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ECONOMIC STATISTICS

ENERGY STATISTICS

Towards a System of Integrated Energy Statistics

Report of the Secretary-General

SUMMARY

The paper describes the programme of the Statistical Office for the development of a global System of Integrated Energy Statistics (SIES). The principal goals are international harmonization, timeliness, comparability and comprehensiveness of statistics. The focus of the programme is the extension of current work into energy balances. The problems of units of measurement, classification, conceptual and methodological guidelines are described, and interfaces between energy and related statistics identified. The Statistical Commission is requested to comment on the programme and to provide guidance and advice.

CONTENTS

	<u>Paragraphs</u>	<u>Page</u>
INTRODUCTION	1 - 2	3
I. ACTION BY THE COMMISSION	3	3
II. GLOBAL REQUIREMENTS FOR ENERGY STATISTICS: A CONTEXT	4 - 13	3
III. PROBLEM AREAS IN ENERGY STATISTICS	14 - 21	8
IV. ENERGY AND RELATED STATISTICS	22 - 28	11
V. THE PROGRAMME OF ENERGY STATISTICS: SUMMARY	29 - 33	13
VI. THE PROGRAMME OF ENERGY STATISTICS: ELABORATION	34 - 50	15

Annexes

- I. WORLD ENERGY SUPPLIES: HISTORICAL BACKGROUND
- II. SUMMARY OF COMMODITIES
- III. FRAMEWORK OF THE ENERGY BALANCE
- IV. SECTOR PROFILES AND SUMMARY PROFILE

INTRODUCTION

1. The adequate supply of energy in appropriate form is a basic prerequisite for economic development. Within the context of the Second United Nations Development Decade, the heightened importance of, and interest in, energy and related matters underscores the need for timely, comprehensive and detailed statistics on the range of global energy activities. The objective of the energy work programme of the Statistical Office is the provision of such statistics on the main aspects of the global energy system. This work is being undertaken in close collaboration with the regional commissions, the Centre for Natural Resources, Energy and Transport of the Department of Economic and Social Affairs and the World Bank. It is designed to reflect the requirements of the International Development Strategy and the deliberations of the General Assembly at its sixth and seventh special sessions.

2. The present paper has been prepared in response to the request of the Statistical Commission to include energy statistics in the agenda for its nineteenth session. ^{1/} The paper describes the work programme of the Statistical Office. The keystone of the programme is the compilation of energy balances, representing the extension of current work rather than radical redesign. The problems of units of measurement, classification, conceptual and methodological guidelines are described, and interfaces between energy and related statistics identified.

I. ACTION BY THE COMMISSION

3. The Commission may wish to comment on the paper and the programme. It may also wish to consider the advisability of convening an expert group to consider:

(a) The preparation of an International Classification of Energy in order to provide an effective basis for the further development and harmonization of international statistics of energy;

(b) The adoption of a common unit of measurement of interfuel comparison for use in energy balances on a global scale.

II. GLOBAL REQUIREMENTS FOR ENERGY STATISTICS: A CONTEXT

4. At the present time, there is a need for a programme of innovation and enhancement of global statistics of energy which is commensurate with the scale and complexity of energy problems. Such statistics are crucial to the comprehensive management, planning and development of this key sector of national economies. A basic prerequisite for the analysis and understanding of the complex functions and interrelationships of the energy economy is the availability of systematic

^{1/} For the provisional agenda, see Official Records of the Economic and Social Council, Fifty-eighth Session, Supplement No. 2 (E/5603 and Corr.1), para. 181.

statistical and related data covering the range of primary and secondary energy commodities as well as the range of transactions from production through international trade to conversion and final end use.

5. The programme of the Statistical Office is predicated upon a systematic compilation, in particular through the vehicle of energy balances, whereby the principal elements of supply may be entered in the accounts against those of demand. Such accounts provide a statistical foundation for analytical and synthetical study of the functioning of the energy economy, thereby facilitating decision making in management and policy formulation.

6. The inadequacies of existing information bases have been revealed by recent critical developments in the world energy economy. ^{2/} The far-reaching impact of energy problems upon the vitality of the economy as a whole has long been recognized:

"Energy problems cannot be solved in isolation, nor can they any longer be considered strictly within the confines of a single country or continent. The way in which they are solved is liable to have a profound impact on many other aspects of economic and social life. The fuel industries ... operate within the broad objectives of public policy set by Governments, who have to ensure that the development of the energy sector is in accord with wider national and international considerations." ^{3/}

7. Such considerations have accentuated the importance of comprehensive and integrated energy planning and policy formulation, ^{4/} which in turn rely upon a thorough statistical foundation. The planner and the policy maker need to have at their disposal the following basic matrix of energy data on a regular and timely basis: ^{5/}

A. Resources

(1) The nature and extent of indigenous energy resources, distinguishing between "known" or "proven" and "inferred" or "interpolated" categories

^{2/} See, for example, Proceedings of the Intergovernmental Meeting on the Impact of the Current Energy Crises on the Economy of the ESCAP region (United Nations publication, Sales No. E.75.II.F.7), paras. 8-11.

^{3/} Organisation for Economic Co-operation and Development, Energy Policy: Problems and Objectives (Paris, 1966), p. 12.

^{4/} The term "integrated" denotes the conduct of energy planning and policy on a multicommodity basis (i.e., covering the different solid and liquid fuels, gases and electricity in a comparative and homogeneous framework, rather than on disparate bases for each energy sector).

^{5/} A paper prepared by the Statistical Office for the Economic and Social Commission for Asia and the Pacific (ESCAP) covered the regional context of this matter. See "Energy statistics, energy accounts: the prerequisites for harmonized energy policy formulation in the ESCAP region" (E/CN.11/STAT/L.10, Bangkok, 1974).

(2) The technological and price thresholds for resource development and extraction, compared with prevailing supply alternatives

B. Production

- (1) Rate of production of primary 6/ energy commodities
- (2) Costs of production
- (3) Stocks at producer facilities

C. Imports

- (1) Quantity and value of imported primary energy commodities
- (2) Quantity and value of imported secondary 7/ energy commodities
- (3) Stocks at importers

D. Exports

- (1) Quantity and value of exported primary energy commodities
- (2) Quantity and value of exported secondary energy commodities
- (3) Stocks at exporters
- (4) Bunkers

E. Gross consumption or gross inland availability

Comprising production + producer stocks + imports + importer stocks - exports + stocks at exporters - bunkers

F. Transformation

- (1) Input: consumption for conversion or transformation
 - (a) Consumption of fuels in thermal power stations

6/ The term "primary energy" refers to those commodities which are utilized without undergoing conversion or transformation of state, i.e., coal, lignite, crude petroleum, natural gas, hydroelectricity and nuclear and geothermal electricity.

7/ The term "secondary energy" refers to those commodities which are transformed prior to utilization, i.e., briquettes, cokes, refined petroleum products, manufactured gases and thermal electricity.

- (b) Refinery input of crude petroleum
 - (c) Briquette plant input of solid fuels
 - (d) Coke oven input of solid fuels
 - (e) Gasworks input of solid fuels
 - (f) Plant input of gases (LNG, LPG ^{8/} and refinery gas)
 - (g) Stocks for conversion and transformation
- (2) Output: production of secondary energy
- (a) Production of thermal electricity
 - (b) Refinery output of all products
 - (c) Plant output of gases
 - (d) Production of briquettes
 - (e) Production of coke oven coke and coke oven gas
 - (f) Production of gasworks gas and gasworks coke
 - (g) Total consumption in conversion plants and losses
 - (h) Units costs of energy conversion

G. Net consumption or net inland availability

This comprises gross consumption - consumption for conversion or transformation.

- (1) Consumption in industry, of which, by sector
- (2) Consumption in transportation, of which, by type
- (3) Consumption for domestic uses
- (4) Consumption in agriculture
- (5) Stocks at consumers
- (6) Unit wholesale and retail prices of energy commodities

^{8/} LNG = liquefied natural gas; LPG = liquefied petroleum gases.

8. The following primary and secondary energy commodities need to be monitored within this basic framework:

	<u>Solid fuels</u>	<u>Liquid fuels</u>	<u>Gases</u>	<u>Electricity</u>
PRIMARY	Hard coal Brown coal/ lignite Peat Misc. solid fuels	Crude petroleum Natural gas liquids	Natural gas	Public hydro Public nuclear ^{9/} Public geothermal Industrial hydro Industrial nuclear ^{9/} Industrial geothermal
SECONDARY	Coke oven coke Gas coke Brown coal coke Patent fuel Brown coal/ lignite/ peat briquettes	Aviation gasolene Motor gasolene Jet fuel Kerosene Distillate fuel oil Residual fuel oil Lubricants and greases Bitumen (asphalt) Naphtha Waxes Petroleum coke White and industrial spirit Liquefied petroleum gases	Refinery gas Coke oven gas Manufactured (gasworks) gas	Public thermal Industrial thermal

9. While the above schema omits treatment per se of the so-called "non-commercial" forms of energy, ^{10/} the category of miscellaneous solid fuels recognizes the role

^{9/} Although, strictly speaking, production of electricity from nuclear power stations derives from the fission of primary materials, and thus is secondary production, for practical purposes it is considered as primary production mainly owing to the difficulties of calculation of nuclear fuel burn-up rates.

^{10/} The term "non-commercial" denotes those sources which do not normally enter commercial energy markets but are consumed largely by producers, such as fuelwood, lumber-mill wastes, bagasse and other fuels that are largely of local significance, such as dung, straw, paddy husk and other vegetal matter.

of such commodities in furnishing an important proportion of the energy base 11/ of many developing countries. It should be recognized that data on such inputs into the energy sector are sparse and irregular.

10. A characteristic feature of the global energy system is its interdependence, both in regional terms and in respect of the total mix of various fuel commodities in national energy bases. Accordingly, the compilation of statistics to monitor global and macro-regional variations in energy supply and demand, particularly vis-à-vis the implications they hold for price fluctuations, is an essential element of the above data matrix.

11. Timeliness of statistics constitutes an important goal in the compilation of such matrices of the energy economy, for planning and policy require up-to-date information. The extrapolation of historical trends in production, trade and consumption is a poor substitute for reliable, detailed and timely statistics of energy.

12. Other important goals in the compilation of integrated energy statistics are internal consistency and external comparability; for maximum utility, such statistics should be internally consistent to allow interfuel comparisons, while lending themselves to straightforward comparison with related facets of the over-all economy. The interfaces of the energy sector with other sectors of the economy are numerous. The comprehensive statistical treatment of the flow and effective end use of energy in an economy is a useful stimulus to the identification and understanding of allied macro-economic and social problems, such as those of the energy-environment interface.

13. It is important to emphasize that, in addition to the systematic compilation of data, the development of a System of Integrated Energy Statistics includes such elements as the framework of classifications, conceptual and methodological guidelines, and the definition of interfaces between energy and related statistics.

III. PROBLEM AREAS IN ENERGY STATISTICS

14. In conjunction with the development of the framework of the system of energy statistics, there exist several problem areas with respect to the methodological aspects of the system. These problem areas fall into five main categories, as follows:

- (a) The units of measurement of energy transactions on an original sectoral basis;
- (b) The related coefficients of conversion to a common basis of interfuel comparison;

11/ The "energy base" comprises the total input of fuel commodities, whether indigenous or imported, into the energy economy.

- (c) The terminology and definitions to be employed in the system;
- (d) The methodologies of compilation of energy balances;
- (e) The integration of international classifications for the energy sector.

The following paragraphs outline proposals and recommendations for work in respect of these problem areas.

15. Units of measurement. Primary collection of energy statistics occurs under the rubrics of the four component sectors, namely, solid fuels, liquid fuels, gases and electricity. Accordingly, the units of measurement in each sector follow the established practices of those sectors. These practices are followed currently in World Energy Supplies (Statistical Papers, Series J) ^{12/} and will be employed in the compilation of energy balances on a consistent basis. Most solid fuel commodities are measured on a ton-for-ton basis, except for some lower-grade commodities which may be measured in terms of hard coal equivalent (as in the case of recovered slurries or low-grade sub-bituminous coals). Liquid fuel commodities are measured in a variety of units, the most basic being volumetric (usually barrels or cubic metres) or weight (tonne). The tonne basis is most useful in the weighing to standard of crude petroleum from different sources according to specific gravity. In the gas sector, two units are in common use, on a volumetric or heat-value basis respectively (cubic metre or teracalorie). Although at present the Statistical Office presents statistics of gases on a volumetric basis, conversion to the heat-value measure is scheduled for Series J in 1977. The decision of the Gas Committee of the Economic Commission for Europe (ECE) to change to the joule as the basic unit of measurement has been noted, and the utility of the adoption of this unit on a global basis will be studied. Distinct units of measurement are employed in the electricity sector (namely kilowatt hour for production and megawatt for capacity) on a radically different basis from those for the fossil fuels by virtue of the nature of the production process. It appears to be extremely difficult to express the effective value of electric power and that of fossil fuels on a satisfactory common basis. As far as the basic units of measurement are concerned, there would appear to be few problems. Existing practices would seem to be satisfactory in the measurement of activity in the individual sectors, whether on a weight basis or a heat-value basis, and no action is necessary on the part of the Commission.

16. Coefficients of conversion. A more serious problem is posed by the establishment of a set of coefficients of conversion to a common basis of interfuel equivalency or comparison. Historically, while solid fuels constituted the major element of total global energy supply, the solid fuel measure of tonne coal equivalent (tce) was appropriate. However, with the growth of liquid fuels to the position of premier input into the global supply, the adoption of a liquid fuel equivalent as the basic yardstick of intersectoral comparison would seem logical (i.e., barrel-a-day oil equivalent, or tonne-a-year oil equivalent). A further

^{12/} See annex I.

problem is posed by the comparative assessment of relative heat value or ability to perform work of the individual fuel inputs. In this regard, a basic heat-value unit such as the teracalorie or therm would seem worthy of consideration. As noted above the joule has been proposed as a potential common unit, also.

17. Whether or not a different common base unit is adopted to replace the present Statistical Office measure of the tonne coal equivalent, an integrated conversion factor matrix for reduction to that base should be constructed for common use throughout the system. Great utility would be achieved by the use of SI (Système International) Units, as developed under the aegis of the International Bureau of Weights and Measures, 13/ in which the standard metric base units of the kilogram, metre and second are employed. The tonne ($=10^3\text{kg}$) is an alternative base unit of mass. The conversion matrix might be established both on a weight (volume) comparison or on a heat-value basis. Detailed analysis of these coefficients of conversion by commodity by country will be necessary to ensure the establishment of flexible interfuel factor adjustments. Accordingly, the Commission may wish to convene an expert group to consider the adoption of a common unit of interfuel equivalent or comparison for use in energy balance on a global scale.

18. Terminology and definitions. There has been little difficulty in extending the standard definitions and terminology in use in the Statistical Office into a standard commodity/transaction format, including the subdivisions peculiar to individual commodities or transactions (e.g., natural gas reinjection). Definition of commodities has been co-ordinated within the framework of the International Standard Industrial Classification (ISIC) and the System of National Accounts (SNA). The definitions and terminology currently in use in the Statistical Division of the Economic Commission for Europe, in the National Accounts and Data Section of the Organisation for Economic Co-operation and Development (OECD) and in the Statistical Office of the European Economic Community (EEC) have also been incorporated into the Statistical Office format. No action on the part of the Commission would appear to be necessary on terminology and definitions, since any discrepancies in international usage have been, and will continue to be, resolved at the working level.

19. Methodologies. In respect of methodologies, the Statistical Office programme for energy balances has been closely co-ordinated with the work of other international agencies in the field of energy statistics. In conjunction with the Economic Commission for Europe, further attention will be given to co-ordination of the existing methodological framework for treatment of energy conversion or transformation industries, as well as to the development of guidelines for disaggregation of consumption categories. 14/

13/ International Bureau of Weights and Measures, Le Système International d'Unités (Paris, 1970).

14/ See "General energy statistics" (CES/AC.32/10), para. 84, and also document E/ECE/883, paras. 21-23, 46-47 and 74-77, which deal with the need for disaggregation of availabilities at end use. Methodology occupies a large portion of the addendum to that document (E/ECE/883/Add.1), pp. 39 ff.

20. Integration of international classifications. The integration of international classifications comprises the single most difficult problem area in the development of a System of Integrated Energy Statistics. The energy sector falls under one industrial classification for production (International Standard Industrial Classification), two trade classifications (Standard International Trade Classification (SITC) and Customs Co-operation Council Nomenclature (CCCN)) and national accounts/goods and services classifications (System of National Accounts/International Standard Classification of All Goods and Services (SNA/ICGS)). No international classification exists of the full range of commodities and transactions of the energy sector per se. The "Classification for the drawing up of energy balances" (BILEN) of the European Communities comes closest to the necessary horizontal (transaction) and vertical (flow) integration of classifications.

21. Thus, in view of the importance an international energy classification would have in providing international guidelines, the Commission may wish the expert group referred to in paragraph 3 above to prepare a Standard International Energy Classification (SIEC), harmonizing the production transactions as classified under the ISIC, with the trade transactions as classified under SITC and developing a comparable end-use classification, the whole to be consistent within the broader classification outlines of the SNA and BEC. ^{15/} The goal of the SIEC should be to facilitate the compilation of statistics on all types of commodity transaction or process-flow in the energy sector. Such work should be closely co-ordinated with that of other international agencies working in the field of energy statistics.

IV. ENERGY AND RELATED STATISTICS

22. While the primary purpose of the programme is the development of a system of integrated energy statistics per se, an important corollary goal is the adaptability of the system to the needs of allied statistical fields. The energy balances or profiles will provide a core of statistics which may be utilized to identify and analyse the interfaces between energy and related statistics.

23. Of particular relevance in this respect is the relationship between the proposed System of Integrated Energy Statistics (SIES) and energy statistics in the "Draft guidelines for statistics on materials/energy balances" described in document E/CN.3/492, which is before the Commission. The statistics developed for the SIES should be fully co-ordinated with the draft guidelines. The development of energy statistics related to the environment treats one of the priority subject areas of the United Nations Environment Programme (UNEP). The Governing Council of UNEP stated in the report on the work of its second session:

"The results of the sixth special session of the General Assembly on the problems of raw materials and development should be taken into account in the

^{15/} Classification by Broad Economic Categories (United Nations publication, Sales No. E.71.XVII.12).

collection of detailed information on energy sources and requirements ..., which should concentrate on the environmental consequences of alternative patterns of energy generation and use." 16/

24. The major subjects for attention comprise reserves, outputs, intermediate and final demands, including stocks, and external trade in the case of energy-type commodities: production of pollutants and wastes in relation to technologies, inputs and costs of extracting, processing and producing energy materials and in relation to the use of energy-type commodities: equipment, technologies and costs of abating, eliminating and recycling the pollutants and wastes.

25. The SIES would be a starting point, or foundation, from which to build the particular types of energy statistics which will be needed as inputs into the materials/energy balances. Again, the SIES should represent the consolidation and extension of existing work in energy statistics, and should be closely harmonized with the needs of international environmental statistics. A deliberate effort has been made at this initial stage of the draft guidelines to ensure that the programme of energy statistics will be in accord with it in terms of the conceptual framework, methodological guidelines and analyses of flow transactions. It should be noted that particular subject matter, such as reserves/resources, is beyond the present scope of the SIES, but future work is envisaged to extend the system to include such elements.

26. The SIES should fit in broad terms into the conceptual framework of the SNA, and a specific attempt should be made in the conceptual and methodological framework of the SIES to harmonize it with allied aspects of the SNA: a key feature of the proposed SIES would be its flexibility, particularly in respect of levels of aggregation or detail.

27. A primary responsibility in the development of international statistics by the Statistical Office is to ensure co-ordination with work in progress in substantive fields at the regional commissions. The SIES should harmonize with the regional work in energy statistics, in particular with the ongoing work of the ECE and ESCAP regions. 17/ Account should be taken of the work of other international bodies, such as OECD, the Organization of Petroleum Exporting Countries (OPEC) and the World Energy Conference, so that, in summary, the SIES should serve as an umbrella framework at the global level for the co-ordination of statistical work in energy. Once the foundation of the SIES is established, it may be extended into more selective or specialized aspects of energy and related statistics, such as integrated price series, equipment series, and especially end-use consumption series whereby unit inputs of energy may be related to unit outputs of goods and services rather than merely to availability at end-use.

16/ Official Records of the General Assembly, Twenty-ninth Session, Supplement No. 25 (A/9625), p. 64.

17/ As outlined in "General energy statistics" (CES/AC.32/10), Geneva 1976, and "Energy statistics and energy accounts" (E/CN.11/STAT/L.10), Bangkok, 1974.

28. Thus, in terms of existing work and in provision of an outline for future work, the SIES would represent a foundation for the development of integrated, internally consistent, and harmonized statistics of energy, while facilitating cross-linkages between energy and related statistics and between global and regional perspectives.

V. THE PROGRAMME OF ENERGY STATISTICS: SUMMARY

29. Two characteristics distinguish the context of the Statistical Office work in energy statistics from that of other United Nations bodies (such as the regional commissions or such agencies as the World Bank): 18/

(1) A broad-ranging global and macro-regional emphasis; and

(2) A great variety among available statistics and among needs for statistical development.

30. The programme emphasizes the extension or enhancement of the statistical base already achieved in energy statistics rather than any radical redesign of this base. The present programme, and in particular the gradual extension of World Energy Supplies (Statistical Papers, Series J), reflects a lengthy cumulative experience in the development of energy statistics. The expertise and experience of the regional commissions, the specialized agencies, the Organisation for Economic Co-operation and Development, the Organization of Petroleum Exporting Countries (OPEC) and the European Economic Community (EEC) have been taken into account in the formulation of the Statistical Office programme.

31. A primary objective of the programme lies in providing a framework for co-ordination of work in energy statistics between those countries which face the need for innovation in energy statistics and those which face the task of consolidating existing statistics. The conceptual module of energy balances has been utilized to provide a generalized framework at the global level for the accommodation of the wide variety of energy statistics which are available in different countries in various parts of the world. Future work will be necessary to hone particular aspects of the system to suit particular needs or purposes, but at this stage a general system is proposed.

32. In this context, the role of the Economic Commission for Europe in the development of classifications, guidelines, definitions and methodology of compilation of international energy statistics should be noted. At the present time, ECE faces the requirement of the extension of its detailed statistics into such aspects of the energy economy as end-use consumption (particularly from the point of view of identifying the impact of energy usage patterns on related sectors of the economy), the effective use of energy commodities and increased efficiency and economy in the production, conversion, transport and use of all

18/ For a treatment of the context of a general system of energy statistics in the ECE region, see document CES/AC.32/10.

forms of energy. ^{19/} The development of the Statistical Office programme will be phased to take into account developments in energy statistics among the regional commissions and specialized agencies.

33. The programme comprises the following elements:

(a) Expansion of World Energy Supplies (Statistical Papers, Series J), to include a wider range of energy commodities and coverage of the transformation and end-use availability of these commodities. No. 19 of the series, in preparation, comprises a 25-year coverage of the major aspects of production, international trade, gross consumption and related statistics on an internally consistent basis. Future volumes, beginning in 1977, will comprise a five-year period of coverage, and particular effort will be given to the improvement of the timeliness of release of the publication and associated data files;

(b) Preparation, as a supplement within Series J, of a "Compendium of national and international sources" of energy statistics. Such a compendium will meet a considerable user demand for information on statistical source materials and will facilitate user compilation of corollary statistics. The compendium will be brought up to date at five-yearly intervals;

(c) Introduction of a new international questionnaire on energy statistics, as the vehicle for the collection of data preparatory to the compilation of energy balances on a national, regional and global scale;

(d) Introduction of a companion volume to the current Series J, presenting national, regional and global energy balances;

(e) Maintenance of the compilation of monthly and quarterly statistics of energy production in the Monthly Bulletin of Statistics;

(f) Maintenance of co-operative liaison with the regional commissions, the Centre for Natural Resources, Energy and Transport and other United Nations divisions, the World Bank, OECD, EEC and other agencies publishing international energy statistics, ^{20/} in order to extend the harmonization of such statistics and avoid duplication;

(g) Development of an international classification of energy commodities and transactions to enhance the consistency and comparability of energy statistics;

(h) Development of particular types of new energy statistics for specific purposes; for example, in co-ordination with the development of international environmental statistics, the development of aggregate energy statistics of importance to analysis of energy-environment interfaces;

(i) Preparation of a handbook of conversion factors and units of measurement for use with statistics of the energy sector, to facilitate intersectoral comparisons in the energy sector and the use of common equivalencies.

^{19/} See E/ECE/883 and Add.1, Geneva, 1975.

^{20/} Such as, in the field of energy reserves and resources, the World Energy Conference, a non-governmental organization.

VI. THE PROGRAMME OF ENERGY STATISTICS: ELABORATION

34. It should be noted that no direct provision has been made in the programme for the development of price statistics in energy. The diffuse and complex area of price statistics will be developed elsewhere, for example, in conjunction with the World Bank. For the time being, developments in energy price statistics will be monitored and discussions will take place with the World Bank and other interested bodies.

35. Similarly, owing to the diffuseness and variety of classification of resources/reserves, as well as to their political sensitivity and to the fact that the World Energy Conference has carried out periodic international surveys in this field for many years, it has been decided to confine the programme, which, as already indicated, is being carried out in collaboration with the Centre for Natural Resources, Energy and Transport and other bodies, 21/ to the clarification and elaboration of conceptual and methodological problems.

36. Following the design and circulation of a pilot questionnaire in 1975, the introduction of a new international questionnaire for the collection of energy statistics extends one element of the current programme. Copies of the pilot questionnaire were sent to each of the regional commissions and to a selection of statistical offices of States members of the Statistical Commission, 22/ and comments and recommendations have been incorporated in the questionnaire.

37. The questionnaire represents the extension of the present questionnaire on energy production statistics (i.e. part I of the Statistical Office Industrial Statistics Questionnaire) to include coverage of the major aspects of transformation and availabilities of commodities for consumption at end use. Annex II summarizes the range of energy commodities included in the questionnaire, while annex III provides a summary of transactions and an outline of the structural framework of these energy balance transactions.

38. Existing international questionnaires on energy have been reviewed and incorporated in the basic framework of the questionnaire in the interests of comparability. Thus, for example, as far as is feasible, the questionnaire follows the established definitions and procedures of the questionnaires on energy of the Statistical Division of the Economic Commission for Europe and of the Statistical Office of the European Communities. Also, identification of commodities in the production stage has been co-ordinated with the International Standard Industrial Classification of All Economic Activities (ISIC, Rev.2, 1968),

21/ Such as the Gas Committee of the Economic Commission for Europe. Also of relevance here is Economic and Social Council resolution 1954 (LIX) of 25 July 1975.

22/ Namely, Argentina, Canada, Czechoslovakia, Gabon, Hungary, India, Japan, Kenya and the United Kingdom of Great Britain and Northern Ireland.

and in the trade stage with the Standard International Trade Classification (SITC, Rev.1, 1961). ^{23/} Changes in the SITC (Rev.2, 1975) have been incorporated, where necessary.

39. The questionnaire comprises four sections, each of which is self-contained to facilitate responses; ^{24/} in this way, individual sections might be detached and forwarded to specialized national agencies concerned with those aspects of energy statistics.

40. A special effort has been made to keep to a minimum the manpower and time demands upon national statistical offices in the filling in of international questionnaires. Thus, for example, sections A, C and D of this questionnaire would not be sent to the member countries of the Economic Commission for Europe. The data for these sections are collected on a regular basis by ECE ^{25/} and would be made available simultaneously to the Statistical Office. The member countries of the European Economic Community, likewise, would be surveyed through the Statistical Office of the European Communities, obviating the need to duplicate the extensive energy questionnaire of that Office.

41. The questionnaire is also designed to provide information for guidelines for the development of international energy statistics by surveying the extent and detail of available data. It should be emphasized that, in the initial stages, countries may not be able to complete all parts of the questionnaire in detail. However, the questionnaire provides a format for the use of countries in further developing their energy statistics. The reply received by the Statistical Office from the Central Statistical Organization of India to the pilot questionnaire, dated June 1975, underscores this point:

"The questionnaire is quite comprehensive and the need for developing such detailed statistics on energy, as envisaged for study of energy trends and planning at the national/international levels, cannot be overemphasized."

42. The questionnaire has been designed for prefilling from the computerized energy data file of the Statistical Office, prior to circulation, so that revisions and the entry of new statistics may be facilitated at the same time. The base year of 1970 now in use is the "initial" year for which energy balances will be compiled, and it is not intended to request data prior to that date.

^{23/} United Nations publications, Sales Nos. E.68.XVII.8 and 61.XVII.6, respectively.

^{24/} Section A, Solid fuels; section B, Liquid fuels; section C, Gases; and section D, Electricity; these sections reflect the four sectors of the energy economy.

^{25/} For publication, respectively, in the Annual Bulletin of Coal Statistics for Europe, the Annual Bulletin of Gas Statistics for Europe and the Annual Bulletin of Electric Energy Statistics for Europe.

43. The introduction of a companion volume to Series J, presenting energy balances, is co-ordinated with the design of the questionnaire. The commodity categories and the framework of the balance-sheet will follow the questionnaire formats. Also, the balances follow, in abbreviated format, the main elements of existing international presentations of energy balances or profiles. ^{26/} In keeping with the philosophy of extension of existing work rather than radical redesign of energy statistics, the accounts represent the extension of Series J to cover the major aspects of the demand for energy in addition to those of supply.
44. The data received in the responses to the questionnaire will be converted into a common unit for intersectoral comparability, and will be supplemented where appropriate with materials from official national publications. The procedure adopted with the questionnaire will be followed in the use of 1970 as a base year, and the format of the questionnaire will be used as the initial format of the balance, to facilitate computer processing of data.
45. The second stage comprises the conversion of each commodity profile to a common unit of measurement, such as tonne coal equivalent, allowing comparability between the different forms of energy. The third stage comprises the compilation of sector profiles ^{27/} from the data in stage two, to reflect the demand side.
46. Sector profile 1 treats energy consumption in transportation including bunkers. Sector profile 2 assesses energy consumption in the domestic sector. It should be noted that "agriculture" has not been established as a distinct consumption category, but it may be subdivided out from either domestic or transportation consumption; similarly, particular types of industrial consumption may be distinguished at a higher level of subdivision (e.g., consumption in iron and steel industries), in sector profile 3. Sector profile 4 deals with the energy conversion industries, i.e., the input and output and the losses accruing thereto in coke ovens, gas works, patent fuel and briquetting plants, thermal power plants and refinery operation. Sector profile 5 treats diversion, disappearance and loss, through non-fuel usage, losses in processing, and non-accountable quantities, including statistical differences.
47. Finally, the commodity and sector profiles are totalled in the summary profile, ^{28/} which is a consolidated statement of energy consumption, to provide the over-all balance, and an overview of the flow of commodities through the energy economy.
48. It is intended to publish the first volume of energy balances in 1977. For individual countries, the latest year for which a balance will be presented from

^{26/} Notably those adopted for use in the European Economic Community, in OECD, and in the ECE Annual Bulletin of General Energy Statistics for Europe.

^{27/} See annex IV, figures I-V.

^{28/} Ibid., figure VI.

1970 onward will vary according to the availability of data. However, in all cases, the latest available data will be presented.

49. The preparation of a "Compendium of national and international sources" of energy statistics was designed to meet user needs for information on official statistical source materials. Such a compendium was prepared for the second issue of World Energy Supplies 29/ in 1957, and it was thought to be useful to bring this material up to date.

50. Attention is focused on the methodological aspects of energy statistics to yield harmonization of statistics with other interested agencies. Work will be devoted in particular to the development of an international classification of energy commodities and transactions, and to the preparation of a handbook of units of measurement and conversion coefficients for use with energy statistics. Thus the programme in energy statistics aims not only at the integration and harmonization of energy statistics per se but also at the procedures and methodologies used for their compilation.

29/ United Nations publication, Sales No. 57.XVII.3.

Annex I

WORLD ENERGY SUPPLIES: HISTORICAL BACKGROUND

1. Since 1952, the Statistical Office has maintained, on an annual basis, the sole global statistical study in the field of energy, providing coverage of the major aspects of production, international trade and gross consumption. This study, entitled World Energy Supplies (Statistical Papers, Series J), is published periodically. The twentieth issue covering the quinquennium 1971-1975, is currently being prepared for publication.

2. Series J was the first publication of the Statistical Office to be supplemented by a computerized data file (from 1954 onward). Currently, the data file contains statistics on 72 different energy commodities or subcommodities for the 25-year period 1950-1974 for approximately 200 countries and areas. There are approximately 220,000 data records, standardized to a common record format and coding structure. The United Nations Standard Country or Area Code for Statistical Use a/ is used for the identification of countries, and the Standard International Trade Classification, Revised b/ for the identification of trade in energy commodities.

a/ United Nations publication, Sales No. E.75.XVII.8:

b/ United Nations publication, Sales No. 61.XVII.6.

Annex II

SUMMARY OF COMMODITIES

Section A. Solid fuels

Statistics on hard coal
Statistics on brown coals/lignite
Statistics on coke oven coke
Statistics on gas coke
Statistics on brown coal coke
Statistics on patent fuel (hard coal briquettes)
Statistics on brown coal/lignite/peat briquettes
Statistics on peat
Statistics on non-commercial solid fuels

Section B. Liquid fuels

Statistics on crude petroleum
Statistics on aviation gasoline
Statistics on motor gasoline
Statistics on jet fuels
Statistics on kerosene
Statistics on distillate fuel oil
Statistics on residual fuel oil
Statistics on lubricants and greases
Statistics on bitumen (asphalt)
Statistics on naphthas
Statistics on waxes
Statistics on petroleum coke
Statistics on other products
Statistics on white spirit and industrial spirit
Statistics on liquified petroleum gases

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E/CN.3/476

English

Annex II

Page 2

Statistics on refinery gas

Statistics on natural gas liquids

Section C. Gases

Statistics on natural gas (including liquified natural gas)

Statistics on manufactured (gasworks) gas

Statistics on coke oven gas

Section D. Electricity

Statistics on electricity: net installed capacity

Statistics on electricity: gross production and consumption

Statistics on fuels consumed in power stations

Annex III

FRAMEWORK OF THE ENERGY BALANCE

A. Summary of the energy balance

<u>Transaction code</u>	<u>Descriptor of transaction</u>
1	Production
2	Imports
3	Exports
4	Bunkers
5	Changes in stocks at producers and importers
6	Transfers in
7	Gross inland availability (1+2-3-4+5+6)
8	Transfers out
9	Used in energy conversion industries
10	Consumption by energy-producing industries
11	Net inland availability (7-8-9-10 and 14+15+16+17) (balance line)
12	Refinery output of all petroleum products
13	Refinery capacity
14	Consumption in transportation sector
15	Consumption in industry and construction
16	Consumption in households and other sectors
17	Changes in stocks at consumers
18	Changes in stocks at refinery
19	Statistical differences and not accounted for
20	Capacity, net installed, total
21	Capacity, net installed, public total
22	Capacity, net installed, industrial total
30	Total fuels consumed in power stations
31	Raw materials used in producing manufactured and coke oven gases

B. Structural framework of the energy balance transactions

<u>Transaction code</u>	<u>Descriptor of transaction</u>
1	Production
1.1	Production, of which, offshore
1.2	Production, of which, from tar sands and oil shales
1.3	Production, of which, natural gasolene
1.4	Production, of which, lease condensate
1.5	Production, of which, other natural gas liquids
1.6	Production: recovered slurry
1.7	Production, of which, reinjected natural gas
1.8	Production, of which, flared or lost natural gas
1.9	Production, of which, methane from coal mines
1.10	Production, net natural gas
1.13	Production at refineries
1.131	Production, of which, used in refinery as refinery fuel
1.14	Production at plants
1.21	Production, industrial and public - hydroelectricity
1.22	Production, industrial and public - thermal electricity
1.23	Production, industrial and public - nuclear electricity
1.24	Production, industrial and public - geothermal electricity
1.30	Production, public - total electricity
1.31	Production, public - hydroelectricity
1.32	Production, public - thermal electricity
1.33	Production, public - nuclear electricity
1.34	Production, public - geothermal electricity
1.40	Production, industrial - total electricity
1.41	Production, industrial - hydroelectricity
1.42	Production, industrial - thermal electricity
1.43	Production, industrial - nuclear electricity
1.44	Production, industrial - geothermal electricity
1.50	Station use and loss in generation and distribution
2	Imports
3	Exports
4	Bunkers
5	Changes in stocks, at producers and importers
5.1	Changes in stocks, of which, at producers
5.2	Changes in stocks, of which, at importers
6	Transfers in
6.1	Transfers in, of which, natural gas liquids
6.2	Transfers in, of which, unfinished and semi-refined oil
7	Gross inland availability (1+2-3-4+5+6)

<u>Transaction code</u>	<u>Descriptor of transaction (continued)</u>
8	Transfers out
8.1	Transfers out, of which, to gas works
8.2	Transfers out, of which, to natural gas processing plants
8.21	Transfers out, of which, losses due to shrinkage in natural gas processing plants
8.3	Transfers out, of which, to the chemical industry as a raw material
8.5	Transfers out, of which, to refineries
8.9	Transfers out, of which, to other producers
9	Used in energy conversion industries
9.1	Used in energy conversion industries, of which, in coke oven plants
9.2	Used in energy conversion industries, of which, in gas works
9.3	Used in energy conversion industries, of which, in thermal power plants
9.4	Used in energy conversion industries, of which, in patent fuel and briquetting plants
9.5	Used in energy conversion industries, of which, refinery input
10	Consumption by energy-producing industries
10.1	Consumption by energy-producing industries, of which, in coke oven plants
10.2	Consumption by energy-producing industries, of which, in gas works
10.3	Consumption by energy-producing industries, of which, in thermal power plant auxiliaries
10.4	Consumption by energy-producing industries, of which, in patent fuel and briquetting plants
11	Net inland availability (7-8-9-10 and 14+15+16+17)
12	Refinery output of all petroleum products
12.1	Refinery output of which, refinery gas
12.2	Refinery output, of which, liquefied petroleum gases
12.3	Refinery output, of which, aviation gasoline
12.4	Refinery output, of which, motor gasoline
12.5	Refinery output, of which, jet fuels
12.6	Refinery output, of which, kerosene
12.7	Refinery output, of which, distillate fuel
12.8	Refinery output, of which, residual fuel
12.9	Refinery output, of which, lubricating oil
12.10	Refinery output, of which, bitumen (asphalt)
12.11	Refinery output, of which, naphthas
12.12	Refinery output, of which, waxes
12.13	Refinery output, of which, petroleum coke
12.14	Refinery output, of which, white and industrial spirit
12.15	Refinery output, of which, unfinished oils and residuals
12.16	Refinery output, of which, petro-chemical feed stock
12.17	Refinery output, of which, other products (specify)

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<u>Transaction code</u>	<u>Descriptor of transaction (continued)</u>
13	Refinery capacity (distillation)
14	Consumption in the transportation sector
14.1	Consumption, of which, railways
14.2	Consumption, of which, coastal and inland navigation
14.3	Consumption, of which, roads
14.4	Consumption, of which, air
14.9	Consumption, of which, other (specify)
15	Consumption in industry and construction
15.1	Consumption, of which, iron and steel industry
15.2	Consumption, of which, chemical industry
15.9	Consumption, of which, in other industries and construction
16	Consumption in household and other sectors
16.1	Consumption, of which, in households
16.11	Consumption, of which, free issues to employees
16.2	Consumption, of which, in agriculture
16.3	Consumption, of which, in public lighting
16.9	Consumption, of which, in other sectors
17	Changes in stocks at consumers
18	Changes in stocks at refinery
19	Statistical differences and not accounted for (only for United Nations Statistical Office internal working use and not for questionnaire)
20	Capacity, net installed, I+P total
20.21	Capacity, net installed, of which, I+P, hydroelectricity
20.22	Capacity, net installed, of which, I+P, thermal
20.23	Capacity, net installed, of which, I+P, nuclear
20.24	Capacity, net installed, of which, I+P, geothermal
21	Capacity, net installed, public total
21.31	Capacity, net installed, of which, public, hydroelectricity
21.32	Capacity, net installed, of which, public, thermal
21.33	Capacity, net installed, of which, public, nuclear
21.34	Capacity, net installed, of which, public, geothermal
22	Capacity, net installed, industrial total
22.41	Capacity, net installed, of which, industrial, hydroelectricity
22.42	Capacity, net installed, of which, industrial, thermal
22.43	Capacity, net installed, of which, industrial, nuclear
22.44	Capacity, net installed, of which, industrial, geothermal
30	Total fuels consumed in power stations
30.10	Hard coal (1,000 metric tons)
30.11	Hard coal (tcal)
30.20	Hard coal briquettes (1,000 metric tons)

<u>Transaction code</u>	<u>Descriptor of transaction (continued)</u>
30.21	Hard coal briquettes (tcal)
30.30	Brown coal and lignite (1,000 metric tons)
30.31	Brown coal and lignite (tcal)
30.40	Brown coal/lignite/peat briquettes (1,000 metric tons)
30.41	Brown coal/lignite/peat briquettes (tcal)
30.50	Peat (1,000 metric tons)
30.51	Peat (tcal)
30.60	Other solid fuels - specify (1,000 metric tons)
30.61	Other solid fuels - specify (tcal)
30.70	Distillate fuel oil (1,000 metric tons)
30.71	Distillate fuel oil (tcal)
30.80	Residual fuel oil (1,000 metric tons)
30.81	Residual fuel oil (tcal)
30.90	Natural gas (tcal)
30.100	Manufactured gas (tcal)
30.110	Coke oven gas (tcal)
30.120	Nuclear fuel (Kg.)
30.121	Nuclear fuel (tcal)
30.130	Other - specify (...)
30.131	Other - specify (tcal)
31	Raw materials used in producing manufactured and coke oven gases
31.1	Hard coal (1,000 metric tons)
31.2	Brown coal/lignite (1,000 metric tons)
31.3	Coke (1,000 metric tons)
31.5	Other (specify) (...)

Annex IV

SECTOR PROFILES AND SUMMARY PROFILE

Figure I

SECTOR PROFILE 1. ENERGY CONSUMPTION IN THE TRANSPORTATION SECTOR

<u>Air</u>		<u>Railways</u>
Aviation gasoline		Hard coal
Jet fuels		Distillate fuel oil
Total		Residual fuel oil
		Electricity
		Other
		Total
<u>Road</u>		<u>Foreign bunkers</u>
Motor gasoline		Aviation gasoline
Distillate fuel oil		Jet fuel
Other		Hard coal
Total		Distillate fuel oil
		Residual fuel oil
		Other
		Total
<u>Coastal and inland waterways</u>		
Distillate fuel oil		
Residual fuel oil		
Kerosene		
Hard coal		
Other		
Total		

Figure II

SECTOR PROFILE 2. ENERGY CONSUMPTION IN THE DOMESTIC SECTOR

Hard coal	Distillate fuel oil
Lignite and brown coal	Residual fuel oil
Patent fuel	Natural gas
Lignite and brown coal briquettes	Gas works gas
Oven coke	Coke oven gas
Gas coke	Electricity
Liquefied petroleum gases	Total
Kerosene	

Figure III

SECTOR PROFILE 3. ENERGY CONSUMPTION IN INDUSTRY

Coal	Residual fuel oil
Patent fuel	Refinery fuel
Lignite and brown coal	Natural gas
Lignite and brown coal briquettes	Gas works gas
Oven coke	Coke oven gas
Gas coke	Electricity
Liquefied petroleum gases	Own
Kerosene	Purchased
Distillate fuel oil	Total

Figure IV

SECTOR PROFILE 4. PROCESSING PLANT INPUT AND OUTPUT

1. Coke ovens

Input
 Hard coal
 Lignite and brown coal
 Total

Output
 Coke oven coke
 Brown coal coke
 Coke oven gas
 Total

Output - input

2. Gas works

Input
 Hard coal
 Lignite and brown coal
 Coke
 Distillate fuel oil
 Residual fuel oil
 Total

Output
 Gas coke
 Gas works gas
 Total

Output - input

3. Patent fuel and briquetting plants

Input
 Hard coal
 Lignite and brown coal
 Total

Output
 Patent fuel
 Lignite and brown coal briquettes
 Total

Output - input

Figure IV (continued)

4. Thermal power plants

Input
 Hard coal
 Lignite and brown coal
 Patent fuel
 Lignite and brown coal briquettes
 Other solid fuels
 Crude petroleum
 Distillate fuel oil
 Residual fuel oil
 Natural gas
 Other gases
 Other (specify)
 Total

Output
 Production of thermal electricity

Output - input

5. Refinery losses

Input
 Crude petroleum input to refinery

Output
 Total production of petroleum products
 Refinery gas used as refinery fuel
 LPG used as refinery fuel
 Total

Output - input

Figure V

SECTOR PROFILE 5. ENERGY DIVERSION, DISAPPEARANCE AND LOSS

Non-fuel uses

Lubricants
 Asphalt/bitumen
 Naphthas
 Petroleum coke
 White spirit
 Non-lubricating oils
 Waxes and greases
 Others (unfinished oils,
 petrochemical feedstocks)

A. Total

Lost in processing

Coke ovens
 Gas works
 Patent fuel and briquetting plants
 Thermal power plants
 Refineries

B. Total

Lost and not accounted for (including statistical differences)

Gases
 Electricity
 Hard coal
 Patent fuel
 Lignite and brown coal
 briquettes
 Cokes
 LPG and refinery gas
 Gasolenes
 Kerosene and jet fuels
 Distillate fuel oil
 Residual fuel oil

C. Total

Over-all total (A+B+C)

Figure VI

SUMMARY PROFILE. CONSOLIDATED ENERGY CONSUMPTION
BY COMMODITY AND SECTOR

<u>Commodity</u>	<u>Sector</u>
Solid fuels	Transportation
Petroleum products	Air
Gases	Road
Electricity	Coastal and inland waterways
Total	Railways
	Foreign bunkers
	Domestic sector
	Industry
	Non-fuel uses
	Lost in processing
	Lost not accounted for
	Total inland
	Foreign bunkers
	Total
