

## PAC EXPENDITURE - CONCEPT AND METHODOLOGY

Extract from : “Pollution Abatement and Control Expenditure in OECD Countries”, Environment Monograph, Paris, 1996.

### PART 1

#### PAC EXPENDITURE: CONCEPT AND METHODOLOGY

##### Definition of “Pollution Abatement and Control”

In this study, pollution abatement and control (PAC) activities are defined as purposeful activities aimed directly at the prevention, reduction and elimination of pollution or nuisances arising as a residual of production processes or the consumption of goods and services. This definition specifically excludes expenditure on natural resource management and activities such as the protection of endangered species (fauna and flora), the establishment of natural parks and green belts and activities to exploit natural resources (such as the supply of drinking water). Other exclusions are expenditure intended either for workplace protection or for the improvement of production process for commercial or technical reasons, even when they have environmental benefits. In total, PAC expenditure comprises the flow of investment and current expenditure that is directly aimed at pollution abatement and control, and which is incurred by the public sector, the business sector and households.

The three conceptual issues associated with the statistical treatment of PAC expenditure are:

- ◆ Definition of a baseline for PAC expenditure;
- ◆ Treatment of integrated pollution control technologies;
- ◆ Avoidance of double counting.
- ◆ These issues are important for the correct compilation, use and interpretation of PAC expenditure data. The following sections consider each of them in turn.

##### Defining the baseline

Investment and current expenditure can have positive environmental effects without being directly motivated by environmental concerns. One example is investment in energy-saving equipment that is carried out because of increases in energy prices. Thus, investment in environmentally friendly equipment by firms may be part of normal, profit-maximising business behaviour. This type of expenditure can be distinguished from other expenditure that is directly incurred for PAC purposes (*e.g.* as a consequence of government environmental policies and regulations).

The question arises whether PAC expenditure data should include only expenditure directly incurred for PAC purposes or all expenditure with positive

environmental effects. The answer depends on the use of PAC expenditure data:

- ◆ If PAC expenditure data are used **to identify the financial consequences of government environmental policy**, then only expenditures incurred directly for PAC purposes should be included.
- ◆ If the objective of collecting PAC expenditure data is to **assess the overall links between capital formation and pollution burden or to identify the share of overall expenditure which has positive effects for the environment**, then all expenditure with positive environmental effects should be included in PAC expenditure.

Most OECD Member countries, in their statistical approaches, include only expenditure that is directly aimed at environmental protection. This approach was also adopted in the OECD questionnaire agreed upon by Member countries. In statistical practice, the identification of such expenditure is difficult, particularly in the business sector, where firms may be unable to distinguish between the different investment motives. It is difficult to identify when pollution abatement is the actual motivation behind less wasteful use of raw materials; therefore, the measurement of air and water pollution abatement expenditure may differ from this baseline. For solid waste, for example, some countries employ simple, pragmatic solutions: the United States routinely attributes a fixed proportion (70 per cent) of expenditure for collection and disposal of municipal waste to pollution abatement and control (30 per cent is assumed to be ordinary expenditure not attributable to government environmental policies and regulations).

***End-of-pipe and  
integrated  
technologies***

The abatement and control of residuals from production processes can be done either by **end-of-pipe technology** attached to a given production process, or by **changing the process** itself. Investments in end-of-pipe technologies do not change the production process and the entire outlay is for pollution control. The difficulty associated with investments in integrated technologies is establishing what proportion of the total investment expenditure should be allocated to pollution abatement and control. In principle, the cost difference between the integrated plant and what would have been paid for a cheaper, viable, but less environmentally benign plant, should be recorded as PAC expenditure. There is, however, no easy way to handle this problem in statistical practice. One possibility is to pose this question explicitly in business surveys. Experience from a number of OECD countries shows that respondents often find it difficult to deliver accurate replies.

It is likely that the problem of accounting for investments in integrated technology will become more important in the future. Government environmental policies and business strategies are moving from curative to preventive approaches, thus increasing the relevance of integrated technologies as opposed to end-of-pipe solutions. In Finland, for instance, process integrated investments accounted for 32 per cent of industrial PAC investments in 1992 and 45 per cent in 1993 (Statistics Finland, 1995).

**Avoiding double counting**

As economic agents interact, the same pollution control activity can be recorded by several agents, thus making double counting a possibility. One example is private sector PAC expenditure that is subsidised by the government. Unless a clear distinction is made between the execution and the financing of PAC activity, both the public sector and the firm will report the expenditure for PAC purposes, resulting in double counting. It is, therefore, important to distinguish between the execution of an environmental service (*abater principle*) and the financing of the environmental service (*financing principle*).

The OECD questionnaire follows a structure that links these two approaches. Figure 1 presents the basic case with financial flows only between the public and the private sector. Investment plus current expenditure minus receipts from by-products of PAC activity make up the expenditure according to the abater principle. Purely financial transfers in the form of subsidies, fees or charges account for the transition to the financing principle. In theory, this approach could cover the various financial flows within the private sector (*i.e.* an input-output table for PAC market transactions) and within the public sector (flows of funds between different levels of government). At present, however, the availability of data limits the possibility of taking such a comprehensive approach.

Figure 1: Abater and Financing Principles

PUBLIC SECTOR		PRIVATE SECTOR	
	Investment expenditure		Investment expenditure
+	Current expenditure	+	Current expenditure
-	Receipts from by-products of PAC activity	-	Receipts from by-products of PAC activity
=	PAC expenditure according to the <i>Abater Principle</i> (Expenditure 1)	=	PAC expenditure according to the <i>Abater Principle</i> (Expenditure 1)
+	Subsidies to the private sector	-	Subsidies from the public sector
-	Fees/charges from the private sector	+	Fees/charges to the public sector
=	PAC expenditure according to the <i>Financing Principle</i> (Expenditure 2)	=	PAC expenditure according to the <i>Financing Principle</i> (Expenditure 2)

Only a few OECD Member countries (*e.g.* the Netherlands) evaluate expenditure according to both principles. Their work shows a significant difference between expenditure calculated according to the abater principle and that based on the financing principle: public sector expenditure is nearly 75 per cent higher, if subsidies and fees are taken into account, meaning a significant difference in the sectoral structure of PAC expenditure.

## PART 2

### PAC EXPENDITURE DATA: INTERPRETATION, USE AND LIMITS

PAC expenditure is the first-order, out-of-pocket expenditure of those economic entities that implement control measures and undertake compliance activities. As such, PAC expenditure does not provide any more, or any less information than, for example, health or education expenditure.

Total PAC expenditure provides a **general indication of a country's financial efforts directed at pollution abatement and control**. However, as absolute figures, the relevance of these data for policy purposes is limited; PAC expenditure has to be related to other variables. A common way of comparing PAC expenditure data across countries is to relate them to GDP or total gross fixed capital formation (Summary Tables 1 and 2).

#### **Dimensions of PAC expenditure**

PAC expenditure has several dimensions, each with a particular interpretation. Here, PAC expenditure is disaggregated by:

- Environmental media (air, water, waste, noise);
- economic sector (public sector, business sector, households);
- type of expenditure (investment, current expenditure).

#### *Environmental domain*

Disaggregation of PAC expenditure by environmental domain (Summary Table 3) indicates whether pollution control efforts are directed towards waste management, noise reduction, or protection of air or water.

Here, waste includes municipal as well as industrial waste, which in turn includes hazardous waste, ordinary waste and inert or heavy waste (waste from the extractive industries and power stations, demolition waste). It includes sewage sludge but excludes waste water. For waste, PAC activities comprise: preventive measures to limit the amounts and harmful effects of waste generated from the final consumption of goods and to limit the production of industrial waste or lessen its harmful effects: collection and transport; treatment and disposal; exploitation of waste; and regulation and monitoring.

PAC activities for soil and water comprise collection and purification of waste water, combating of pollution in the marine environment, prevention, control and monitoring of surface water pollution, combating of pollution of inland surface waters, prevention and combating of thermal pollution of water, abatement of groundwater and soil pollution, and regulation and monitoring.

PAC activities for air comprise monitoring and regulation of atmospheric pollution, prevention of air pollution linked to the production process, installation of non-polluting technologies (clean technologies and clean products used in the production process) and elimination of emissions at the source (dust removal equipment and filters).

<i>Environmental domain</i>	<p>PAC activities for noise include regulation and monitoring, preventive action at the source and construction of anti-noise installations. Measures aimed at reducing industrial noise for workplace protection are excluded.</p> <p>PAC activities related to other types of pollution control include abatement and control of non-radioactive radiation, multifunctional PAC activity and general administration of the environment.</p>
<i>Economic sectors</i>	<p>Disaggregation of PAC expenditure by economic sector indicates, first of all, the sector, where the PAC activity occurs (abater principle). When financial transfers between different sectors are taken into account, disaggregation of PAC expenditure by economic sector points to the sector paying for the PAC activity (financing principle). In Summary Tables 1-3 expenditure is allocated to the various sectors according to the abater principle and does not include financial transfers. Any conclusions about the sharing of the financial burden among sectors must therefore be drawn with great caution. The economic sectors distinguished are the public sector, the business sector and households.</p> <p>The public sector comprises federal and local governments and communities.</p> <p>The business sector covers agriculture, hunting and fishing (ISIC 11 and 13); forestry (ISIC 12); mining and quarrying (ISIC 2); manufacturing (ISIC 3); electricity, gas and water (ISIC 4); construction (ISIC 5); transport, storage and communications (ISIC 7); and other services (ISIC 6, 8 and 9 except government).</p> <p>Household PAC expenditure according to the abater principle includes sewage treatment by households (<i>e.g.</i> septic tanks) and purchase, operation and maintenance of air pollution control devices for motor vehicles. Operation and maintenance expenditure includes items such as price differentials for unleaded gasoline or service costs for proper adjustment of engines. Fees paid to communities for services such as waste collection are included in household PAC expenditure evaluated under the financing principle.</p> <p>The business sector and households comprise the private sector.</p>
<i>Type of expenditure</i>	<p>The distinction between investment and current expenditure helps in identifying patterns of abatement and control efforts over time. Typically, when PAC measures are first implemented, investment expenditure accounts for a large share of total PAC expenditure. Over time, current expenditure becomes increasingly important.</p> <p>Investment expenditure is defined as outlays (purchases and own-account production) on land and on additions of new durable goods to the stock of fixed assets for pollution abatement and control.</p> <p>Current expenditure includes PAC outlays for own production of environmental services (wages, rents, energy, maintenance and intermediate inputs) and for environmental services and specific goods bought in from the market (when, for instance, a chemical firm has its waste site cleaned up by a specialised enterprise).</p>

## Measuring economic effects

PAC **expenditure** is not the same as the **cost** of pollution abatement and control, but the cost can be calculated from PAC expenditure data. Capital goods are used over a number of years and their cost is spread over their service life. Expenditure data, on the other hand, shows the total value of the capital goods in the year of acquisition and does not, therefore, reflect accurately the economic effects over time. The calculation of the PAC cost requires appropriate assumptions about service lives, interest rates and several other parameters. For current expenditure, the notions of cost and expenditure coincide. For the purposes of assessing the economic impact of environmental policies, it would be preferable to look at cost rather than expenditure.

A different use of PAC expenditure data is to calculate PAC shares in total cost or total turnover for particular industries. **Cost shares** are a useful indicator for assessing **the effects of environmental regulation on industry competitiveness**. In industries where PAC cost shares are small, the impact of environmental policies will be felt less than in industry branches where these shares are high.

PAC expenditure data are also an important aid in identifying the positive economic effects of environmental policies. Measures to protect the environment create demand for abatement and clean production technologies and environmental consulting services, and spur environment-related R&D. National and international statistics on PAC expenditure provide the basic information needed to estimate the size and evolution of markets and potential for the environment industry.

## Caveats

The relationship between PAC expenditure and the state of the environment can be explored only as part of the overall context of a country, and with the aid of supplementary information. Out of context, high PAC expenditure can be associated both with low environmental quality (indicating that such levels of expenditure are necessary) and with high environmental quality (indicating improvement as a result of high PAC expenditure).

PAC expenditure measures the economic effort to control pollution; it does not measure the cost of environmental damage. As such, PAC data should not be generalised to wider cost-benefit analysis, or used to decide whether abatement is justified. In deciding whether to undertake abatement, damage costs should be used. These are often very different from control costs.

All significant changes in a country's PAC expenditure must be reviewed with care. PAC expenditure may increase because of improved sectoral coverage (*e.g.* local government expenditure was not included before) or the inclusion of investments in integrated technology (*e.g.* only investments in end-of-pipe technology were reported earlier).

The remainder of this report presents the main results from the 1996 survey of PAC expenditure in OECD Member and Observer Countries. Since the previous survey in 1994, country coverage and the international comparability of data have improved. In many instances, however, definitions and methodologies remain diverse across Member countries. International comparisons should, therefore, be limited to orders of magnitude.