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Report of Statistics Norway on quality components of oil statistics

Note by the Secretary-General

In accordance with a request of the Statistical Commission at its thirty-sixth session,** the Secretary-General has the honour to transmit to the Statistical Commission the report of Statistics Norway on quality components of oil statistics. The focus of the report is national oil statistics as the key to the quality of international oil statistics. It analyses the main quality challenges and makes recommendations for improvement both at the governance and at the technical level.

The Commission may wish to discuss the recommendations and points for discussion contained in paragraphs 81 to 91 of the report.

* E/CN.3/2006/1.

** See *Official Records of the Economic and Social Council, 2005, Supplement No. 4 (E/2005/24)*, chap. III, para. 7.

Report of Statistics Norway on quality components of oil statistics

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I. Introduction

1. At its thirty-sixth session the Statistical Commission discussed the report of Statistics Norway on energy statistics (E/CN.3/2005/3). The present report, submitted pursuant to the recommendations made by the Commission, is an attempt to review the major issues which affect the quality of national and international oil statistics. While the focus is on oil, the conclusions and recommendations of the report have a wider relevance to energy statistics in general and are intended to contribute to the work of the newly established City Group and Intersecretariat Working Group on Energy Statistics.

2. The economy in most countries is influenced by what happens in the international oil markets. Shortcomings in national and global oil statistics have contributed to market volatility and have created enormous challenges for economic policymaking in many countries. Elevating oil statistics to the level of official statistics will help improve their quality. Furthermore, moving towards common definitions and conversion factors, while challenging, will also help to improve the quality of the statistics and their interpretation.

II. Scope and coverage of the report

3. The purpose of the present report is to present key characteristics of oil statistics and point out crucial methodological challenges. While applying an international perspective, the focus is on national oil statistics, based on the understanding that global statistics will always depend on the quality of national data. We use the Norwegian system for oil production statistics as a reference for this discussion. The document follows the value chain from remaining primary resources to investment decisions, production, imports/exports, stocks and use, and emphasizes the need for information and statistics through the entire chain.

4. The scale of the oil market indicates that relatively small errors in data and conversion factors will have huge effects and can cause great errors in the statistics. Some of these errors are inevitable, but good production routines, consciousness and knowledge of the market and technical insight will minimize the risk of errors. The intention is to emphasize the importance of high-quality national data and to indicate how such national data can be building blocks in an international system for oil statistics.

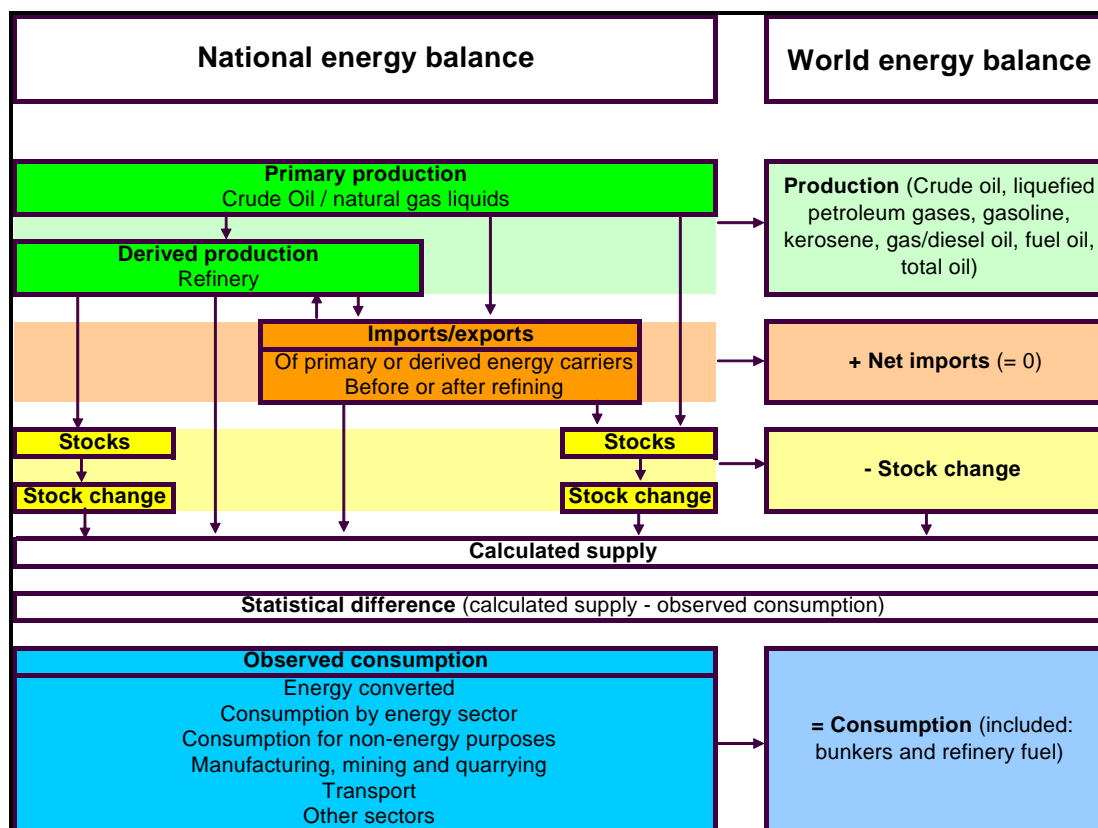
5. First, we will look at the current situation and explain the need for high-quality oil statistics, based on the oil market's influence on the global economy, and describe the current practice and use. Second, there will be a description and discussion of national use of oil statistics, with a focus on national energy balances and national accounts. We will look at some important principles for statistics in general and for oil statistics in particular, and describe the institutional framework in oil-production statistics. Third, we will move on to a more detailed discussion of the production of oil statistics, with a description of definitions, classifications and concrete quality challenges and potential pitfalls. Finally, there will be a discussion of the future potential for national and international oil statistics, and we will present a list of recommendations for further improvements.

III. The need for high-quality oil statistics

6. Oil is the most traded commodity worldwide, and the economy in most countries is influenced by what happens in the international oil markets. Fluctuations in oil prices have significant effects on both global and national economies. For decades it has been observed that unexpected fluctuations and shocks in oil prices have created economic shocks and enormous challenges for economic policy in many countries, all over the world. These problems may have many causes, but it should not be overlooked that the shortcomings in national and global oil statistics have contributed to problems in understanding the causes of imbalances in petroleum markets, choosing the appropriate corrective measure and measuring the effectiveness of various energy policies. If we could improve the statistics for oil, we would have an improved ability to understand oil markets and project oil prices. An improved understanding and forecasting of oil prices will be useful for all policymakers.

7. Users of oil statistics need reliable information on the world's remaining oil and gas resources and their regional distribution. This is important for long-term analyses of the oil market. Information on the level of and changes in investment in oil-producing countries is likewise important for assessing the direction of possible changes in production capacity.

8. To obtain international consistency, it is crucial that every country have internal consistency in national oil statistics. These are the basis for international reporting, which has a close connection with national energy balance and national accounts.



9. National energy balances are some of the most important sources of data for calculating emissions of greenhouse gases and other air emissions. High-quality energy data are necessary for high-quality emission figures. The emission inventories are reported to the United Nations Framework Convention on Climate Change and United Nations Economic Commission for Europe (ECE) Convention on Long-Range Transboundary Air Pollution. The figures are used by the United Nations to investigate countries' fulfilment of Kyoto Protocol obligations.

10. Furthermore, national oil statistics for oil-producing countries are very important in national accounts. National accounts in all countries are based on international principles and standards. As a consequence, oil production and related activities have to be included in national accounts, whose principles provide guidelines for defining national production, the production boundary and international transactions and relations.

11. International statistical principles focus on comparability between countries. This goes for all statistics, including oil statistics. There are variations between national statistical systems, and the position of oil statistics in the system of official statistics also varies from country to country. This means that there are differences among countries both in the role of the national statistical office in the production of oil statistics and in the extent to which the basic principles for official statistics are followed. The distribution of tasks between reporting units, administrative bodies, political bodies, international corporations and organizations, as well as national statistical offices and international statistical organizations, will vary between countries, and this can be a hindrance to international consistency. An important step on the road to international consistency is the focus on national oil statistics and developing concepts, standards and methods that are broadly accepted by countries internationally.

IV. National use of oil statistics

12. Oil statistics are used directly by external users, both in the energy sector (private and governmental) and in other sectors for monitoring and policy actions. Lack of accuracy and frequent revisions are problems encountered by users.

13. National oil statistics are the foundation for international reporting, and we have already mentioned the connection between the national and the international energy balance (see figure). Data may be collected directly from industries, or from administrative information, collected by several types of governmental bodies. National systems for oil statistics require internal consistency between different divisions of a statistical office. The system for oil statistics further requires consistency between the statistical office and the industrial and organizational bodies that provide data, as well as close cooperation and dialogue between the actors. Good national statistical systems will ensure a consistent national energy balance, with small statistical differences, and create positive synergies for international oil statistics.

14. Consistency among the various oil statistics is also very important for achieving consistent national accounts. In this context, the important components are quarterly investment statistics, import and export figures, the energy balance, structural statistics and the production indices. The direct activities, measured by employment, etc. may be moderate, but for oil-producing countries the revenue is of

great economic importance. Oil statistics are important for economic policy because of the influence oil production has on revenue, and investments are in some periods very dominant and have clear, direct economic effects, both on the level of production and on economic trends. Oil revenue will also have effects on the balance of payments and the monetary situation. A first step in the process of making national accounts is to calculate values and prices on the basis of information from the oil statistics. In this process, volume figures for oil and gas extraction are important for harmonizing and balancing, as well as for consistency checks. National accounts figures are published in current values, as well as in constant prices. The volume figures are subject to much attention when the national accounts are published as key economic indicators for the development of the economy. Volume figures are, further, an important component in the quarterly production index, which is a part of the quarterly national accounts.

15. Oil statistics consist of different data sets, which to some extent use different sources and input. This may create challenging situations with regard to consistency. While oil statistics are made and used by various institutions, the national statistical institute in a country is usually responsible for the national accounts, and there is an obvious need for coordination. The use of different oil statistics in the national accounts is a very important consistency check for national oil statistics, as statistics from various sources are put together in a balanced system. Consequently, there is a mutual dependency between the different users and the producers of oil statistics. However, different uses of oil statistics may require different definitions or products.

V. International use of national oil statistics

16. While national oil statistics are important for oil-producing countries, global oil statistics are important for all countries. Several organizations and institutions compile global oil statistics, but it has been a common concern that international oil statistics suffer from severe quality problems. Main quality problems are linked to:

- (a) Timeliness of national figures;
- (b) Accuracy and important revisions of national figures;
- (c) National differences in definitions and measurement;
- (d) The application of different methods for international aggregation.

17. To improve the timeliness of global statistics and the transparency of the oil market, the International Energy Agency (IEA) developed a questionnaire for monthly reporting of oil statistics, to be submitted by the member countries two months after the reference month. The results are used as input to the monthly *Oil Market Report*, issued by IEA, which gives an updated world overview of the oil market situation. It is widely used by the organizations in the market, analysts, policymakers and journalists to survey the oil market.

18. Users of oil statistics demanded that oil data be more transparent and that national figures be combined to form a global information system. As a result of these needs, the six main organizations engaged in international oil statistics embarked on an initiative to assess the monthly oil-reporting capability of their member countries. They designed a monthly oil-data report, known as the Joint Oil

Data Initiative (JODI), and asked member countries to complete it for the last two months. JODI focuses on key figures. The survey covers figures for production, imports, exports, stocks and inland consumption of crude oil, liquefied petroleum gases and some aggregated groups of refined petroleum products.

19. JODI is an attempt to create a global information system for oil production in which being up to date has been given high priority. The JODI database was formally opened on 19 November 2005. Even though JODI is a great success, it should be mentioned that there are some quality problems. In all statistics there is a trade-off between being up to date and accuracy. The JODI reports use preliminary figures extensively, and final figures are in principle not available until one year after the end of the year the data refer to. The data-quality problems sometimes originate in uneven and inadequate reporting by individual countries and national statistical systems. Some countries provide data of rather poor quality, and for some cells no data at all. In some cases, data are of questionable accuracy owing to respondents' lack of experience with oil-market data. The reporting is voluntary, with no means of sanction, and not all participating countries submit data regularly. Therefore, before the database was opened to the general public it underwent a very rigorous quality analysis and the country series were classified into quality classes on the basis of agreed criteria. It should of course be added that JODI is a new system, and errors and weaknesses will hopefully be redressed.

20. Transparency in the global oil market requires, first of all, a high level of participation among countries, particularly large exporters and consumers. Next it requires that the participating countries have national statistics of high quality and that internationally approved, or at least known, methods and definitions be used.

21. The international organizations that receive data will then be in need of knowledge about the reporting countries so as to ensure that the correct conversion factors and measurement units are used. This requires cooperation with the reporting countries and access to documentation reports on production routines and methods used.

22. International organizations also have annual reporting systems that include final figures on oil statistics reported almost a year after the reference year. These reports are therefore more accurate than the monthly reports, and they contain more detailed information on inland consumption. However, many of the quality challenges discussed in the present report are general and principal challenges that will also concern the annual reports.

VI. Statistical principles

23. Main common principles for official statistics are accessibility, independence, high quality based on transparent and well-founded methodology, confidentiality and cost-efficiency (including minimizing response burden). These principles are concretized and broadly accepted in major statistical fields, but for oil statistics the common situation can be unclear.

24. Quality principles are based on the need for statistics to be relevant, accurate, timely and punctual, comparable and coherent, and accessible and clear.

25. International comparability is very important and is a core objective for international statistics. The idea is to achieve a world overview of the oil market. It

is therefore essential that all reporting countries use the agreed definitions, units and conversion factors. This is not simple, as even single countries may operate with different internal definitions and product groups. The principle that statistics should be timely and punctual is also very important for short-term reports such as JODI, which is vulnerable to delays exceeding time limits.

26. A statistical system for oil statistics has to be built on the following elements:

- (a) Definition of the relevant institutions, economic players and business units;
- (b) Definition of products, commodities, and standards and classifications;
- (c) Proper data capture from the units;
- (d) Data analysis, estimation and dissemination;
- (e) International collection and dissemination of national statistics.

In the following sections we will analyse these elements.

VII. Institutional framework

27. The key to the quality of national oil statistics is the governance of the national statistical system, which means addressing issues such as the role of the national statistical office in the production of energy statistics; “official statistics”; and how the use of statistical standards, concepts and classification can be enforced at the national level. It is important to ensure confidentiality and enforce the submission of requested data by reporting units. These are issues that may be taken care of by the statistical office. Oil statistics can also be produced by other government agencies (energy agencies) or by oil companies (national or private). The legal basis for collecting corporate data on product flows depends on the institutional arrangement. If the national statistical office is responsible, a statistics act can be used to have access to corporate data directly or to have access to administrative data. It is an important statistical principle to reduce the response burden and encourage the reuse of data. Besides the quality aspect, this is one main reason for the extensive use of administrative data and registers.

28. A centralized administration for national oil-production statistics and centralized reporting units gives a good overview of the sector. This is of great advantage, as most data used in international reporting already enter into energy balances, energy accounts and other existing statistics. The existence of centralized bodies provides good potential for contact and cooperation with the industry. In addition, it increases the possibility of quality controls and checks. This is undoubtedly of great importance, and of great significance for the data to be of high quality.

29. Examples of administrative bodies that collect oil data are governmental oil agencies and directorates, ministries, tax authorities, customs authorities and industry organizations. These bodies will presumably possess accessible databases and time series that may be used for official statistics. Such data are often subject to extensive quality checks, and the knowledge and competence of these bodies are arguments in favour of involving them. Meanwhile, we have to discuss whether such an involvement influences the data quality or whether it may create biases.

The reporting units and population

30. The population of economic units in oil statistics would be oil companies, producing fields and refineries, together with consumer groups. Of this population, the reporting units should, according to common principles of national accounts, be the ones active within the national borders. Foreign companies with activity within another country's borders should be obliged to provide data to the host national government.

Production

31. Primary production data can be collected from companies at the enterprise level or at the establishment level, which in the oil industry will be the producing field. Production data may also be collected from administrative data, typically reported via a governmental oil agency. The majority of the primary oil information originates from data provided by the oil industry, such as that on the production of crude oil and natural gas liquids, imports, exports and stocks. The role of the industry is therefore extremely important in any country's system of oil statistics. Secondary production data are also provided by the industry, in particular the refineries.

Imports and exports

32. External trade statistics based on customs declarations, including loads of crude oil and other petroleum products transported by pipeline, ship, etc., cover imports and exports. Exceptions are products that are exported directly. This will not be registered by customs offices. Additionally, the importing and exporting bodies, such as producers or other traders, and the transport sector, such as pipeline operators and tankers, will record such direct exports.

Stocks

33. Stocks are kept at refineries, terminals and oilfields. The statistics act will also give the national statistical office access to such corporate data.

Consumption

34. Consumption units will be:

- (a) Refineries (feedstock and fuel);
- (b) Energy-converting facilities (power and heating plants, blast furnaces, refineries, etc.);
- (c) Consumers by energy sector (mines, power and heating plants, refineries etc.);
- (d) Consumers for non-energy purposes (petrochemical industry);
- (e) Manufacturing, mining and quarrying;
- (f) The transport sector;
- (g) Other sectors (fishing, agriculture, households, etc.).

35. The national energy balance will require statistics on inland consumption of petroleum products, distributed by consumer groups. These statistics are often based

on corporate data from companies that sell petroleum products and administrative data on net imports, which are often published separately.

VIII. Norwegian institutional arrangement

36. We have used the Norwegian system for oil production statistics as a reference for the present report. Norway has a centralized arrangement, in which the national statistical office (Statistics Norway) is responsible for energy statistics in general and oil statistics in particular. The mandate of Statistics Norway is broad and also covers energy statistics. Energy statistics are sectoral statistics, similar to industrial, trade or agricultural statistics, which all have their role and are part of official statistics on their own, while also having to feed into the national accounts. The mandate of Statistics Norway is defined by a statistics act, which enables us to have access to all relevant data from providers that we find appropriate, including governmental institutions.

37. The oil business is strictly regulated by the Government, and this role is carried out by the Norwegian Petroleum Directorate (NPD). Major players are, besides NPD, the oil-producing companies, refineries and stock terminals. The system consists mainly of a few large bodies, which makes for a good overview and proximity between the data providers and the statistical office. NPD collects all relevant data from the oil-producing companies, and the data are forwarded to Statistics Norway. There is close cooperation between NPD and Statistics Norway, which is a huge advantage, due to their expertise and knowledge of the market. Data are disseminated and calculations are made before international reporting. The statistical office is not a user of statistics itself, but fulfils its mandate on the basis of the needs of society. However, there are some indirect internal uses of oil statistics in producing the energy balance and the national accounts.

38. The conclusion, based on experience in Norway, is that the role of the statistical office in the production of good-quality energy statistics should be strengthened, either by taking a more active part in the process of collecting and disseminating data, or by ensuring the application of statistical standards by the producers of energy statistics. In this way oil statistics will be elevated to the level of official statistics and will have to respond to the quality requirements of official statistics.

IX. Concepts, standards and classifications

39. When comparing oil-production statistics from various countries and regional and international organizations, it is essential that the same definitions and conversion factors be used. This is generally a problem, as there are several operational definitions, even for core concepts such as crude oil. A common consensus on the list of products to cover is also essential. This is, however, not always obvious.

Product definitions

40. There are different standards for classification of energy products, and different organizations use different definitions. Existing product classifications are:

(a) The Harmonized Commodity Description and Coding System (HS) used for foreign trade statistics worldwide;

(b) The Central Product Classification (CPC), used by the United Nations for production statistics and closely linked to the European Union (EU) classification of products by activity (CPA) and Products of the European Community (PRODCOM) classification;

(c) PRODCOM; from 2005, energy products do not appear to be included.

41. The United Nations Statistics Division has compared these different classifications in a study and has found several problems and differences. The conclusions are that for crude oil and natural gas the PRODCOM classification is much more detailed than CPC, while there is quite good accordance between HS and CPC. For petroleum gases there is less correspondence, and for refined petroleum products there is need for a major revision. The analysis below will use the findings of this study.

42. Some organizations that use their own definitions are the United Nations Statistics Division, the Latin American Energy Organization (OLADE), the Organization of the Petroleum Exporting Countries (OPEC), the Asian Pacific Energy Research Centre (APEREC) and IEA. Below we will try to find the commonalities of the different definitions for the products. The definitions used by the various institutions and organizations differ considerably. This is an attempt to interpret them and to extract their essences.

Crude oil

43. A minimum common definition is that crude oil has to be in a liquid state at normal surface temperature and pressure. Furthermore, there seems to be agreement that crude oil must be a mineral oil of natural origin comprising a mixture of hydrocarbons and associated impurities, such as sulphur.

44. A precise chemical definition of crude oil is less attainable, and there may be different groups of crude oil. The differences relate mainly to whether field/lease condensate or some natural gas liquids should be included, and to what extent they should be included. If common agreement is achieved as to whether to include condensate or not, this has to be properly defined.

45. The product classification used in national account and economic statistics — the CPA classification — is not very explicit, and it operates with the following definition: petroleum oils and oils obtained from bituminous minerals and crude, except for natural gas condensates. The CPA classification has a single code for all natural gas condensates.

Natural gas liquids

46. Natural gas liquids are liquid or liquefied hydrocarbons recovered from natural gas in separation facilities or gas processing plants, or extracted from unstabilized crude. There seems to be agreement on including ethane, propane, butane and pentane, while the inclusion of natural gasoline, plant condensate and field condensate is more questionable. A common characteristic of all the components to be included is that they are liquefied.

47. The national account CPA classification includes ethylene, propylene, butylene and butadiene, natural gas, gaseous hydrocarbons, propane and butane.

Liquefied petroleum gases

48. Liquefied petroleum gases have a more restricted definition than natural gases, and there seems to be a common agreement that liquefied petroleum gases comprise propane and butanes.

Joint Oil Data Initiative aggregates

49. JODI is based on a simplified questionnaire. It has a few key product categories, and the categories are aggregated products. There is a focus on being up to date, resulting in less detail.

50. A detailed description of all the refined products is provided by the different organizations. Here we will list only the JODI product aggregates:

- (a) Liquefied petroleum gases, comprising propane and butane;
- (b) Gasoline, comprising motor and aviation gasoline;
- (c) Kerosene, comprising jet and other kerosene;
- (d) Gas oil, for automotive and other purposes;
- (e) Fuel oil — heavy residual oil and boiler oil, including bunker oil;
- (f) Total oil — the categories liquefied petroleum gases to fuel oil, and all other petroleum products (refinery gas, ethane, naphtha, petroleum coke, white spirits and special boiling point solvents, paraffin waxes, bitumen, lubricants and others).

Units of measurement and conversion factors

51. Oil and oil products are measured in different units. Barrels, litres or tons are used mostly, depending on what is convenient. The important thing is to keep control of these different units. In the energy balance it is useful to have all the products measured in the same terms — for example, energy content. For this purpose, conversion factors are used. Conversion factors may vary within defined product definitions due to variations in purity. An example is the case of crude oil and natural gas, where the conversion factors vary according to where in the world the product originates.

Definition of production

52. Most organizations agree on defining production so as to include all production within national boundaries, including offshore production. More precisely, the production of primary energy carriers could be defined to include only marketable production, excluding volumes returned to formation. The production of natural gas should also include saleable quanta. A relevant question is whether it should also include quantities used in the producing field, for energy production, flaring or injection, or sold to another field for injection. Furthermore, it has to be decided whether the production of finished petroleum products at refineries should include refinery losses and refinery fuel.

Definition of imports and exports

53. Import and export figures should reflect the volumes that have crossed the national boundaries, with or without customs clearance. An important question is whether imports should be reported as coming from the country of ultimate origin. This would be interesting for primary products, but in today's market it is impossible. Oil is widely traded, often bought on paper in one country with a declared destination but sold while at sea to another.

Definition of stocks

54. Oil stocks are a critical element of information in an oil balance. The majority of oil stocks are essential ones for keeping the global supply system operating. Oil can be stored in pipelines going from the wellhead production sites to refineries or from refineries to consumers, or it can be held in tankers, railway cars and road tankers linking production sites, refineries and consumers.

55. It is widely agreed that the definition of stocks represents the primary level of stocks at the end of the month within national territories, including stocks held by importers, refiners, stock-holding organizations and Governments. However, some countries maintain stocks in other countries, and these should be accounted for somehow. The important issue is that there be agreement on how to treat these stocks and that the definitions be kept under control. An easy solution would be to base this on the national account definitions, which are already internationally approved.

Definition of stock change

56. The definition of stock changes is also widely agreed upon, measured as closing stocks minus opening stocks. The opening stocks on the first of each month equal the closing stocks of the previous month. A positive number indicates a stock build; a negative number indicates a stock draw.

Definition of international marine bunkers

57. The international marine bunkers concept may cause problems for some countries, especially regarding the national accounts definitions versus the energy balance approach. These differences can be important for countries with major ports serving a large international hinterland or for countries with a large international shipping fleet. Problems also include fuel for fishing vessels working in international waters, military use and supply ships travelling back and forth to offshore installations.

Estimated future investment and remaining resources

58. Estimates of planned future investment and remaining resources are generally quite uncertain. The importance of these concepts favours the making of clear definitions and methods for estimating such figures. Investment figures are naturally based on corporate data, with few means of quality control. Estimates of remaining resources are also made by the operators, but to a larger extent also at the government level. There is no common and clear definition of these concepts today, and the remaining resource concept is quite controversial and a matter of much international attention. However, ECE established an ad hoc group of experts on

harmonization of energy reserves and resource terminology, and as a result the United Nations Framework Classification for Energy and Mineral Resources has been developed and adopted.

Definition of net domestic consumption

59. Net domestic consumption is defined as the observed deliveries of finished petroleum products for inland market consumption, including both traditional consumption by households and intermediate consumption in economic sectors. To cover all consumption, this should also include net imports by wholesale dealers and retailers. This figure may differ from the calculated figure, due, for example, to differences in coverage or in definitions used in different reporting systems.

X. Quality challenges

60. The main problems in national oil statistics are definition and technical problems. An example of a technical problem is the use of reporting units: whether to classify at enterprise level or the establishment level. One producing unit may have several licensees, and a practical method would be to create a balance for each unit. In other cases the practical unit will be at the enterprise level. This mix of units may cause some challenges.

61. An example of a definition problem is product definitions: some apparent statistical differences can be caused by a mixture of product definitions. If a product is counted as crude oil in one statistic and as a natural gas liquid in another, this may cause deviations. Another example is concept definitions: how the value of production is calculated depends on the definition of production. It also depends on the price of the product, which price is used (e.g., market, international) and where in the chain the price is collected.

62. Deviations between different methods can be caused by the definition used or by actual errors. The comparison of methods is likely to uncover these reasons for deviation.

Production figures

63. Final allocated production figures are often not available in time for international needs, which means that preliminary production figures are used extensively. The fact that estimated production figures are used before the final figures are available is a potential source of error. Estimated figures are often arrived at by aggregating the daily production in, say, the first half of the month.

64. The production of natural gas liquid products may be difficult to measure exactly, because they consist of several products produced in one stream. They are later fractionated at refineries, measured and split by product. In cases where a natural gas liquid product is unspecified, the exact product may be identified by measuring density.

65. Production figures may vary slightly during the year due to revisions and updates. In cases where different users collect data from the same source at different times, source data may contain differences, leading to inconsistency between reports that in principle should contain the same data. The logical conclusion would then be to agree that data should be collected once and then made available to all users, or

that the data providers should define data to be final at a certain time and then perform revisions and updates at given times.

66. In the measurement of production the treatment of injection can create inconsistencies. Injection could be included in gross production, and not in net production, while some definitions may require injection to be included in net production. The same holds for flaring and consumption for energy production in the oilfield. National accounts demand statistics that are consistent with their definitions, and, in this example, injection should be included only if there is a sale to another producing field.

Values and prices

67. We can sometimes observe inconsistencies caused by errors in price and value variables. Different prices are used at different stages of the value chain, ending in an export price or a market price. Other prices may be norm prices, set by the Government and based on market prices, among other things, and used in connection with internal sales to prevent underpricing. Agreement on what price to use, or explicit information on what prices are used, is essential to ensure consistency between values and volumes in the balancing of production, consumption, exports and imports.

Imports and exports

68. Foreign trade of products is generally registered (a) by the importing or exporting companies and (b) at customs offices. Some volumes of petroleum exports may be shipped or piped directly from the petroleum fields to other countries. If these volumes do not enter the national customs territory, they will not be registered in the customs data, and the only source will be corporate data. Both sources will generally have only information on the first buyer, which generally is not of the same nationality as the final consumer. The two sources may use different figures because of lack of information about load capacity or the fact that they operate with different destination countries or countries of origin. In some cases there may also be different reporting on the production field of origin. The combination of these problems will require that the two sources be compared, and to prevent the possibility of double counting a consolidated balance to compare each load should be produced. This will, however, demand a great deal of resources, and in practice may be impossible.

69. At sites where different countries cooperate, such as the North Sea, crude oil or other products may cross borders several times on their way to the destination country. When the loads cross borders, this is registered by the customs offices. To prevent double counting, these loads have to be treated specially. One problem may be that there may be some delay in customs declarations. Imports and exports are dated at the time of billing, which may be different from the actual import or export date. This may lead to statistical deviations caused by methodological issues, not by actual conditions.

70. Another source of error relating to customs declarations may be the need for the correct classification of exported products. Tax authorities identify the exported commodity and require unambiguous definitions and explicit marking.

Stock figures

71. Crude oil and natural gas liquids are stored onshore, at refineries or terminals, and offshore, at platforms or installations on the seabed. Possible errors or difficulties may relate to uncertain stock level measurements, or instances when crude oil is temporarily stored at the end of a month. Temporarily stored oil is included in the production figures, but may not be exported or included in stock figures. The stock level at the end of a month depends on the date of the last shipment of crude oil. Stocks at terminals are built up and drained continuously. This means that stock in theory may vary between empty and full capacity from month to month. Over time, the level seems to be random, without trends.

72. Stocks of natural gas are complicated, since storing natural gas requires expensive technology. Natural gas is often cooled and compressed, which involves a very expensive and demanding technology. Natural gas stored in pipelines is another challenge, as it is difficult to measure. Increasing the pressure in pipelines will increase capacity, and can be used as a storage method.

73. In most countries stock data are publicly available. However, in a few countries stock data are still considered confidential and regarded as valuable commercial information upon which competitors may act. To enable us to have aggregated information on stock levels for each product it is crucial that data on oil stock levels be reported for all countries.

Inland consumption

74. Inland consumption is in principle defined as production plus net imports, minus refinery fuel, minus international marine bunkers, plus interproduct transfers, minus stock change. This figure may differ from observed inland consumption.

75. To get accurate figures for observed inland consumption, distributed by consumer group, it is necessary to link sales with the right customer group. This can be achieved by use of the International Standard Industrial Classification/Statistical Classification of Economic Activities within the European Community (ISIC/NACE) system, in which sales companies link their customers to the right ISIC/NACE codes. This requires that the sales companies be in possession of an updated register that has every customer's code. The problem with this method is that the final consumers are not necessarily identified, which is particularly relevant for large suppliers. However, the quantity of each petroleum product should be correct.

76. If there is a lack of primary data and satisfactory methods for calculating inland consumption, the consumption is set to equal calculated consumption. This is obviously a source of errors.

Statistical difference

77. Statistical difference is defined as the difference between calculated domestic consumption and observed consumption. Major statistical differences are a problem, and indicate that inaccurate figures have been used at some point in the process. Trends in statistical difference are more disturbing, indicating structural or methodological errors.

Historical data and revisions

78. Historical data and time series are very important in the analysis of trends and developments in the market, and for policymakers in measuring the effects of their policies. They are also an important source of checks and controls of new data. Wide deviations or sudden changes in direction may be caused by actual errors and need to be investigated.

79. Changes in data caused by historical errors, changes in definitions or new information will influence the historical time series, and revisions have to be effected carefully. International coordination is important when revisions are carried out, especially when carried out due to changes in definitions. This is essential to secure consistency between countries and continuity in time series. A direct parallel is the revision of the national accounts, which is coordinated internationally and carried out within the same time frame for every country. Changes in data caused by actual errors at the data production time may be revised continuously without creating any major problems.

80. A problem with revising historical data due to a change in definitions is that the data production may be based on historical definitions, and consequently it could be difficult to transform old data into new definitions. This problem also creates challenges for comparability and development over time, where a certain development in time series can be caused by improved methods, and not actual circumstances.

XI. Recommendations and points for discussion

Improve national oil statistics

81. **It is strongly recommended to strengthen the role of national statistical offices in the production of good-quality energy statistics by having them take a more active part in the process of collecting and disseminating data and ensure the application of statistical standards by the producers of energy statistics. In this way oil statistics will be elevated to the level of official statistics and will have to respond to the quality requirements of official statistics.**

Consult with stakeholders

82. **Representatives of the oil industry, industry and trade associations, and energy- and environment-related non-governmental organizations should be actively consulted. The involvement of these groups in the preliminary discussions on information needs and their continued partnership are essential for the success of the strategies to be developed.**

Integrate international definitions into national statistics

83. **To secure comparability between countries, which is crucial for a transparent market, it is of great importance to attain a common set of definitions. The international standards that are used should be reviewed, with the objective of international agreement on a single set of definitions adopted by each reporting country.**

84. A broadly based review team, with members from the various organizations, should be established to analyse the different definitions and suggest a common definition for each product and for some key concepts, such as production and stocks. The team should also come up with a suggestion for common international reporting to prevent double reporting. The work could be seen in connection with revising the United Nations manuals.

85. To obtain such agreement may be difficult, but we have to emphasize the advantage, both nationally and internationally, of having one common set of definitions. A compromise will be to agree on an international standard for use in international reporting and applied when completing the questionnaires, while national definitions are used nationally. For this, countries will need to compare their definitions with the international ones and document all differences.

Revisions

86. When common international standards are agreed upon, all countries should revise their reports on the basis of these definitions. It is important to establish common international routines for revising data to secure continuity and consistence. These could be based on the routines for revising the national accounts.

Statistical differences

87. It would be useful to analyse statistical differences in reporting. It is likely that there is some statistical difference from month to month, particularly for large producers, importers or exporters, but in the long run there should not be a trend in statistical differences. All products and countries should be analysed to discover possible trends. Such analyses could, apart from resulting in methodological improvements, also uncover "lost volumes". Institutions such as IEA and the United Nations, which have access to international data and time series, could be responsible for this.

Documentation of production routines

88. Each country should document its national production routines for oil statistics and make the documentation available so that each country's methods and routines can be reviewed and evaluated easily, weaknesses can be revealed and improvements can be suggested. These papers should follow a defined outline with a list of concepts and methods to be covered, for easy comparison between countries.

Increase the qualification level of statistical staff

89. The composition of an energy statistics team is important. According to the International Monetary Fund, the core of the data-quality problem is the uneven and inadequate data reporting by individual countries and national statistical systems. In several cases, data are of questionable accuracy owing to lack of experience on the part of the respondents. Adequate data reporting requires the participation of people who understand the technical side and the problems encountered by oil producers and refineries when trying to respond to statistics questionnaires, as well as people who know international statistical

classifications and standards, questionnaire design, sample selection, etc. This applies to both national and international teams. Joint manuals, handbooks, regular meetings between reporting countries and the organizations, and training courses for statisticians are good means to increase statistical skills, ensure understanding and coordinate the methodology and definitions to be used.

Introduce new concepts in national reporting

90. To give the oil market information on the likely future development of production in the medium and the long run, information on investment in oil and gas exploration and production and remaining resources is needed. Well-established concepts will contribute to the predictability of the market, but depend to a large extent on data that are subject to few means of quality control. The possibility of establishing an internationally approved and objective method for these estimates should be discussed.

Continue international cooperation to refine global data systems and improve quality and timeliness

91. As mentioned above, there is a trade-off between being up to date and accuracy, and there are some countries that provide data of rather poor quality. The biggest producers and exporters provide data of good quality, but work needs to be done to increase participation by countries and to enhance the quality of less reliable data. Refinement of the system is needed, and it is especially important to find ways of further improving the timeliness of data while reducing the use of preliminary and estimated figures.