United States General Accounting Office

GAO

Report to the Chairman, Committee on the Budget, United States Senate

May 1999

INTERNATIONAL ENERGY AGENCY

How the Agency Prepares Its World Oil Market Statistics

GAO/RCED-99-142

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-282384

May 7, 1999

The Honorable Pete V. Domenici
Chairman, Committee on the Budget
United States Senate

Dear Mr. Chairman:

Oil companies, investment firms, governments, and other participants in the world oil market need timely and accurate information on world oil supply, demand, and stocks to make decisions about current and future sales and purchases of oil.[1] The International Energy Agency (IEA), among other sources, provides such information to participants in the world oil market.

IEA is an organization of 24 industrialized member nations that was established in the wake of the 1973-74 Arab oil embargo.[2] Based in Paris, IEA is an autonomous organization within the framework of the Organization for Economic Cooperation and Development (OECD).[3] In addition to other functions, IEA develops detailed statistics on world oil supply, demand, and stocks that it publishes in its monthly Oil Market Report. The objective of the report is to show historical statistics for the preceding 4 years and up to 18 months of projections.[4] In general, when the historical statistics show a difference between the quantity of oil supplied and the quantity demanded, that is, an excess of supply over demand, or vice versa, such a difference is expected to be reflected in a change in oil stocks. Differences between the historical world oil supply

[1] The International Energy Agency uses the term "stocks" to refer to oil in inventory. Accordingly, unless otherwise stated, we will use stocks in this report to refer to oil in inventory.

[2] The 24 member countries of IEA are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

[3] OECD is an international organization that monitors economic trends in the free market economies of its 29 members. Its member-countries include the 24 IEA member nations and the Czech Republic, Iceland, South Korea, Mexico, and Poland.

[4] IEA's oil market projections are prepared every summer and revised monthly.

and demand statistics that are not accounted for by changes in OECD oil stocks can be generally referred to as "missing barrels." [5]

In its April 1998 issue of the Oil Market Report, IEA reported that differences existed between its world oil supply and demand statistics that could not be accounted for by changes in stocks, implying that some oil was missing. Concerned about the overall quality of IEA's world oil market statistics and the importance of such information to the world oil market, you asked us to review how IEA prepares its world oil market statistics and to examine the issue of the missing barrels. Specifically, as agreed with your office, this report responds to the following questions: (1) How does IEA prepare its historical and projected world oil market statistics? and (2) What accounted for the missing barrels in IEA's historical world oil market statistics in 1998?

Results in Brief

IEA uses a "bottom-up" approach to prepare its historical and projected oil market statistics. Under this approach, IEA constructs historical and projected oil market statistics for individual countries and adds them together to develop world totals. For its historical statistics, IEA uses questionnaires and information from various other sources--such as national governments, international organizations, and oil companies--to obtain the data. According to oil market experts we spoke with, IEA's historical statistics are the best available data on world oil supply, demand, and stocks.[6] For its projected statistics, IEA uses its own analysis and judgments based on a number of factors that influence world oil supply and demand. These factors include, for example, for supply, changes in oil production rates for 400 oil fields and, for demand, changes in the structure of the economy and energy demand of each country. IEA keeps the price of oil constant throughout the projection period because the agency has a policy of not forecasting oil price.

[5] IEA refers to these imbalances as "miscellaneous to balance" in its Oil Market Report but indicated that they can be referred to as missing barrels. More specifically, IEA refers to the imbalances as missing barrels if non-OECD oil stocks are assumed to be zero and there is no change in the amount of oil in "floating storage"/transit (see the report section on IEA's Historical Oil Statistics for more discussion on oil in floating storage/transit).

[6] Oil market experts and officials we contacted preferred not to be identified individually. Accordingly, throughout the report, we have maintained their anonymity and, for the most part, presented aggregate views collectively expressed by these experts and officials. App. I shows a full listing of the companies, agencies, and organizations we contacted.

Missing barrels are accounted for by two factors: (1) limitations in the statistics on oil supply, demand, and stocks reported to IEA, such as preliminary data that are subject to future revision; and (2) actual oil held in stocks but not reported as part of IEA's official oil stock statistics. Although highlighted by IEA in April 1998, missing barrels are not new, having occurred in 24 of the last 26 years. In 1998, IEA estimated world oil supply at 75.3 million barrels per day, world oil demand at 73.7 million barrels per day, and increases in OECD oil stocks at 0.4 million barrels per day. The remaining 1.2 million barrels per day (or 438 million barrels for the year) are the estimated missing barrels for 1998, and represent about 1.6 percent of the approximately 75 million barrels traded in the world oil market every day.

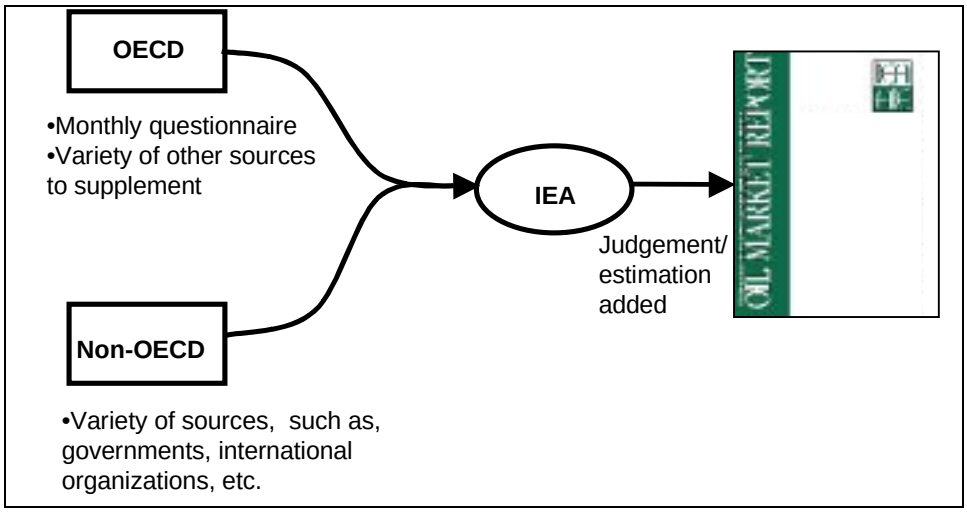
IEA Uses a Bottom-Up Approach to Prepare Its Historical and Projected Oil Market Statistics

IEA prepares its historical and projected oil market statistics using a bottom-up approach that relies on statistics for each country. These statistics are developed through questionnaires and other information sources, depending on the country.

IEA's Historical Oil Statistics

In developing its historical oil statistics, as illustrated in figure 1, IEA relies on its access to data through questionnaires from all OECD countries and augments this information with data from oil companies, consulting groups, and other sources. Because IEA does not have the same access to data through questionnaires from non-OECD countries, it relies on a wide variety of sources for information, according to IEA officials.

Figure 1: IEA's Framework for Developing Its Historical World Oil Market Statistics



Source: Information from IEA.

In developing their historical statistics on oil supply, IEA officials said that they obtain the data directly from the OECD member governments, oil companies, and consulting groups. IEA then checks these detailed country-level data against totals for similar, more aggregated data that are reported separately through its monthly oil statistics questionnaire. This questionnaire, sent to all 29 OECD countries, asks for official information on oil supply (production), demand, and stocks. To complete the statistics on world oil supply, IEA obtains data for non-OECD countries through governments, international organizations (such as the United Nations and the World Bank), oil companies, and the oil industry trade press.

IEA officials said they use a similar approach in developing their historical statistics on world oil demand and stocks. That is, they use a questionnaire to develop information on oil demand and stock levels for each OECD country, while they rely on a variety of sources to develop the demand data for non-OECD countries. IEA officials said that IEA does not collect statistics on oil stocks in the non-OECD countries.

IEA's statistics include oil that is in "floating storage" (that is, being held in marine tankers used for temporary storage) and oil in transit at sea by obtaining estimates of oil in these sources from firms that monitor oil tanker traffic. This oil may be from OECD and/or non-OECD countries. However, IEA officials said that because the statistics on oil in floating

storage and in transit at sea are estimates, they might not necessarily represent the actual amounts of oil in these situations.

Historical Statistics Are the Best Available but Have Some Limitations

Many of the oil market officials and experts we talked to said that IEA's historical oil market statistics are the best available because the agency's unique direct access to the national governments allows it to collect comprehensive data. They also said IEA's long history and familiarity with data from these governments and other entities allow it to make better judgments about the reasonableness of the data being provided and thus follow up on apparent inconsistencies. IEA officials told us that the statistics from the OECD countries are generally of better quality and more reliable than those from the non-OECD countries. Nonetheless, IEA officials pointed out certain limitations regarding the historical statistics on supply, demand, and stocks for both OECD and non-OECD countries. These limitations can introduce errors into the data, although the magnitude and direction of these errors are not clear.

For historical supply statistics, IEA officials said that some of the numbers reported to them are preliminary and, as such, are subject to revision. They also stated that they use their judgment to estimate and fill in data not available from various sources, or reconcile data collected from multiple sources. In addition, they mentioned that significant time lags exist in some of the reported data. For example, data reported to IEA for its December 1998 issue of the Oil Market Report could have lags of up to 12 months for some non-OECD countries. That is, some producing countries would report data as of December 1997. In these cases, IEA officials said that they use estimated statistics to fill in the months of 1998, until data become available later from the usual sources.[7] Such estimates, to the extent that they remain estimates, may overstate or understate oil supply for the applicable months.

In the case of historical demand statistics, IEA officials told us that they also use judgments and/or estimations to fill in missing data and reconcile data collected from multiple sources. In addition, some of the non-OECD countries report their demand data in quarterly and annual averages. In these cases, IEA breaks the data into monthly averages using its judgment and analysis of prior years' monthly patterns or patterns in neighboring

[7] This is different from missing data. While lagged data may later be reported to IEA, allowing it to replace the estimated ones in a future issue of the report, missing data are not likely to become available from the sources that IEA relies on.

countries, which may not necessarily represent the actual monthly numbers. The officials also pointed out that monthly oil demand data are not available for the Former Soviet Union and China, two countries that account for about one-third of the non-OECD oil demand. IEA officials said that they use "apparent demand," defined as oil production minus net oil exports, as a surrogate for these two countries' demand. However, such apparent demand estimates are only approximations because, as IEA officials pointed out to us, export data from non-OECD countries, including China and the Former Soviet Union, are not reliable.

For the statistics on oil stocks, IEA officials noted that they do not collect data for non-OECD countries and that the statistics on stocks of OECD countries include only primary stocks, such as those held in refineries, oil terminals, and pipelines. These OECD oil stocks do not account for oil held in relatively small storage facilities (known as independent storage) in various OECD locations. According to IEA, these independent storage stocks can add up to a large quantity of oil. Finally, reported OECD stock data are often preliminary and subject to revision.

IEA's Projected Oil Statistics Are Based on Its Own Analysis and Judgments

IEA prepares its oil supply and demand projections on the basis of its own analysis and judgments; IEA officials do not consider them as forecasts.[8] The supply projections are based on IEA's analysis of 400 individual oil fields and areas in the 77 oil-producing countries. Members of the Organization of Petroleum Exporting Countries (OPEC) are not included in this projection because IEA would, in effect, be indicating the potential direction of world oil price by predicting OPEC supply. (See below for how IEA treats OPEC supply.) According to IEA officials, to derive the supply projections, their analysis includes judgments about such factors as the rate at which oil production from each field will increase or decline, the length of time for a field's production to peak and stabilize, field maintenance, and start-up dates for new fields. In developing its supply projections, IEA's analysis also considers the operating capacity of oil exploration and production support and service industries such as drillers and equipment and service contractors. In addition, IEA considers other oil production-related information obtained from oil field operators, producer-country governments, consultancies, and the oil industry trade

[8] According to IEA, a forecast would entail predicting OPEC supply and crude oil and petroleum product prices, and their effects on demand and non-OPEC supply. OPEC was created in 1960; its current members include Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.

press. IEA officials told us that they assume that the price of oil remains constant throughout the projection period because IEA has a policy of not forecasting the price of oil. Furthermore, the officials said that they do not make adjustments for contingent factors, such as potential weather-related events or other random disruptions, like equipment failures and disruptions in oilfields located in politically unstable areas.

To prepare its projected statistics of world oil demand, IEA officials told us that they consider historical data on oil demand and economic growth rates for each country in the world as a backdrop for their judgments and assumptions. They then consider, for each country, such factors as the changes in the share of each fuel used relative to the aggregate energy used as well as changes in the structure of the economy. As in the case of supply, the demand projections assume normal weather conditions and constant oil price throughout the projection period.

In its analyses, IEA's projected world oil demand exceeds the projected supply from the 77 non-OPEC countries. IEA assumes that OPEC supply and stock change will make up the difference.

Missing Barrels Are Due to Limitations in Statistics and Unreported Oil Stocks

IEA and most of the oil industry officials and market experts we contacted told us that the missing barrels in IEA's oil market statistics are due to both limitations in the historical oil market data and the data on actual oil held in stocks that are not part of the statistics on oil stocks covered by IEA. Furthermore, they could not quantify how much of the missing barrels are due to statistical limitations and how much are the result of physical oil storage in unreported stocks. Moreover, missing barrels are not a new condition, and the amount and direction of the missing barrels have fluctuated over time. As discussed earlier, although the historical oil statistics published by IEA are considered by oil market experts to be the best available, they have limitations that can introduce errors.

Such limitations suggest that, at any point in time, the historical oil supply and demand as well as the stock data reported by IEA could be overstated or understated by an unknown magnitude. In fact, IEA officials told us that they continuously revise their historical statistics over time, as new information becomes available. This means that the reported amount of missing barrels at any point in time could later change and become smaller or larger, positive or negative.

IEA and most oil industry and market officials we contacted told us that part of the missing barrels in 1998 could be oil physically held in stocks that are not counted by IEA statistics. IEA's statistics on oil stocks do not account for non-OECD stocks. IEA and several oil market experts that we contacted told us that some of the missing barrels could be in storage tanks located in non-OECD countries. They also said that some of the oil could be in some independent storage tanks in OECD countries that are not reported in the official statistics on oil stocks submitted to IEA, or in the previously mentioned "floating storage" and oil in transit at sea. According to several experts we talked to, oil might be stored because the price of oil during 1998 was, more often than not, higher in the future months than in the near-term months. This provided an incentive for increased oil storage for future sale.

Number of Barrels Missing in 1998

According to the historical statistics in the February 1999 issue of IEA's Oil Market Report, an average of 1.2 million barrels per day , or a total of 438 million barrels of oil for the year, were regarded as missing in 1998.

Table 1 shows IEA's statistics on world oil supply, demand, OECD oil stock change, and floating storage/oil in transit in 1998. For example, average world oil supply for 1998 was 75.3 million barrels per day, while world oil demand was 73.7 million barrels per day. Thus, world supply exceeded world demand by 1.6 million barrels per day. This implies that world oil stock should have increased by that much. However, the stock data reported to IEA by OECD countries showed that stocks increased by only 0.4 million barrels per day, and the amount of oil in floating storage/in transit did not change. Therefore, an average 1.2 million barrels of oil per day were unaccounted for, or missing, in 1998.

Table 1: Missing Barrels in 1998 (Millions of barrels per day)

	1st Quarter 98	2nd Quarter 98	3rd Quarter 98	4th Quarter 98	Average 98
Supply	76.5	75.6	74.1	74.9	75.3
Demand	74.5	72.1	73.2	74.8	73.7
Supply exceeds demand	1.9	3.4	0.9	0.1	1.6
OECD Oil Stock change	-0.1	1.7	0.4	-0.5	0.4
Floating Storage/Oil in Transit	0.2	0.1	0.0	-0.1	0.0
Missing barrels	1.9	1.7	0.5	0.6	1.2

Note: Numbers may not total because of rounding.

Source: IEA data from table 1, World Oil Supply and Demand, Oil Market Report, Feb. 9, 1999.

As the table shows, a larger portion of the missing barrels in 1998 occurred during the first half of the year, with about 1.9 million barrels per day in the first quarter and 1.7 million barrels per day in the second quarter. These levels decreased considerably by the third and fourth quarters, with missing barrels dropping to 0.5 million barrels per day and 0.6 million barrels per day, respectively.

An average of 1.2 million barrels per day (or 438 million barrels of oil for the year) that were missing in 1998 represent about 1.6 percent of the 75 million barrels per day traded in the world oil market.[9] Thus, about a 0.8 percent error in the historical statistics for both oil supply and demand could account for the entire year's missing barrels.

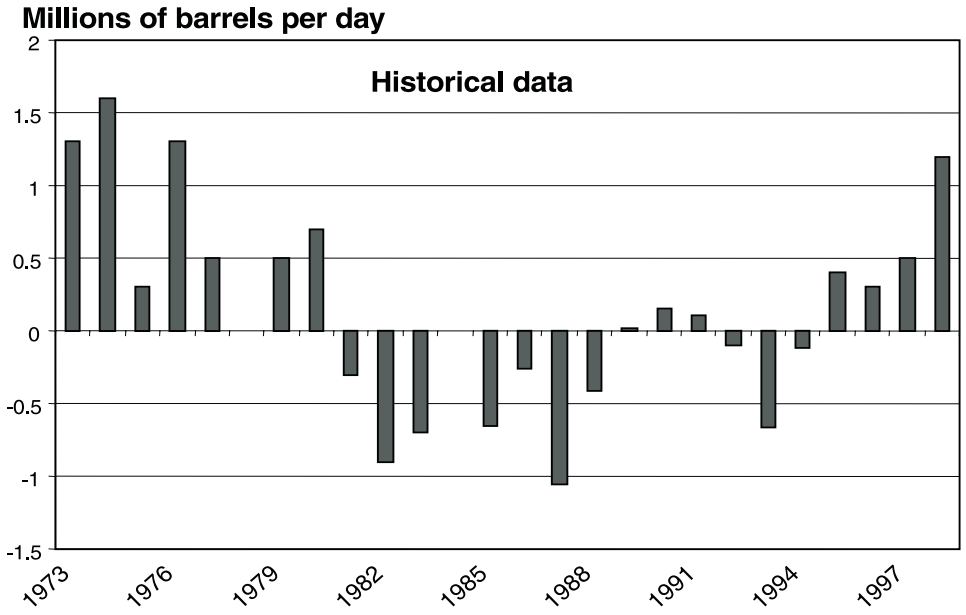
Missing Barrels Are Not New

Differences between IEA's historical world oil supply and demand statistics, which are not reflected in changes in oil stocks, are not new and have been larger and smaller in the past. Using IEA's data from 1973 to 1998, figure 2 shows missing barrels have occurred in 24 of the last 26 years, in varying magnitudes and directions. For example, the number of missing barrels was higher than the 1998 level in 1973, 1974, and 1976, averaging about 1.6 million barrels per day in 1974 and 1.3 million barrels per day each in 1973 and 1976. On the other hand, the number was lower

[9] The 75 million barrels per day of oil is the average of the supply and demand for 1998.

for all the other years shown, with no missing barrels in 1978 and 1984. Similarly, 14 of the 26 years had positive missing barrels, while 10 other years had negative missing barrels. Positive missing barrels implies that oil supply exceeded demand but was not reflected in stock increases, while negative missing barrels implies that oil demand exceeded supply but was not reflected in the amount of oil drawn from stocks.

Figure 2: Missing Barrels, 1973-98



Source: IEA.

Agency Comments and Our Evaluation

We provided a draft of this report to IEA for review and comment. We discussed the report with IEA officials, including the Head, Oil Industry and Markets Division, which prepares the Oil Market Report, and the Head, Statistics Division. IEA agreed with the report and provided clarifying comments that we incorporated, where appropriate.

Scope and Methodology

To determine how IEA prepares its statistics on world oil supply, demand, and stocks, we interviewed IEA officials and reviewed relevant documents from the agency. We also interviewed other oil industry and market officials to gain an understanding of their familiarity with how IEA prepares its world oil market statistics. Appendix I lists all the companies, agencies, and organizations we contacted.

To determine what accounted for the missing barrels in IEA's world oil market statistics in 1998, we interviewed IEA and other oil industry and market officials. We also reviewed relevant documents from IEA and other sources and analyzed oil market statistics from IEA and others.

We conducted our review from November 1998 through April 1999 in accordance with generally accepted government auditing standards.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies to Senator Frank Murkowski, Chairman, and Senator Jeff Bingaman, Ranking Minority Member, Senate Committee on Energy and Natural Resources; Senator Don Nickles, Chairman, and Senator Bob Graham Ranking Minority Member, Subcommittee on Energy Research, Development, Project, and Regulation, Senate Committee on Energy and Natural Resources; Representative Joe Barton, Chairman, and Representative Ralph M. Hall, Ranking Minority Member, Subcommittee on Energy and Power, House Committee on Commerce; and Representative Ken Calvert, Chairman, and Representative Jerry F. Costello, Ranking Minority Member, Subcommittee on Energy and Environment, House Committee on Science. We will also send a copy of this report to Mr. Robert Priddle, Executive Director of the International Energy Agency. We will also make copies available to others on request.

Please call me at (202) 512-3841 if you have any questions about this report. Major contributors to this report were Daniel Haas, Godwin Agbara, and Michael Sagalow.

Sincerely yours,

Susan D. Kladiva
Associate Director, Energy,
Resources, and Science Issues

Companies, Agencies, and Organizations Contacted by GAO

Integrated Oil Companies	British Petroleum/Amoco Mobil Oil Corporation Texaco Inc.
Federal and International Agencies	U.S. Department of Energy International Energy Agency
Consultants/Industry Analysts	BT Alex Brown Incorporated Center for Global Energy Studies Merrill Lynch & Company PIRA Energy Group Smith Barney, Inc. Simmons and Company International
Associations	American Petroleum Institute Independent Petroleum Association of America
Oil Industry Trade Press	Energy Intelligence Group

Ordering Information

The first copy of each GAO report and testimony is free. Additional copies are $2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary, VISA and MasterCard credit cards are accepted, also.

Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

Orders by mail:

U.S. General Accounting Office
P.O. Box 37050
Washington, DC 20013

or visit:

Room 1100
700 4th St. NW (corner of 4th and G Sts. NW)
U.S. General Accounting Office
Washington, DC

Orders may also be placed by calling (202) 512-6000 or by using fax number (202) 512-6061, or TDD (202) 512-2537.

Each day, GAO issues a list of newly available reports and testimony. To receive facsimile copies of the daily list or any list from the past 30 days, please call (202) 512-6000 using a touchtone phone. A recorded menu will provide information on how to obtain these lists.

For information on how to access GAO reports on the INTERNET, send an e-mail message with "info" in the body to:

info@www.gao.gov

or visit GAO's World Wide Web Home Page at:

http://www.gao.gov

United States
General Accounting Office
Washington, D.C. 20548-0001

Official Business
Penalty for Private Use $300

Address Correction Requested

Bulk Rate
Postage & Fees Paid
GAO
Permit No. GI00