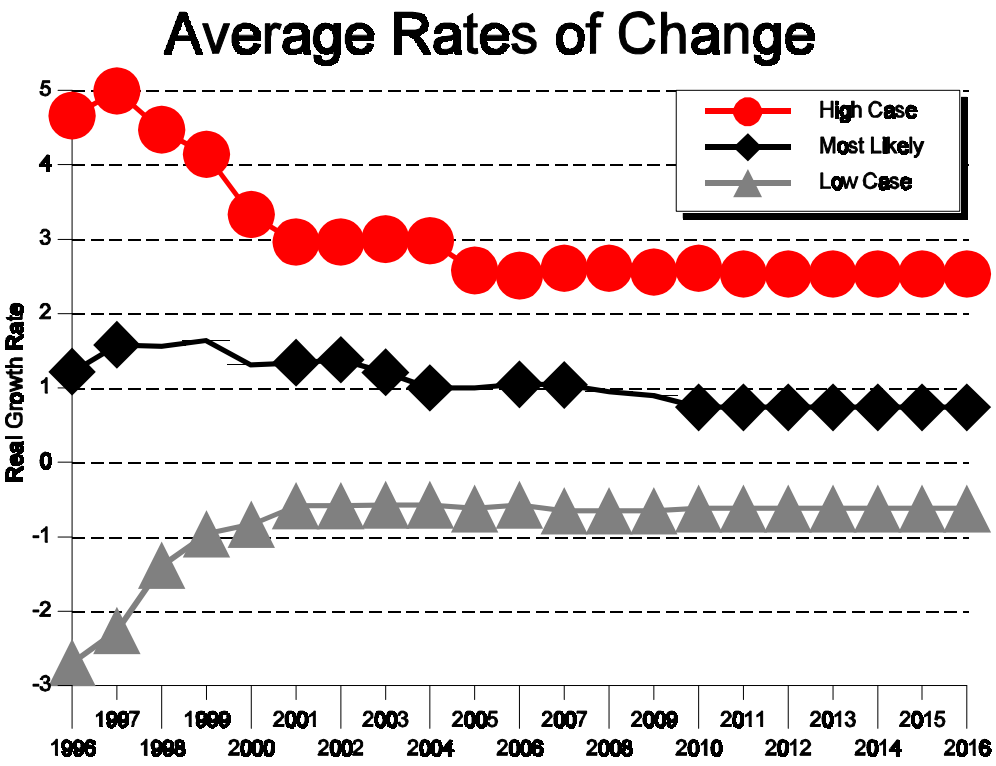

Comparison of Historical Oil Prices
and Delphi Forecasts
1993 $/Barrel
$95.00
$85.00
$75.00
$65.00
$55.00
$45.00
$35.00
$25.00
$15.00
$5.00
1972
1976
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
Historical
Delphi I
Delphi II
Delphi III
Delphi IV
Delphi V
Delphi VI
Delphi VII
Delphi VIII

Figure 2 (Cont.)

YEAR	HISTORICAL ($1993)	OIL PRICE FORECASTS (1993 $/BARREL)							
		Delphi I	Delphi II	Delphi III	Delphi IV	Delphi V	Delphi VI	Delphi VII	Delphi VIII
1972	$9.84								
1973	$11.80								
1974	$33.25								
1975	$33.84								
1976	$31.13								
1977	$31.71								
1978	$29.61								
1979	$40.57								
1980	$58.15								
1981	$57.96								
1982	$49.51	$50.06							
1983	$41.61	$50.56							
1984	$39.39	$51.08							
1985	$35.85	$51.58	$37.79						
1986	$18.11	$52.09	$36.88	$20.35					
1987	$22.71	$52.62	$36.00	$20.68	$22.04				
1988	$17.98	$54.21	$35.48	$21.06	$22.38	$17.51			
1989	$20.80	$55.83	$34.97	$21.71	$22.70	$17.64			
1990	$23.30	$57.50	$34.47	$22.50	$23.28	$17.73			
1991	$18.69	$59.23	$35.08	$23.35	$24.20	$18.32	$19.77		
1992	$18.35	$61.01	$35.72	$24.21	$25.21	$18.87	$20.08		
1993	$15.87	$62.84	$36.36	$25.15	$26.29	$19.58	$20.54	$18.61	
1994	$14.73	$64.73	$37.01	$26.05	$27.33	$20.27	$21.03	$18.68	
1995		$67.63	$37.67	$26.69	$28.50	$21.51	$21.52	$18.75	$15.96
1996		$70.68	$38.59	$27.95	$29.51	$22.93	$22.15	$18.99	$16.15
1997		$73.86	$39.56	$29.01	$30.78	$23.41	$22.82	$19.25	$16.41
1998		$77.17	$40.56	$30.12	$32.10	$23.96	$23.51	$19.66	$16.66
1999		$80.65	$41.57	$31.29	$33.54	$24.85	$24.28	$20.11	$16.94
2000		$84.28	$42.63	$32.41	$35.06	$25.85	$25.09	$20.56	$17.16
2001		$88.07	$43.68	$33.56	$36.46	$26.58	$25.74	$20.95	$17.39
2002		$92.04	$44.78	$34.77	$37.92	$27.41	$26.40	$21.37	$17.63
2003			$45.89	$36.02	$39.46	$28.28	$27.10	$21.76	$17.84
2004			$47.04	$37.32	$41.08	$29.15	$27.83	$22.20	$18.02
2005			$48.22	$38.71	$42.77	$30.04	$28.58	$22.64	$18.20
2006				$40.12	$44.57	$30.93	$29.18	$23.06	$18.39
2007					$46.45	$31.85	$29.80	$23.49	$18.58
2008						$32.77	$30.43	$23.93	$18.76
2009						$33.75	$31.09	$24.41	$18.93
2010							$31.78	$24.89	$19.07
2011							$32.49	$25.35	$19.21
2012							$33.21	$25.82	$19.35
2013								$26.31	$19.49
2014								$26.81	$19.64
2015									$19.78
2016									$19.93

Figure 3



YEAR	CASES (AVERAGE RATES)		
	HIGH	MOST LIKELY	LOW
1996	4.66	1.22	-2.69
1997	4.99	1.58	-2.26
1998	4.47	1.56	-1.38
1999	4.14	1.64	-0.96
2000	3.33	1.31	-0.83
2001	2.96	1.34	-0.58
2002	2.96	1.38	-0.58
2003	3.00	1.21	-0.57
2004	2.98	1.00	-0.57
2005	2.58	1.00	-0.62
2006	2.51	1.05	-0.57
2007	2.61	1.04	-0.65
2008	2.61	0.95	-0.65
2009	2.56	0.90	-0.65
2010	2.61	0.74	-0.62
2011	2.53	0.74	-0.62
2012	2.53	0.74	-0.62
2013	2.53	0.74	-0.62
2014	2.53	0.74	-0.62
2015	2.53	0.74	-0.62
2016	2.53	0.74	-0.62

TABLE 1

CONTRIBUTING FACTORS TO A HIGH OIL PRICE CASE (AVERAGE)

FACTORS	CONTRIBUTION (%)	
	DELPHI VIII	DELPHI VII
Greater oil demand in developing countries	21	16
Long term adherence by OPEC countries to strict production quotas	18	30
Continuing military conflict and/or political instability in the Middle East	18	9
Greater oil demand in industrialized countries	12	5
Continuing military conflict and/or political instability in the former Soviet Union and the resulting impact on the production and export of oil and gas from this area	12	--
Limited development of substitutes for oil	4	9
Political restrictions on production in non-OPEC oil exporting countries	3	14
Additional environmental restrictions on development of known U.S. oil resources	3	4
Other contributing factors. Those listed for Delphi 8 included: (a) Iraq not resuming production, (b) inter-national devaluation of the dollar, and (c) world, especially U.S., economic growth	3	1
Limited opportunities for further conservation	2	6
Iraq resuming production for the world oil market	1	--
The new political climate in Washington, D.C.	1	--
The recent economic and political changes in Mexico	1	--
The impact of GATT on world oil trade	1	--
Limited discoveries of major new non-OPEC oil fields	--	6
Total	100	100

TABLE 2

CONTRIBUTING FACTORS TO A LOW OIL PRICE CASE (AVERAGE)

FACTORS	CONTRIBUTION (%)	
	DELPHI VIII	DELPHI VII
Permanent or long-term collapse of the OPEC production quota system	24	27
Lower oil demand in developing countries	18	6
Lower oil demand in industrialized countries	13	3
Worldwide oil resources proving to be larger than currently estimated	11	5
Other contributing factors. Those listed for Delphi 8 included: (a) technological gains in oil and gas production, (b) Iraq resuming full production, (c) upstream costs continuing to fall, and (d) rapid rise in Soviet Union exports	10	6
Successful government policies and/or private actions to induce conservation	7	15
Subsidies in developing countries for oil exploration and development	5	13
Continuing military conflict and/or political instability in the former Soviet Union and the resulting impact on the production and export of oil and gas from this area	4	--
Relaxation of U.S. environmental restrictions on development of known oil resources	3	13
The new political climate in Washington, D.C.	2	--
Subsidies for U.S. oil exploration and development	1	12
The recent economic and political changes in Mexico	1	--
The impact of GATT on world oil trade	1	--
Total	100	100

APPENDIX A

California Energy Commission
Delphi VIII Panel Survey
March 1995

Instructions

This survey is made up of three sections:

1. The first section asks for your estimate of the most likely path that oil prices will follow over the next 20 years.

2. The second section asks for your estimate of a high price path such that 90 percent of possible price paths would lie below that estimate. An accompanying question asks that you select and estimate the importance of various contributing factors that might cause such a high price path.

3. The third section asks for your estimate of a low price path such that 90 percent of possible price paths would lie above that estimate. As with the high estimate, an accompanying question asks that you select and estimate the importance of various contributing factors that might cause such a low price path.

Note that the index for crude oil prices in this survey is the average annual price of internationally traded crude oil (as per the U.S. Energy Information Administration's Weekly Petroleum Status Report, rather than Brent, WTI or some other premium oil index). We have included a recent copy of the GDP implicit price deflator, on the last page of the survey, for your use in forecasting the real rates of oil price change in the second and third sections.

Space for additional comments about your responses, and any suggestions or observations you may have concerning the questionnaire is also provided.

Name_____

Organization_____

Date_____

I. Most Likely Case

Question 1. What is your most likely estimate for the 1995 annual average price of internationally traded crude oil (in 1995 dollars)?

$_____/bbl

Question 2. For the period 1995 through 2016, please enter estimates of the most likely average annual real rates of oil price change. Use as many time intervals, of whatever length, as you require.

1995 - 19_____: _____percent/year

19____ - _____: _____percent/year

_____ - _____: _____percent/year

_____ - 2016: _____percent/year

Question 3. Estimate the probability (0-100%) that your price forecasts for periods beyond 1995 will be generally correct.

_____percent

II. High Oil Price Path

Question 4. For the period 1995 through 2016, please enter estimates of the most likely average annual real rates of oil price change, such that 90 percent of all possible price paths would lie below your estimated high price path. Use as many intervals, of whatever length, as you require.

1995 - 19_____: _____percent/year

19____ - _____: _____percent/year

_____ - _____: _____percent/year

_____ - 2016: _____percent/year

Question 5. Estimate, as a percentage, the extent to which each of the following factors would contribute to price levels contributing to this high price path.

a. Long term adherence by OPEC countries to strict production quotas: _____

b. Continuing military conflict and/or political instability in the Middle East: _____

c. Continuing military conflict and/or political instability in the former Soviet Union and the resulting impact on the production and export of oil and gas from this area: _____

d. Political restrictions on production in non-OPEC oil exporting countries: _____

e. Additional environmental restrictions on development of known U.S. oil resources: _____

f. Limited development of substitutes for oil: _____

g. Iraq resuming production for the world oil market: _____

h. Greater oil demand in industrialized countries: _____

Demand for oil in industrialized countries will grow at an annual rate of (circle one):

-2% to 0%
0% to 2%
2% to 4%
>than 4%

i. Greater oil demand in developing countries: _____

Demand for oil in developing countries will grow at an annual rate of (circle one):

-2% to 0%
0% to 2%
2% to 4%
>than 4%

j. Limited opportunities for further conservation: _____

k. The new political climate in Washington D.C.: _____

l. The recent economic and political changes in Mexico: _____

m. The impact of GATT on world oil trade: _____

n. Other contributing factors: _____

_____

_____ _____

[Total=100%]

III. Low Oil Price Path

Question 6. For the period 1995 through 2016, please enter estimates of the most likely average annual real rates of oil price change, such that 90 percent of all possible price paths would lie above your estimated low price path. Use as many intervals, of whatever length, as you require.

1995 - 19_____: _____percent/year

19____ - _____: _____percent/year

_____ - _____: _____percent/year

_____ - 2016: _____percent/year

Question 7. Estimate, as a percentage, the extent to which each of the following factors would contribute to price levels contributing to this low price path.

a. Permanent or long-term collapse of the OPEC production quota system: _____

b. Relaxation of U.S. environmental restrictions on development of known oil resources: _____

c. Continuing military conflict and/or political instability in the former Soviet Union and the resulting impact on the production and export of oil and gas from this area: _____

d. Subsidies for U.S. oil exploration and development: _____

e. Subsidies in developing countries for oil exploration and development: _____

f. Worldwide oil resources proving to be larger than currently estimated: _____

g. Lower oil demand in industrialized countries: _____

h. Lower oil demand in developing countries: _____

i. Successful government policies and/or private actions to induce conservation: _____

j. The new political climate in Washington D.C.: _____

k. The recent economic and political changes in Mexico: _____

l. The impact of GATT on world oil trade: _____

m. Other contributing factors: _____

_____

_____ _____

[Total=100%]

Please note any additional comments about your responses, and any suggestions or observations you may have concerning the questionnaire in the space below: