Dr Elzbieta Broniewicz
Technical University of Bialystok
St. Tarasiuka 2, 16-001 Kleosin
POLAND
e-mail: ekotrend@pb.edu.pl

Application of environmental protection expenditure account

Summary

The paper presents the environmental protection expenditure account (EPEA) conception, according to methodology of Statistical Office of the European Communities Eurostat. The analysis of EPEA elements in certain countries of European Union was presented, e.g. production of environmental services, environmental protection expenditure and financing of environmental protection. Surveys were conducted in some countries of European Union – Austria, Germany, France, Denmark, the Netherlands and Latvia, Lithuania and Poland. In old members EU survey's results concern 1991-1999, but in new members the first surveys were undertaken in 2005 and concern years of 2002-2004. EPEA Tables were compiled for environmental domain – air protection, waste management, wastewater management and others, and for institutional sectors – governments, specialised producers, non-characteristic producers, households and rest of the world. Important part of the paper is proposition and examples of application of EPEA in environmental management process and sustainable development.

1. European System for the Collection of Information on the Environment (SERIEE)

Tendency to complex calculating of costs and advantages of natural environment management have been observed since about 1970. In spite of this only after publishing the World Commission Environment and Development report in 1987, international community seriously analyzed environmental aspects and sustainable development. This question will also provide the basic theme on UN Conference on Environment and Development in 1992. Initially creating of satellite accounts complementary in relation to traditional national accounts was proposed. After that attempts of modifying of national accounts were taken. Consequently, in 1993 UN conception - *System of Integrated Environmental and Economic Accounts* (SEEA) was published.

In 1994 Statistical Office of UE Eurostat has published the handbook *European System for the Collection of Economic Information on the Environment - SERIEE*, which includes basic definitions and methods applied in data collecting about environment protection expenditure.

Eurostat has developed SERIEE to satisfy the demand for environmental data. It is intended to supply the Member States with a common framework for the collection and presentation of economic data on the environment. The immediate objectives of SERIEE are:

- to trace the monetary flows linked to environmental protection,
- to characterise the impact of environmental protection on the European economic system,
- to compute indicators.

SERIEE consists of 3 pillars (Fig.1):

1. Natural Asset Account.
2. Environmental Protection Expenditure Account.
3. Intermediate Systems for data collection and treatment.

Figure 1. Pillars of European System for the Collection of Economic Information on the Environment

SERIEE				
Natural Asset Account		Environmental Protection Expenditure Account		Intermediate Systems for data collection and treatment

Source: own compilation.

Following this publication, several countries engaged in pilot exercises in order to test the implementation of the SERIEE framework and in particular the Environmental Protection Expenditure Account (EPEA). In parallel, Eurostat started to collect data on environmental expenditure by industries and government from Member States. The EPEA pilot exercises showed that in statistical practice it is difficult to fully transpose and implement the 1994 SERIEE framework. Adjustments and simplifications were necessary for making compilation more practical.

In 2002 Eurostat published modification of SERIEE – *SERIEE Environmental Protection Expenditure Accounts – Compilation Guid*e.

2. Environmental Protection Expenditure Account (EPEA)

EPEA describes the resources allocated for environmental protection by different categories of economic units (national expenditure for environmental protection), those activities which carry out environmental protection, as well as the financing of these resources and activities. This description, within a framework consistent with the national accounts, facilitates the breakdown of the national expenditure and makes it possible to distribute its financing among the different categories of units: general government and households as consumers, producers, rest of the world.

The purpose of the EPEA is, within a framework consistent with the European System of Integrated Economic Accounts (ESA), to come up with answers to the following questions:

- How much does a nation spend on environmental protection and what form does this expenditure take?
- How and by which units is this expenditure financed?
- Which economic activities are induced by environmental protection?

EPEA consists of three main tables:

1. Table A – National environmental protection expenditure by components and by users/beneficiaries
2. Table B – Production of characteristic services
3. Table C – Financing of national expenditure for environmental protection

and two supplementary tables:

1. Table B1 – Production of characteristic services
2. Table C1 – Environment-related financial burden (Figure 2).

Figure 2. The set of EPEA tables

Table B	Table B1	Table A	Table C	Table C1
Production table	Supply-use table	Uses (Expenditure) tables	Financing of expenditure	Net cost related to environmental protection
OUTPUT of EP services	FROM OUTPUT TO USES: introduction of Imports/Exports and Taxes/Subsidies on products	USES OF EP SERVICES by resident units	FINANCING of uses of EP services	FINANCING OF CURRENT uses of EP services
Gross capital formation + land acquisition		Gross capital formation + land acquisition	Gross capital formation + land acquisition	Cost of capital (interests)
		Uses of adapted and connected products	Uses of adapted and connected products	Uses of adapted and connected products
		Specific transfers	Specific transfers	Specific transfers
				Less EP benefits
				Environmental taxes

Source: Eurostat, (2002), *SERIEE: Environmental Protection Expenditure Accounts: Compilation Guide*.

In EPEA there is distinction between:

- Characteristic activities are activities whose purpose is environmental protection. For the classification of characteristic activities the CEPA (*Single European Standard Statistical Classification of Environmental Protection Activities*) is used.
- Connected and adapted products are products which are neither characteristic services nor do constitute characteristic activities but whose use serves an environmental protection purpose.
- Specific transfers are unrequited payments received by resident or non-resident units which contribute to the financing of characteristic activities and uses of specific products or constitute a compensation for income or capital losses related with environmental protection.
- Market and non-market output

  Market output is basically output sold at economically significant prices (when it covers at least 50% of the cost of production).

  Non-market output is output provided free or at prices that are not economically significant.
- Units

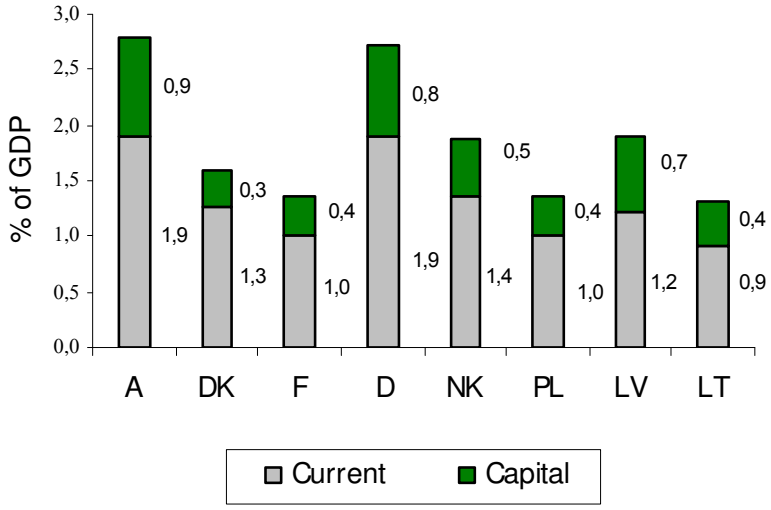
  There are three kinds of units, identified according to their function(s) with respect to environmental protection – user and/or beneficiary units, characteristic producer units and financing units
- User and/or beneficiary units are units which:
  - use specific products (characteristic services, adapted and connected products) under the heading of final or intermediate consumption,
  - make investments in order to produce environmental protection services,
  - make investments in specific products,
  - benefit from specific transfers for environmental protection.
- Characteristic producer units are units which produce environmental protection services. The following are distinguished:
  - specialised producers (They execute a characteristic activity as their principal activity)
  - non-specialised characteristic producers (They execute a characteristic activity as secondary or ancillary to their principal non-characteristic activity)
- Financing units finance environmental protection (directly or indirectly).

3. Application of environmental protection expenditure account

3.1. International level

The EPEA is an instrument for the follow-up of environmental policy. The main objective is to assess the economic resources for environmental protection. As for national accounts in general, the final aggregate (the national expenditure for environmental protection) is mainly useful for international comparisons. The main indicator for international comparison is the share of environmental protection expenditure in Gross Domestic Product. Figure 3 presents the percentage of national expenditure in relation to GDP in each country for the main components of current and capital national expenditure (consumption of external services, consumption of ancillary services, uses of adapted and connected products and subsidies, capital formation and net acquisitions of land) for the total of the three main domains – air protection, wastewater and waste management. The comparability of data between countries is limited due to differences in coverage and methods. It is however possible to give an overview of results for the 'core' expenditure in terms of environmental domains and components of expenditure.

Figure 3. Expenditure for air protection, waste and wastewater management in % of GDP, the latest available year



Source: E. Broniewicz (2006), *Environmental protection expenditure account in European countries*, EMAN Conference, Graz.

Austria and Germany have the highest expenditure in relation to GDP, 2.77% and 2.71% respectively for the total of the three domains. For both countries, current expenditure is 1.9 % of GDP. Latvia and the Netherlands come in second position, with 1.91% and 1.87% of GDP. Current expenditure is 1.35% for the Netherlands and 1.23 % for Latvia. However, the estimates in the

Netherlands are rather old – 1991 year. The results of Latvia are from 2003. The percentage for Denmark is 1.60% of GDP, but this does not include ancillary activities nor connected and adapted products, which would add approximately 0.55% of GDP. Finally, Poland, France and the Lithuania are much lower: 1,37%, 1.36% and 1.31% of GDP respectively.

3.2. National level

The EPEA aggregates are closely comparable with national accounts main aggregates so that ratios between EPEA aggregates and national accounts aggregates may be calculated that are true shares. Ratios could include e.g.:

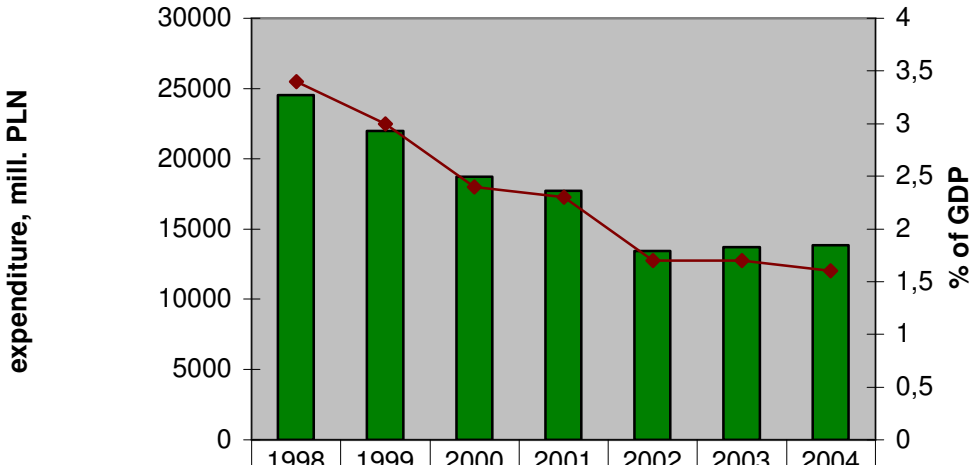
$$\frac{national\ expenditure}{Gross\ \ Domestic\ Product},$$

$$\frac{capital\ expenditure}{Gross\ \ fixed\ capital\ formation},$$

$$\frac{government\ \ expenditure}{government\ consumption}.$$

In Figure 4 is presented national expenditure of environmental protection in Poland in 1998-2004.

Figure 4. Expenditure for environmental protection in Poland in 1998-2004 [constant price, 2004] and the share in GDP [%] – except households



	1998	1999	2000	2001	2002	2003	2004
expenditure	24550	21966	18697	17695	13424	13707	13860
% of GDP	3,4	3	2,4	2,3	1,7	1,7	1,6

Source: own compilation.

The amount of expenditure and relation to GDP in Poland was constantly decreasing.

Constant price estimates are series expressed in the prices of a base year to explain changes in quantities in monetary terms. They are widely used in economic analysis and in many cases economic analysis is best served by analysis of changes in constant prices.

More useful for policy analysis are the various components of the national expenditure, the national expenditure by environmental domain, and the changes over time.

Key aggregates are national current and capital expenditure, by categories of users/beneficiaries and financing units, and by environmental domains. A typical presentation is shown in Tables 1 and 2.

Table 1. Current and capital expenditure for environmental protection in Belgium [mill. of euro]

Categories	Expenditure for environmental protection in million euro		
	1997	2000	2002
Households	647	741	957
Government	679	1055	1056
Producers	2086	2948	3636
market purchases of EP services	840	1637	1171
internal measures	1246	1311	2445
Rest of the world	4	4	14
Total	3416	4748	5663

Source: own compilation on the basis of: G. Vandille (2005) : *Environmental Protection Expenditure Accounts for Belgium: 1997- 2002*, Brussels.

Table 2. Financing of current and capital expenditure for environmental protection in Belgium [mill. of euro]

Categories	Financing of expenditure for environmental protection in million euro		
	1997	2000	2002
Households	868	973	1142
Government	416	843	964
Producers	2131	2927	3556
market purchases of EP services	242	356	275
internal measures	1889	2571	3281
Rest of the world	1	5	1
Total	3416	4748	5663

Source: own compilation on the basis of: G. Vandille (2005) : *Environmental Protection Expenditure Accounts for Belgium: 1997- 2002*, Brussels.

Employment in environmental protection activities is another important indicator. The production table (Table B) includes data on employment by characteristic producers. Starting from this information employment data may be published, which should distinguish the detailed categories of producers.

Table 3. Employment in environmental protection activities

Categories	Current expenditure for environmental protection in million national currency		
	year 1	year 2	year 3
Non-market producers			
Market producers			
specialised producers			
government			
corporations			
ancillary activities			
Total			

Source: Eurostat (2002): SERIEE – Environmental Protection Expenditure Accounts – Compilation Guide, Luxemburg.

The presentation of current and capital expenditure by domain in time series is very important to assessment of environmental policy goals. The tables may be shown, as in Table 4. It could be very interesting, if these tables may be compiling for each economic activities.

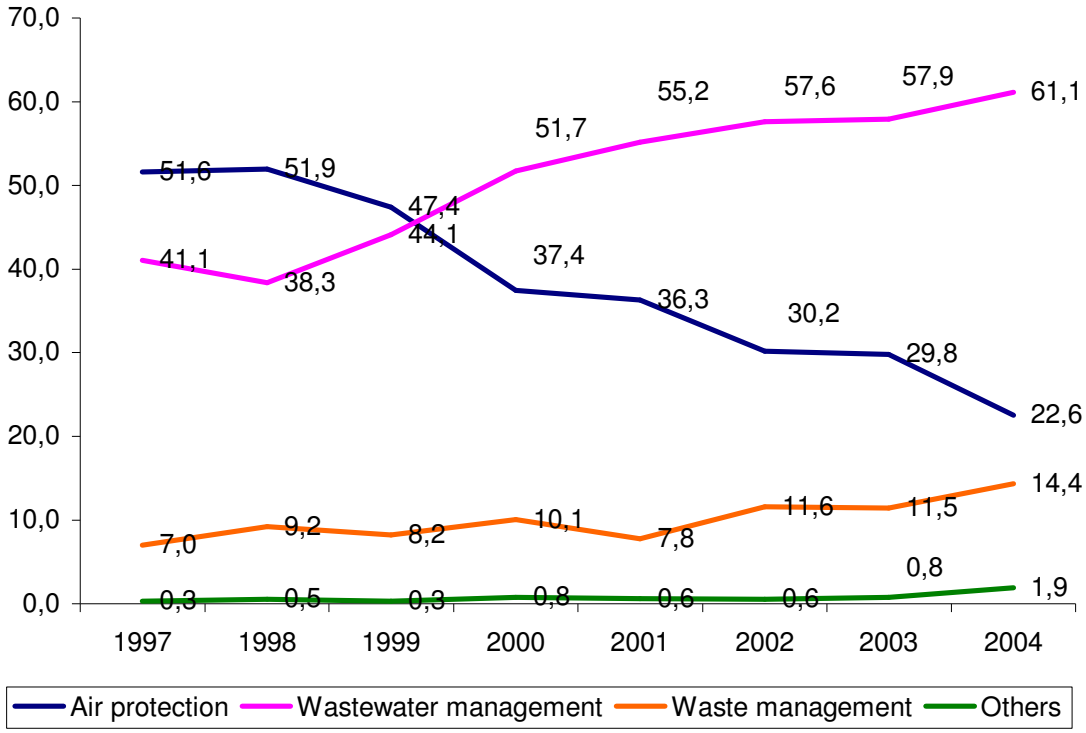
Table 4. Current and capital expenditure

Environmental domains	Expenditure for environmental protection					
	Current		Capital		Total	
	absolute values	%	absolute values	%	absolute values	%
Air						
Water						
Waste						
Soil and groundwater						
Noise						
Landscape and biodiversity						
Radiation						
R&D						
General administration, etc.						
Total		100%		100%		100%

Source: Eurostat (2002): SERIEE – Environmental Protection Expenditure Accounts – Compilation Guide, Luxemburg.

In Figure 5 are presented capital expenditure by environmental domains in Poland in 1997-2004.

Figure 5. Structure of capital expenditures of environmental protection by domain In Poland In 1997-2004 [in %]



Source: own compilation.

The two domains – wastewater management and air protection are constantly the main domains in Poland. In 2004, they were 83,7% capital expenditures. Goals of *Environmental Policy in Poland* [2002] in the period of 2002-2010 predict the following structure of capital expenditure of environmental protection:

- air protection – 27.8%,
- wastewater management – 39.0%,
- waste management – 29.0%,
- other domains – 4.2%.

3.3. Links to physical, social and economical data

An important issue is to present physical data in parallel with monetary data. Data on flows of pollutants and other environmental pressures is particularly interesting for users to link environmental expenditure time series with changes in the pressures on the environment that are due to economic activities.

Data on effective pollutant flows can concern the 'produced' pollutants, the 'collected and treated' pollutants, the 'eliminated' pollutants and the pollutants 'discharged' to nature (e.g. water

bodies). Some of these flows can be directly related with environmental protection activities, e.g. flows of waste and wastewater that are collected and treated by waste and wastewater management activities.

However, emissions vary not only according to the environmental protection measures but also with the level and the structure of economic activity. Therefore the influence of changes in economic activities should be eliminated through the calculation of aggregated emission coefficients by industry (e.g., emissions per unit of output or value added). Emissions also vary with environmental protection measures which do not translate in expenditure (changes in products for intermediate consumption, energy saving etc.). Comparison is however limited as the stock of fixed capital for environmental protection can hardly be divided according to the various pollutants.

Such issues could be addressed when emission data are published with expenditure data. Austria in 1999 made a integrated matrix for various type of activity (Table 5).

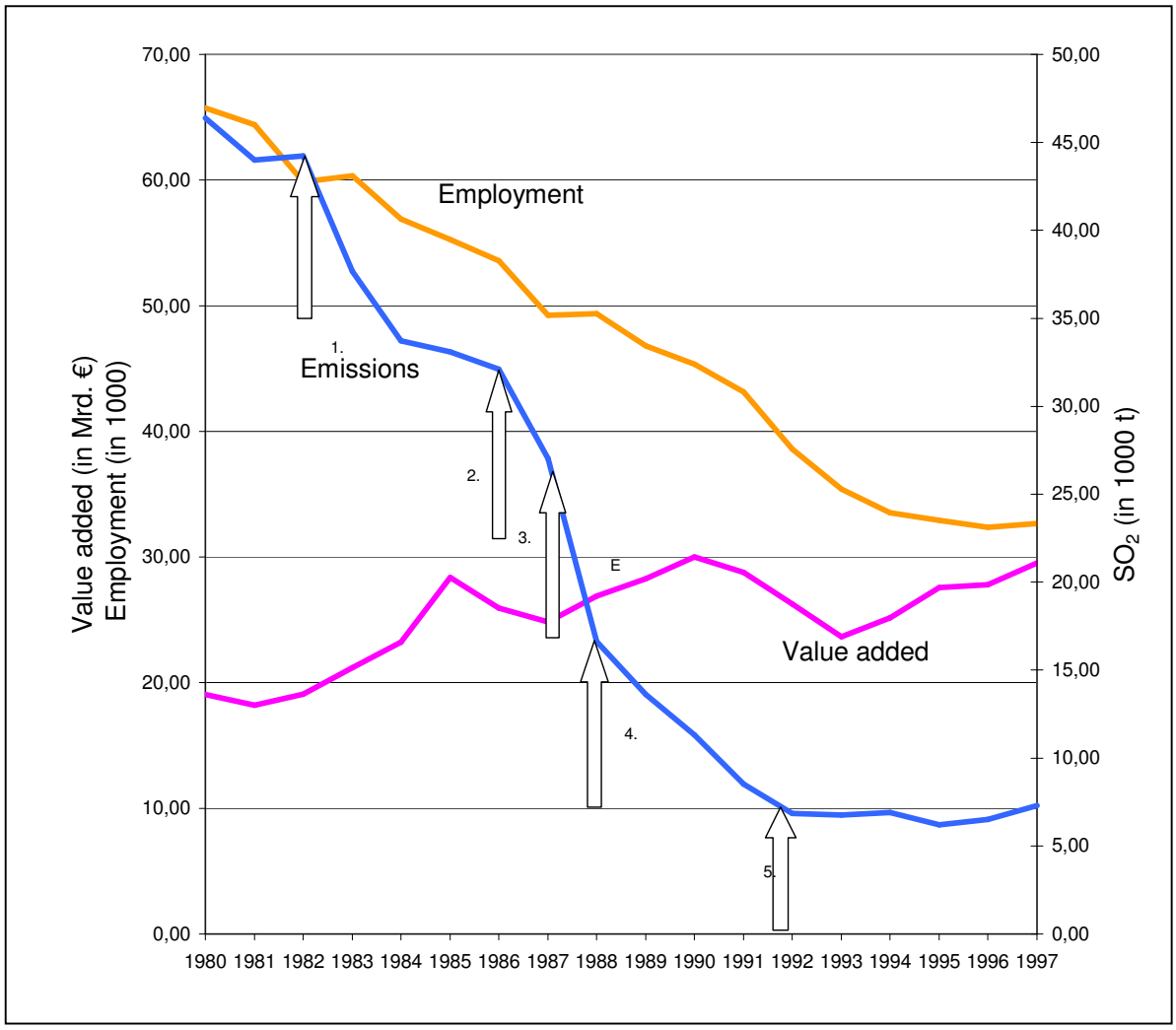
Table 5. Matrix for

Structure	Output	Value Added	Emplo-yees	Material Flow Account			Final Energy Consumption	Emissions to Air					Hazar-dous Waste	Non- Hazar-dous Waste	Environmental Expenditure	
				Fossil Material	Biomass	Mineral Substances		SO_2	No_x	CO_2	N_2O	NH_3			Air	Waste
	Basic Prices															
	1.000 Euro		Full Time Equivalent	Mio. Tons			Tera-joule	Tons					Tons		1.000 Euro	
Basic Metals	6 345 281	2 272 113	31 151	7 374 839	-	6 712 268	50 894	5 253	8 953	10 097 461	51	58	58 170	3 973 117	60 327	39 228
Coke, Refined Petroleum and Chemical Products	8 133 456	4 277 308	29 944	24 479 501	-	2 444 798	27 612	6 536	10 148	3 744 409	1 078	215	42 998	-	41 361	30 179
Non-Ferrous Metals	-	-	-	252 706	-	4 555 132	5 632	-	-	-	-	-	-	-	-	-
Other Non-Metallic Mineral Products	4 727 027	2 222 164	35 382	2 816 201	-	50 703 638	27 624	1 156	7 150	3 407 054	3	12	6 356	-	12 370	25 841
Motorvehicles, Transport Equipment	7 753 681	2 397 739	36 123	57 220	-	-	5 020	48	172	119 845	3	5	24 816	-	18 041	11 365
Machinery and Equipment	10 341 623	4 396 179	75 104	50 161	-	1 470 500	4 309	79	227	181 176	4	5	10 154	-	4 447	11 763
Mining and Quarrying	1 271 866	647 083	7 246	3 551 066	-	88 909 631	5 844	750	1 125	914 615	8	21	5 135	-	8 236	11 921
Beverages and Tobacco	12 457 648	4 552 443	77 991	368 906	41 431 037	-	16 307	575	1 136	661 342	16	31	7 379	1 197 675	15 848	99 183
Pulp, Paper Products, Publishing and Printing	8 831 980	3 388 987	43 141	2 812 548	1 787 000	-	60 778	3 595	8 210	3 228 932	116	149	11 058	710 836	9 318	32 569
Wood and Wood Products	5 311 295	1 782 405	38 712	57 367	-	-	8 218	309	1 983	319 757	42	54	4 529	3 502 400	6 611	7 019
Construction	27 963 750	14 968 184	273 078	1 204 860	9 164 568	89 528 762	15 644	150	320	110 999	7	10	14 809	21 907 000	-	-
Textiles, Wearing Apparel and Leather Products	4 507 530	1 591 966	41 500	74 377	-	-	6 215	191	338	272 022	3	7	2 317	135 507	4 284	10 999
Ohter Manufacturing Domains	26 465 449	11 728 090	212 233	4 782 109	13 980 704	6 105 066	20 083	966	1 473	875 981	17	28	81 574	-	20 639	172 961
Transport via Railway	9 789 221	6 280 226	131 485	1 251 718	5 295 113	5 048 367	9 434	2 086	91 203	15 833 306	2 010	2 132	21 549	-	-	-
Other Land Transport				7 583 568	10 599 766	10 699 954	225 880								-	-
Transport via Pipeline				160 367	-	-	8 451								-	-
Water Transport	117 295	36 787	322	6 505	-	-	278	10	543	58 573	2	2	147	-	-	-
Air Transport	2 308 539	740 060	7 562	527 716	-	-	22 850	170	745	108 233	12	25	89	-	-	-
Private and Public Services	180 321 062	114 532 110	1 859 538	-	1 503 823	3 368 448	108 325	1 536	5 557	2 210 214	546	214	237 704	2 340 637	4 341	1 402 914
Energy Supply	9 437 757	4 474 053	33 046	9 269 514	-	-	-	7 018	12 140	12 280 092	170	176	246 497	-	28 977	33 852
Private Households	-	-	-	10 037 104	33 421 019	16 137 154	284 615	10 793	13 502	10 498 327	403	491	97 000	2 509 000	316 409	497 016
Agriculture, Hunting and Forestry	5 882 339	3 917 792	26 446	557 706	72 139 102	1 936 624	27 278	211	18 149	1 102 171	3 716	67 208	522	370 000	36 230	104 119
Total	**331 966 799**	**184 205 688**	**2 960 004**	**77 276 060**	**189 322 131**	**287 620 343**	**941 290**	**41 432**	**183 074**	**66 024 509**	**8 206**	**70 842**	**872 803**	**36 646 172**	**587 439**	**2 490 930**

Source: Baud S. (2005) *Environmental Protection Expenditure Account and Environment Industry Account*, Statistic Austria.

Data form this table for time series, can be presented on figures. One of this (Figure 6) shows various variables: employment (social indicator), value added (economic indicator) and emissions of SO_2 (environmental indicator) for units in NACE 27 „Production and treatment of metal“, Member State.

Figure 6. Development of SO2 in NACE 27 „Production and treatment of metal“, Member State



Source: Hanauer J. (2005) *Environmental Accounts,* DG ESTAT Unit E5, Eurostat.

For this figure expenditure of air protection in this type of economic activity can be add. It may be a good tool for many analysis.

Conclusions

The amount of countries which have elaborated Environmental Protection Expenditure Account is constantly rising. Old members of European Union have more experience and have EPEA accounts in time series. New members are in beginning stage of compilation EPEA Tables. Now, this is very important to find application this data in practise. An environmental policy and sustainable development need many indicators to assessment and decision-making.

Bibliography

1. Broniewicz E. (2006): *Environmental protection expenditure account in European countries*, EMAN Conference, Graz.
2. Eurostat (2002): SERIEE – European System for the collection of economic information on the environment – 1994 Version, Luxemburg.
3. Eurostat (2002): SERIEE – Environmental Protection Expenditure Accounts – Compilation Guide, Luxemburg.
4. Eurostat (2002): Environmental protection expenditure in accession countries, Data 1996-2000, Luxemburg.
5. Baud S. (2005): *Environmental Protection Expenditure Account and Environment Industry Account*, Statistic Austria.
6. Hanauer J. (2005): *Environmental Accounts,* DG ESTAT Unit E5, Eurostat.
7. Vandille G. (2005): *Environmental Protection Expenditure Accounts for Belgium: 1997- 2002*, Brussels.