STATISTICAL OFFICE OF
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COMMUNITIES

B1 – National accounts methodology,
statistics for own resources

Subsoil asset accounts for oil and gas – Guidelines for the set of standard tables

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Contents

1 Introduction

The subsoil asset accounts are part of integrated environmental and economic accounts. The basic framework for the subsoil asset accounts was developed by the Eurostat Task Force on Subsoil Assets. The aim is to give a description of stocks and flows of subsoil assets in physical and monetary terms, linked to the ordinary national accounts. The results are presented in the form of balance sheets and accumulation accounts similar to those found in the European System of Accounts (ESA95).

These guidelines are an aid for country correspondents in filling in the subsoil asset accounts tables in a harmonised way. The present guidelines are a revised version of the guidelines sent out with the set of tables in 2001. Analysis of the data that were provided to Eurostat in 2001 and published in 'Natural Resource Accounts for Oil and Gas, 1980-2000' showed that further harmonisation, in particular of the monetary estimates, would be important in order to improve comparability in future rounds of data collection. A harmonisation proposal was prepared by Eurostat in collaboration with Member States' representatives, and agreed by the Eurostat Working Party 'Economic Accounts for the Environment' at its October 2002 meeting. This proposal is the basis for the revised guidelines.

The guidelines present the tables and suggest data sources and estimation methods for the different items in the accounts. Section 2 discusses the physical balance sheets and different definitions of oil and gas reserves. Section 3 covers estimation of the resource rent. Section 4 sets out the structure of the monetary balance sheets, and suggests valuation methods for the stocks and flows of oil and gas. Annex 1 gives an example of how the the resource rent can be partioned between the extractor and the government. Annex 2 provides an example of the valuation methods descripbed in Section 4.

For a more detailed description of the methods and definitions, please refer to the Eurostat publication 'Accounts for subsoil assets – Results of pilot studies in European countries'.

2 Physical balance sheets and accumulation accounts

The physical balance sheet and accumulation accounts have been combined into a single table that shows time-series of the stocks and stock changes for the reserves.

Table 1: Physical balance sheet

	Year 1	Year 2	Year 3	Year 4	Year 5
Opening stock: Discovered and undiscovered reserves					
Extraction					
Other changes in volume					
Discoveries					
Closing stock: Discovered and undiscovered reserves					
Discovered reserves					
Proven reserves					
Other discovered reserves					
Undiscovered reserves					

Table 1 is to be filled in in two versions, one for crude oil including natural gas liquids (NGL) and one for natural gas (for convenience, the rest of the manual will use the terms oil and gas for these two product groups). The units to be used in the tables are million tonnes for oil and billion standard cubic meters[1] (Sm^3) for gas.

Possible sources for the basic data on volumes are energy statistics departments, ministries, petroleum directorates, geological survey institutions or extraction companies.

The main reserve definition to be used in Table 1 should ideally be the expected, or probability weighted, level of discovered and undiscovered reserves. If data on all categories are not available, Table 1 should be filled in based on the available reserve data. The precise definitions used should be described under “Reserve definition” in the standard tables.

The different items in the table are explained below.

Opening stocks: Discovered and undiscovered reserves
The level of the reserves at the beginning of the year. Should be equal to the closing stock of the previous year.

Extraction
The volume extracted during the year.

Other changes in volume
This item includes all changes in the stock level from the beginning to the end of the year, except extraction. They can be divided into discoveries, which have been confirmed by the drilling of test wells, and reassessments of previous estimates. If the data are available, discoveries should be shown separately. When undiscovered reserves are included in the stock estimates, discoveries will reflect a reclassification from undiscovered to discovered reserves.

Closing stocks: Discovered and undiscovered reserves
The level of reserves at the end of the year. Data on the closing stocks of the different sub-categories should be provided as well.

[1] A standard cubic metre is measured at a temperature of ca 15° C and a pressure of ca 1.01325 bar.

Classification of reserves
Stocks of subsoil assets are generally not known with certainty. Both the size of the deposits and the profitability of exploration are uncertain. There is no established international standard classification for subsoil assets. Different classification systems are used by the institutions compiling physical data, according to data availability and user needs.

As a starting point for a discussion of resource classification systems, one may use the McKelvey box, which illustrates the classification of resources based on geological and economic criteria.

The McKelvey box

		Physical resource base				
		Discovered			Undiscovered	
		Established		Possible	Hypothetical	Speculative
		Proven	Probable			
Economic	Developed	X	-	-	-	-
	Non-developed	X	X	X	X	X
Sub-economic		X	X	X	X	X
Non-economic		X	X	X	X	X

The geological dimension classifies the resources according to the degree of certainty. This can vary over time as a result of exploration and development activity. The economic dimension classifies the resources according to the profitability of exploration. This can vary over time with changes in prices and extraction technology.

The two major categories of the geological dimension are **discovered** and **undiscovered** reserves. Discovered reserves have been confirmed by drilling of test wells, while undiscovered reserves are inferred from seismic data and geological models. The discovered reserves can be subdivided into proven, probable and possible reserves, based on the degree of certainty that the reserves will be extracted. Proven reserves are almost certain to be technically and economically producible, while probable and possible reserves have lower probabilities of being produced. For example, the UK Department of Trade and Industry defines proven reserves as having an estimated probability of at least 90% of being produced. Probable reserves have a chance of between 50% and 90% of being producible, and possible reserves have a probability of between 10% and 50%.

According to ESA § 7.41, subsoil assets are “proven reserves of mineral deposits located on or below the earth’s surface that are economically exploitable given current technology and relative prices….”. However, since the cost for proving new reserves is often very high (in particular in the North Sea), oil companies only prove the volume necessary for a limited time of extraction, typically 5 to 10 years. Therefore, the volume of proven reserves is not representative of the overall volume of reserves of oil and gas present on the economic territory of EU/EEA countries.

Based on the arguments above, the subsoil asset accounts include not only proven reserves, as recommended in the ESA, but also probable and possible reserves, as well as undiscovered reserves. Only “economically recoverable” resources should be included in the physical (and monetary) balance sheets. The best estimate to include in the subsoil asset accounts is considered to be the expected, or probability weighted, level of discovered and undiscovered reserves. However, data on all categories, in particular undiscovered reserves, may not be available in all countries. In some countries, reserve data weighted by probability is readily available from the institution that compiles the basic data. If this is not the case, probability weights may be applied to the available reserve categories, before they are added together. The default weights could be 1.0 for proven reserves, 0.5 for possible reserves and

0.1 for probable reserves. Alternatively, the non-weighted sum of proven and probable reserves can be used as a second best estimate for the expected level of discovered reserves: if the probability distribution is symmetric, the expected mean and the median (the 50% probability level) will coincide.

3 The resource rent

The resource rent is the net income from extraction, defined as the value of output less all costs of extraction, including capital costs (i.e. consumption of fixed capital and return to fixed capital). The data source for resource rent calculations is normally the national accounts data for the extraction industries. For oil and gas, the industry is NACE Rev.1 group 11.1 Extraction of crude petroleum and natural gas.

The definition of the resource rent used in the subsoil asset accounts is:

Output (basic "well head" prices)
+ Specific taxes less subsidies on products
– Intermediate consumption
– Compensation of employees
– Other non-specific taxes less subsidies on production
– Consumption of fixed capital
– Return to fixed capital
= Resource rent

Most of the variables are standard national accounts variables, except the return to fixed capital and the classification of taxes and subsidies into specific and non-specific.

Return to fixed capital is calculated by applying a normal real rate of return to the net stock of fixed capital in the extraction industry, valued at the beginning of the period. For EU/EEA countries, an 8% real rate of return on fixed capital should be taken as the default value.

Specific taxes and subsidies are those that apply only to the oil and gas extraction industry, while non-specific taxes and subsidies apply to other industries as well. Specific taxes are considered part of the resource rent (appropriated by government). Specific subsidies for oil and gas extraction are probably negligible in Europe (but may be of importance for other subsoil assets, such as coal).

When the resource rent calculation gives a negative value, the resource rent should be set equal to zero.

An equivalent definition of the resource rent is:

Net operating surplus
+ Specific taxes less subsidies on products
+ Other specific taxes less subsidies on production
– Return to fixed capital
= Resource rent

Table 2 shows the variables that are part the definition of the resource rent, and some related variables that describe the production process and capital transactions of the extraction industry. Most of the variables are standard national accounts variables, except the specific taxes and the resource rent estimates. The variables in bold are the most important for the rent calculations.

Table 2: Economic accounts and resource rent for NACE 11.1 Extraction of crude petroleum and natural gas

	Year 1	Year 2	Year 3
Current transactions			
Output (basic "well head" prices)			
Intermediate consumption			
Gross value added			
Compensation of employees			
Other taxes on production			
Other subsidies on production			
Consumption of fixed capital			
Construction, equipment, etc. for extraction			
Mineral exploration			
Net operating surplus			
Capital transactions			
Gross fixed capital formation			
Construction			
Equipment and other			
Mineral exploration			
For own final use			
Purchased or otherwise acquired			
Changes in inventories			
Net acquisitions of subsoil assets			
Net acquisitions of leases and other transferable contracts			
Supplementary data			
Labour inputs (number of employees)			
Closing net stocks of fixed assets			
Production equipment and construction			
Exploration expenditure			
Return to fixed capital			
Specific taxes less subsidies on products			
Other specific taxes less subsidies on production			
Specific taxes on income			
Rent (royalties) on subsoil assets			
Resource rent			
= Net operating surplus			
+ Specific taxes less subsidies on products			
+ Other specific taxes less subsidies on production			
- Return to fixed capital			
Resource rent appropriated by the government			
= Specific taxes less subsidies on products			
+ Other specific taxes less subsidies on production			
+ Rent (royalties) on subsoil assets			
+ Specific taxes on income			
Resource rent for the extractor			
= Net operating surplus			
- Rent (royalties) on subsoil assets			
- Specific taxes on income			
- Return to capital			
Resource rent, oil			
Resource rent, gas			

The table should be filled in in national currency, in the unit normally used for publishing the national accounts.

The terms used in the definition of the resource rent are explained below.

Output should be valued at the "well-head" basic prices, therefore excluding all taxes less subsidies on products and trade and transport margins. However, when taxes and subsidies on products are specifically related to oil and gas extraction they should be included, to estimate the total value of the reserves to the country. This is the item called **Specific taxes less subsidies on products.**

Trade and transport margins, i.e. charges related to transport and delivery from the "well-head" to the place where purchasers take ownership of the extracted oil or gas, may be difficult to separate. Undersea pipelines from offshore wells to cargo terminals are often an integral part of the extractors' fixed capital. In this case the corresponding operating and capital costs must be charged against output (valued at basic prices at the place of delivery).

Intermediate consumption should be valued at purchasers' prices.

Compensation of employees is used as an estimate of the value of labour services. If there is a significant number of self-employed persons in the extraction industry, an estimate of the value of their labour services should be added to the compensation of employees.

Other non-specific taxes less subsidies on production refer to taxes and subsidies on production that are not specific to the extraction industry. Taxes that are specific, i.e. taxes that according to the tax code are paid only by the extraction industry, are not considered part of the production costs, but are included in the resource rent. Specific subsidies on production are not included in the resource rent, but non-specific subsidies are.

Consumption of fixed capital applies to the fixed capital used in production, including exploration expenditure in the form of intangible fixed assets (asset category AN. 1121, see ESA § 6.03 and annex 7.1). In the national accounts, consumption of fixed capital is usually calculated together with the net stock of fixed capital, using the perpetual inventory method (PIM). The PIM is based on time-series of gross fixed capital formation and assumptions about asset life times and depreciation profiles (ESA § 6.04).

Return to the fixed capital is calculated by applying a normal rate of return to the net stock of fixed capital in the extraction industry, valued at the beginning of the period.

The normal rate of return used in the calculations should be a real rate, since the holding gains on the net stock of fixed capital "take care" of the adjustment for price changes.

For EU/EEA countries, an 8% real rate of return on fixed capital should be taken as the default value in the absence of more detailed information. This is based on national standards, and on an examination of empirical data on the ratio between the net operating surplus and the net capital stock for manufacturing industry as a whole.

Resource rent

The resource rent for oil and gas extraction may be divided into different categories. In Table 2, the total resource rent is divided between oil and gas, and between the government (in many countries the legal owner of the resources) and the extractor. The methods that can be used to make these estimates are discussed below.

3.1 Distribution of total resource rent between oil and gas

In the national accounts, production costs of the oil and gas extraction industry are generally not divided between oil and gas. In some cases the oil and gas wells are physically distinct and separate data can be compiled, but often this is not possible.

Because oil and gas are sold in different markets and normally have different production profiles, it is useful for valuation purposes to estimate resource rents for oil and gas separately. Separate output data for oil and gas is usually available, but this is often not the case for the extraction costs.

Extraction costs are defined as the sum of the following items from the resource rent calculation:

- Intermediate consumption
- Compensation of employees
- Other non-specific taxes less subsidies on production
- Consumption of fixed capital
- Return to fixed capital

When no specific information about the distribution of the extraction costs between oil and gas is available, they should be divided with the shares that oil and gas have in the total value of output. If there are specific net taxes on oil and/or gas, these should be added to the output in basic prices before the output shares are calculated. When this method is used, the resource rent is distributed between oil and gas in proportion to output.

3.2 Decommissioning costs

As long as the current decommissioning costs are small, the regular national accounts data should be used in the resource rent estimates. Depending on countries' national accounting practices, decommissioning costs would then probably be included in the extraction costs - and thus excluded from the resource rent - in the year(s) they occur as part of the intermediate consumption or possibly the consumption of fixed capital (if decommissioning costs are recorded as gross fixed capital formation). If, in the future, the current decommissioning costs become large enough to distort the resource rent, they should be removed from the resource rent calculation, and a more permanent solution should be sought together with the national accountants.

3.3 Government appropriation of the resource rent

The oil and gas resources in EU/EEA countries are usually legally owned by governments, while extraction is carried out by separate companies. Through taxes and royalties, the governments appropriate part of the resource rent from extraction. The government's part of the resource rent can be defined as the sum of royalty payments and revenue from production and income taxes that are specifically related to extraction.

The relationship between the part of the resource rent that is appropriated by the government and the total resource rent can be interpreted as a measure of the government's success in appropriating as much of the resource rent as possible. However, users of the estimates should be aware of the uncertainties and assumptions involved in estimating both the total resource rent and the government appropriation.

If the government appropriation can be assumed to be a large part of the resource rent, it can be used as a proxy of the resource rent itself. Empirically, this valuation may be sufficiently accurate owing to the considerable uncertainties that affect other methods and would also result in some implicit "smoothing" of the resource rent. In particular, this method avoids having to make an assumption about the rate of return to fixed capital.

In order to estimate the government's share of the resource rent, taxes on production and income are divided into two groups, taxes specific to oil and gas extraction (including specific taxes on production) and taxes of a general nature. The government's part of the resource rent consists of the specific taxes on production and income (and royalties). The remainder of the total resource rent is then the extractor's part.

This raises the question of how to divide the taxes paid by the extracting industry into 'specific' and 'non-specific' taxes. One method is to look at the taxes that according to the tax code are specific to extraction. This works well for taxes on production, but for income taxes the results of this method are sensitive to the way the taxation system is set up. If specific taxes on income are payable on the extractor's profit after the general (non-specific) corporate income tax, then corporate taxes are paid on the part of the rent that later will be appropriated by the government as specific taxes. This means that the government would collect corporate taxes on its share of the resource rent.

If the tax system involves payment of specific taxes after general corporate taxes, a better solution is to calculate a "normal" corporate income tax on the normal return to fixed capital. The rest of the income tax is then allocated to the government's part of the resource rent. The tax rate that is applied to the normal return to fixed capital can for example be calculated as the ratio of corporate taxes paid to net operating surplus for the extraction industry. See Annex 1 for an example, based on the situation in the Netherlands.

4 Monetary balance sheets and accumulation accounts

The monetary balance sheets and accumulation accounts have been combined into a table that is similar in structure to the table used for the physical accounts (Table 1). The value estimates should be consistent with the physical stocks and flows.

Table 3: Monetary balance sheets

	Year 1	Year 2	Year 3	Year 4	Year 5
Opening stock					
Nominal holding gains and losses					
Neutral holding gains and losses					
Real holding gains and losses					
Other changes in volume					
Extraction					
Revaluation due to time passing					
Closing stock					

Table 3 is to be filled in for oil and gas separately. The data should be in national currency, with the same unit as in Table 2.

Definition and valuation methods for the different items are discussed below.

See Annex 2 for an example of the calculation of stocks and flows in monetary terms, based on these definitions.

4.1 Valuation of the stocks

The value of the stock of reserves should be estimated using the present value method, i.e. by discounting the expected future resource rent resulting from the extraction process.

The discount rate

A discount rate of 4% should be used. This is close to the average real rate of return on government bonds.

The future resource rent

Making a forecast of the future resource rent requires assumptions about the development of prices, extraction costs and the level of extraction. For accounting purposes it is advisable to use relatively simple and transparent assumptions. In this context, it is useful to consider two elements separately, rent per unit extracted and the level of extraction.

Future resource rent per unit extracted

The stock value estimates should be calculated using a future unit rent (resource rent per unit extracted) that is constant, and equal to a three-year symmetric moving arithmetic average of the unit rents. The figure for year t is calculated as the arithmetic average of years t-1, t and t+1. Before the average is calculated, the unit rents should be converted to the prices in the current year (year t) using the GDP deflator.

Usually, the estimate for year t is compiled at a time when the unit rent data for t+1 are already available, but if this is not the case, a forecast of the t+1 unit rent should be made based on available short-term data for year t+1. The stock value estimates should then be revised at a later date, using unit rate data for the whole year t+1. Possible short-term data sources for the unit rent are the quarterly national accounts and price statistics for oil and gas. Unit extraction costs are relatively stable in the short run, so if no short-term data are available, the costs of the previous period can be used.

Future extraction path

Stock value estimates for the latest available year and for annual updates should be based on an explicit forecast of the future extraction path, if one is available. If no specific information is available about the path of future extraction, the estimates should be based on a constant level of extraction, equal to extraction in the year the estimates refer to. When a new year is added to the series, the forecasts used for the stock value estimates for previous years should **not** be revised using the actual extraction for the latest year.

The assumed future extraction path should be consistent with the estimate of the physical resource stock. This means that the sum of the assumed extraction in year t+1 and future years should be equal to the stock at the end of year t.

The establishment of a historic time series should ideally be based on the same principles as those used for the latest year (i.e. based on forecasts available at the time the estimates refer to), but this may be difficult in practice, so a simplified method is acceptable as a second-best solution.

In this case, the estimate of the future extraction path should be based on one of the following methods:

a) Actual extraction data up to a certain year, and a forecast for future years. (In order to harmonise the estimates as much as possible, the last year for which actual extraction data is used should be 1998.)

or

b) Constant extraction, equal to the level in the year the estimates refer to.

The method used should be the one that is deemed to be the best approximation to forecasts made in the past for the country in question.

Decommissioning costs

The resource stock value estimates are based on extrapolation of the current resource rent, which (using the method suggested above) includes only small current decommissioning costs, so it is likely that the effect of the future decommissioning costs will be underestimated if no correction is made. This would lead to overestimation of the stock values, so in principle a forecast of future decommissioning costs should probably be included in the net present value calculation. In practice, however, both the size and the timing of future decommissioning costs may be difficult to estimate, and the estimates for the UK show that the impact is relatively small. For these reasons, it is suggested to leave future decommissioning costs out of the subsoil accounts for the time being. This is an area that will be investigated further in the future, however.

Sensitivity analysis

Because the stock values are so dependent on the assumptions used in the calculation, it is useful to include a sensitivity analysis in the accounts. Table 4 shows the current price values of the closing stocks of oil and gas for the latest year, based on different combinations of assumptions for the discount rate, the rate of return and the unit rent. The shaded cells represent the 'standard' set of assumptions, used in Table 3.

Table 4: Value of closing stock of oil and gas, based on different assumptions

	Crude oil and NGL				**Natural gas**			
	Unit rent				Unit rent			
	3-year moving average			Current year	3-year moving average			Current year
	Rate of return			Rate of return	Rate of return			Rate of return
Discount rate	6%	8%	10%	8%	6%	8%	10%	8%
0%								
2%								
4%								
6%								
8%								

4.2 Value of the flows

The accumulation accounts show the link between the opening and closing stocks of the assets. In Table 1 the changes in the physical stocks of subsoil assets are classified into extraction and other changes in volume, with discoveries as a sub-category. The monetary value of the resources, defined as the present value of the expected future resource rent, can change also for other reasons. The following classification and corresponding valuation methods for the changes in the monetary value of subsoil assets are suggested:

Opening stock	Value of reserves at the end of the previous year, t-1: $PV_{t-1}(rr_{t-1}, E_{t-1})$
Nominal holding gains and losses	Change in the value of opening reserves due to change in the level of the unit resource rent: $PV_{t-1}(rr_t, E_{t-1}) - PV_{t-1}(rr_{t-1}, E_{t-1})$ $= (rr_t/rr_{t-1}) * PV_{t-1}(rr_{t-1}, E_{t-1}) - PV_{t-1}(rr_{t-1}, E_{t-1})$ $= (rr_t/rr_{t-1} - 1) * PV_{t-1}(rr_{t-1}, E_{t-1})$
Neutral holding gains and losses	The part of the nominal holding gains and losses that can be attributed to change in the general price level: $PV_{t-1}(rr_{t-1}*I_t/I_{t-1}, E_{t-1}) - PV_{t-1}(rr_{t-1}, E_{t-1})$ $= (I_t/I_{t-1} - 1) * PV_{t-1}(rr_{t-1}, E_{t-1})$
Real holding gains and losses	The part of the nominal holding gains and losses that can not be attributed to change in the general price level: $PV_{t-1}(rr_t, E_{t-1}) - PV_{t-1}(rr_{t-1}*I_t/I_{t-1}, E_{t-1})$ $= (rr_t/rr_{t-1} - I_t/I_{t-1}) * PV_{t-1}(rr_{t-1}, E_{t-1})$
Other changes in volume	Change in value due to other changes in the volume of reserves and change in the future path of extraction: $PV_{t-1}(rr_t, (e_t, E_t)) - PV_{t-1}(rr_t, E_{t-1})$ $= PV_{t-1}(rr_t, (e_t, E_t)) - (rr_t/rr_{t-1}) * PV_{t-1}(rr_{t-1}, E_{t-1})$
Extraction	Quantity extracted multiplied by the present year's per unit resource rent: $- rr_t * e_t$
Revaluation due to time passing	Value of the opening reserves at the conditions of the present year (i.e. calculated using the unit resource rent and extraction of the present year), multiplied by the rate of discount: $r * PV_{t-1}(rr_t, (e_t, E_t))$
Closing stock	Value of the remaining reserves at the end of the present year, t: $PV_t(rr_t, E_t)$

In the table above,

- § rr_t is the three-year moving average unit rent for year t,
- § e_t is extraction in year t,
- § E_t is the expectation in year t of future annual extraction from year t+1 until the stock is exhausted in year t+n, i.e. it is a vector $(e_{t+1}, e_{t+2}, \ldots\ldots, e_{t+n})$,
- § r is the rate of discount (which is assumed to be constant over time),

§ PV_t is the present value calculated at the end of year t, which is a function of the unit rent, future extraction and the discount rate. The formula for PV_t is:

$$PV_t(rr_t, E_t) = \frac{rr_t e_{t+1}}{(1+r)} + \frac{rr_t e_{t+2}}{(1+r)^2} + \frac{rr_t e_{t+3}}{(1+r)^3} + ... + \frac{rr_t e_{t+n}}{(1+r)^n}$$

§ I_t represents an index of the general price level, and is used for partitioning the nominal holding gains into neutral and real holding gains. According to the ESA 95 §8.57, the price index for final national uses, excluding changes in inventories, should be used for this purpose.

4.3 Stock value estimates in constant prices

Two different approaches are used for stock value estimates for oil and gas in constant price or volume terms. They may be called the production approach and the income approach.

A) The production approach

The value of the stock of oil and gas in year t is calculated in the prices of the previous year using the same formula and data as for the current price stock, by replacing the unit resource rent used for year t with the unit rent used for year t-1. (Strictly speaking, the resource rent is an accounting residual that does not have price and volume dimensions, so the unit rent is not a price, but the terms volume and price are used here for convenience.) The unit rents used here are the three-year moving averages. This results in time series of stock values for oil and for gas where each year is expressed in the previous years prices. These can then be combined with the current price data and chain volume indices can be compiled using the same methods as in the standard national accounts. These volume indices show the changes in the stock values caused by changes in the physical stocks and the future extraction path.

B) The income approach

This is a measure of the value of the stock in real terms, estimated by deflating the nominal stock values with a general price index. Compared to the production approach, this will not only show the effect of changes in physical stocks and extraction path, but also changes in the relative price (or rather relative unit rent) of oil and gas. This will give a measure of the development in the purchasing power of the monetary value of the stock. (The method is similar to that used in the ESA95 for measuring income flows in real terms.) The price index used should be the same as the one used to estimate the neutral holding gains, i.e. the price index for final national uses, excluding changes in inventories (ESA 95 §8.57).

The proposal is to add two rows for each approach to the current price monetary balance sheets for oil and gas. The first row shows the value of the closing stock in the previous year's prices, the second row shows the value in the prices of a reference year. The reference year should be the same as that used by Eurostat for the national accounts data, currently it is 1995.

Annex 1: Government appropriation of the resource rent

This annex illustrates how income taxes paid by the extraction industry can be divided into specific and general taxes, for the purpose of calculating the government's share of the resource rent. The example is based on the situation in the Netherlands, but could be applicable also to other countries.

The initial assumptions are:

Net operating surplus: 100
Net capital stock: 125
Rate of return to fixed capital, before corporate taxes: 8%
General corporate income tax rate, payable on net operating surplus: 25%
Special income tax rate on extraction, payable on income after corporate taxes: 70%

In this case, we get:

Return to fixed capital, before tax: 10 (= 0.08*125)
Resource rent: 90 (=100 – 10) (Net operating surplus less return to fixed capital)
General corporate income taxes: 25 (= 0.25*100)
Special income tax on extraction: 52.5 (= 0.7*75)
Extractor's after tax income: 22.5 (= 100 – 25 – 52.5)

Using the tax code's definition of specific taxes on income, we get:

Government's share of resource rent: 52.5 (=Special income tax on extraction)
Extractor's share of resource rent: 37.5 (= 25 + 22.5 - 10)

With these definitions, the extractor's share of the resource rent includes all general corporate income taxes, also the part that falls on the rent appropriated by the government as special income tax on extraction.

Two alternative ways to divide the corporate tax revenue are possible (method B is recommended):

A) Divide the general corporate tax revenue of 25 between government and the extractor in proportion to their shares of the net income after corporate taxes. The shares are:

Government: 0.7 (=52.5/75)
Extractor: 0.3 (=22.5/75)

The total resource rent of 90 will then be distributed as follows:

Government: 70 (= 52.5 + 0.7*25)
Extractor: 20 (=22.5 – 10 + 0.3*25)

Note that in this case the extractor's part of the rent includes the corporate tax paid on this rent (25% of 20 = 5), i.e. the rent is measured "pre-tax".

B) A "normal" corporate tax for the extractor could be estimated by applying the general corporate tax rate (estimated as corporate taxes divided by net operating surplus) to the return to fixed capital: 2.5 (= 0.25*0.08*125)

The total resource rent of 90 will then be distributed as follows:

Government: 75 (=52.5+25 –2.5)
Extractor: 15 (= 22.5 - 10 + 2.5)

The remaining part of the extractor's after tax income of 7.5 (= 22.5 – 15) is then the after tax return to fixed capital.

Annex 2: Valuation of stocks and flows

The example below shows the calculation of stocks and flows in monetary terms. The example data are fictional, and refer to oil and NGL for the year 2001. The starting points for the value calculations are the physical balance sheet for 2001, the forecasts of future extraction made in 2000 and in 2001 and the moving average unit resource rent in 2000 and 2001.

Physical balance sheet for oil and NGL, million tonnes

	2001
Opening stock	500
Extraction (e_{2001})	-112
Other changes in volume	37
Closing stock	425

Forecast of future extraction, million tonnes

	2001	2002	2003	2004	2005	2006
Made in 2000 (E_{2000})	110	110	105	90	85	0
Made in 2001 (E_{2001})	:	115	100	95	85	30

Moving average of unit resource rent, euro per tonne

In 2000 (rr_{2000})	10
In 2000 (rr_{2001})	12

In order to calculate real and neutral holding gains, the general price level is assumed to increase by 5% from 2000 to 2001.

The discount rate is assumed to be 4%.

Based on these data, the calculation methods described in section 4.2 give the following results:

Category	Value	Calculation
Opening stock	4476	Value of the reserves at the end of the previous year, 2000: $PV_{2000}(rr_{2000}, E_{2000})$ $= (10*110)/1.04 + (10*110)/1.04^2$ $+ (10*105)/1.04^3 + (10*90)/1.04^4$ $+ (10*85)/1.04^5$
Nominal holding gains and losses	895	Change in the value of opening reserves due to change in the level of the unit resource rent: $PV_{2000}(rr_{2001}, E_{2000}) - PV_{2000}(rr_{2000}, E_{2000})$ $= (rr_{2001}/rr_{2000}) * PV_{2000}(rr_{2000}, E_{2000}) - PV_{2000}(rr_{2000}, E_{2000})$ $= (rr_{2001}/rr_{2000} - 1) * PV_{2000}(rr_{2000}, E_{2000})$ $= (12/10 – 1) * 4476$
Neutral holding gains and losses	224	The part of the nominal holding gains and losses that can be attributed to change in the general price level: $PV_{2000}(rr_{2000}*I_{2001}/I_{2000}, E_{2000}) - PV_{2000}(rr_{2000}, E_{2000})$ $= (I_{2001}/I_{2000} - 1) * PV_{2000}(rr_{2000}, E_{2000})$ $= (1.05 – 1) * 4476$
Real holding gains and losses	671	The part of the nominal holding gains and losses that can not be attributed to change in the general price level: $PV_{2000}(rr_{2001}, E_{2000}) - PV_{2000}(rr_{2000}*I_{2001}/I_{2000}, E_{2000})$ $= (rr_{2001}/rr_{2000} - I_{2001}/I_{2000})*PV_{2000}(rr_{2000}, E_{2000})$ $= (1.2 – 1.05) * 4476$
Other changes in volume	361	Change in value due to other changes in the volume of reserves and change in the future path of extraction: $PV_{2000}(rr_{2001}, (e_{2001}, E_{2001})) - PV_{2000}(rr_{2001}, E_{2000})$ In this expression, $PV_{2000}(rr_{2001}, (e_{2001}, E_{2001}))$ $= (12*112)/1.04 + (12*115)/1.04^2$ $+ (12*100)/1.04^3 + (12*95)/1.04^4$ $+ (12*85)/1.04^5 + (12*30)/1.04^6$ $= 5732$ while $PV_{2000}(rr_{2001}, E_{2000})$ is the sum of the opening stock and the nominal holding gains/losses, i.e. 4476 + 895 = 5371

Category	Value	Calculation
Extraction	- 1344	Quantity extracted multiplied by the present year's per unit resource rent: $- rr_{2001} * e_{2001}$ $= - 12 * 112$
Revaluation due to time passing	229	Value of the opening reserves at the conditions of the present year (i.e. calculated using the unit resource rent and extraction of the present year), multiplied by the rate of discount: $r * PV_{2000}(rr_{2001}, (e_{2001}, E_{2001}))$ $= 0.04 * 5732$
Closing stock	4618	Value of the remaining reserves at the end of the present year, 2001: $PV_{2001}(rr_{2001}, E_{2001})$ $= (12*115)/1.04 + (12*100)/1.04^2$ $+ (12*95)/1.04^3 + (12*85)/1.04^4$ $+ (12*30)/1.04^5$

Summarising, we get the following monetary balance sheet:

Monetary balance sheet for oil and NGL million euro

	2001
Opening stock	4476
Nominal holding gains and losses	895
Neutral holding gains and losses	224
Real holding gains and losses	671
Other changes in volume	361
Extraction	-1344
Revaluation due to time passing	229
Closing stock	4618