BSO/ORIGIN Annual Report 1990

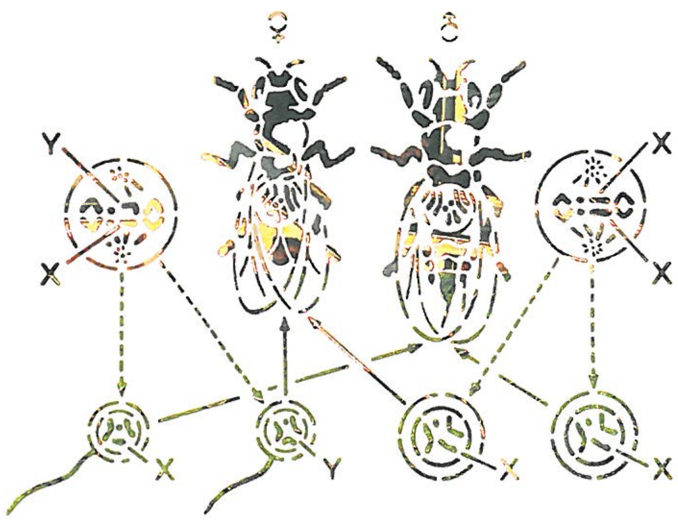
Company objectives BSO/ORIGIN

BSO/ORIGIN's prime objective is to provide high-quality services to trade and industry and to the government, with a view to supporting the principal in introducing new technologies in the broadest sense of the word.

The support is extended in the form of advice, management, development, implementation, education and training.

The company aims to be the most professional and qualitatively the leading provider of services in this market segment, both from the (external) point of view of the prospective customer and from the (internal) point of view of the staff members, creating a working environment with which the latter can identify themselves and in which they are prepared to work with enthusiasm and dedication.

BSO/ORIGIN strives to achieve this objective on a financially sound basis so as to safeguard the company's continued existence.



And the band played on...

While the Titanic, the world's largest passenger liner, was sliding beneath the waves, the ship's orchestra carried on playing undaunted. The absurdity of the situation leaves us with a feeling of overwhelming pity.

The fools: playing on to the bitter end as though nothing was wrong. Or were they trying to prove that nothing was wrong? How was it possible?

However, is our situation so very different from theirs? Every day the papers bring us reports of environmental problems, disasters and scandals that threaten our planet.

Strangely, those reports usually come at the back of the financial pages. As though nothing was wrong, we first hear the good news about X & Co.'s improved turnover and Y Corporation's expansion plans. Encouraging noises, but with the same false cheerfulness as the orchestra on the Titanic.

Playing on as though nothing was wrong? Or perhaps trying to prove nothing's wrong?

Apart from an occasional mention in the science and technology pages, the papers rarely address the relationship between the environmental news and the financial news. As though the link between ecology and economy were one of etymology only.

We can no longer afford to shut our eyes to the other relationship that exists between these two. That's why the traditional annual report essay this time deals with the link between ecology and economy and seeks a means of measuring that correlation.

Whatever happens, we must not allow ourselves to be blinded by the financial aspects of our economy, unable (or unwilling) to see that the ship is in danger of sinking.

We mustn't play on as though nothing was wrong, so that the future generation will ask 'How was it possible?'

Eckart J. Wintzen
President BSO / Holding

Pulling our planet out of the red

Waste-paper collections, bottle banks, organic waste collections, catalytic converters on our cars, going easy on the gas pedal: with a little luck, we'll learn how to take better care of our environment. But let's not delude ourselves. It will take more than these steps, however important they may be in themselves, to restore the environment to good health. This kind of 'clean behaviour' has hardly produced spectacular results. True, the rate of environmental damage is slowing a little, but the damage itself is still growing day by day. And that's in a stable and already very prosperous country, not a developing nation which is in the process of building up its standard of living.

In today's world, only 15% of countries are already rich. Another 25% are growing towards prosperity and the remaining 60% are poor nations, about 35% of them struggling at below subsistence level. We in the developed world might question whether material wealth should be the only goal, but this carries little conviction in countries which have barely experienced it.

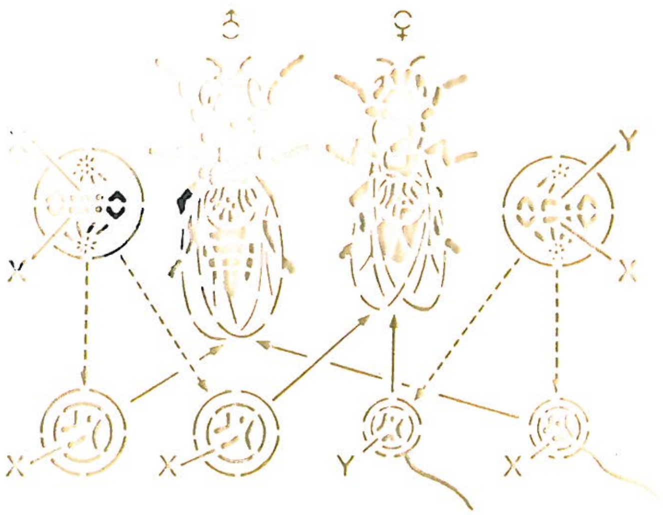
It is easy enough to complain about the destruction of the rain forest when your own forests were cut down centuries ago, leaving a handful of nature reserves. We can hardly deny our fellow inhabitants of the planet the right to seek progress for themselves. Unfortunately, their advancement has implications for us.

We can make a simple calculation. Fact one: world population is still growing inexorably. Fact two: an increasing number of countries are becoming active as producers and trading partners. Fact three: standards of living are still rising, even in the most highly-developed countries. Combine these three trends and even a modest increase of 2 to 4% in each case means that, in 30 years' time, the burden on the environment will be 15 times greater than today. This exponential growth cannot be controlled without drastic action.

But is this a valid calculation? One is reminded of the 19th-century New Yorker who worked out that if horse-drawn traffic continued to grow unchecked, the mountains of manure in the streets would ultimately reach the rooftops. He failed to anticipate the development of manure-free transport – and we might question whether it was really an improvement. The waste emitted by today's traffic has risen far beyond the rooftops of the most prestigious skyscrapers, to penetrate deep into the stratosphere.

Fortunately, one factor has been ignored in our calculation: the ecological measures which are now being implemented. Equally fortunately, these go well beyond speed limits and separate waste processing. But that still doesn't

$$\text{global damage} = \frac{\text{population} \times \text{penetration} \times \text{standard of living}}{\text{ecological efficiency}}$$



change the fact that we're not doing enough. More action has to be taken. But in which areas? All of them – which is easier said than done.

Take population growth: to control this, development aid has to be linked with family planning. But it will still be a slow and difficult process, with enormous social, financial and logistical hurdles to overcome.

Should we accept a reduction in our standard of living? An oft-repeated cry, but unfortunately the pursuit of happiness so often means the pursuit of more. We are never satisfied, and nothing is ever good enough. We should, the argument goes, cure ourselves of this 'addiction'. But the desire for more is deep-seated, since it's one of the basic drives that stimulate development. So this is one of the hardest nuts to crack, in both psychological and ethical terms.

What about curbing economic growth? But where? In the countries that have just begun to take part in the process? Or in our own countries? Quite apart from the fact that our economies have grown hand in hand with our welfare needs, we wince at the very idea. In our current scheme of things, government budgets would implode and stock markets crash as soon as growth came to a halt.

Companies with shareholders, which includes almost all larger companies, therefore have no choice and are doomed to growth. But they are free to direct that growth and so to work at solving the dilemma. On one side of the scale we have the capitalist growth paradigm and, on the other, growing ecological destruction. The challenge is therefore to redirect growth in a way which causes less ecological damage. This will make unprecedented demands on the creativity of the entrepreneurs – the only group with real opportunities to take action.

If the business world really wants to tackle the problem, they will need appropriate measurement tools: the main one could be ecological accounts, so that they can use and perform calculations on environmental data in the same way as their existing financial data. This means that value added can no longer be related to sales alone, but has to be offset against the loss of environmental value.

This will require a different perception of corporate accounting, moving away from strict financial analysis towards a more comprehensive overview, in which utilisation of the planet's resources carries as much weight as other factors. We can no longer behave like wanton heirs, who not only squander the revenue generated by their inheritance, but also eat into its very fabric.

Ecological accounting

The only companies which seek, and sometimes succeed, in incorporating environmental measures into their production systems are companies which can justify this in terms of the benefit of a more environment-friendly public image. While this is a good starting-point for a spiral of motivation and action, it is not enough. A more fundamental change is needed, so that economic value added genuinely takes into account the loss of ecological value. All economic processes, with a few exceptions, are destructive to the environment. That cannot be avoided, but we can start to relate the ecological costs to the economic benefits.

In due course, the data must be calculated, assigned a monetary value and organised so that companies can work with them as easily as with traditional accounts. This will enable budgets and cost/benefit analyses to be prepared as part of a strategy in which economic and ecological impacts are in balance. Like traditional accounts, 'eco-accounts' must be measurable and verifiable and must therefore be based on agreed standards. Only then can ecological progress be accurately assessed and discussions of environmental impact placed on a more rational footing.

Clearly, a new system of this kind will not be created overnight, any more than the existing system was. But we have to make a start – 'start' being the operative word.

Environmental accounts

Environmental accounts express a company's environmental impact in financial terms.

They can be used to calculate a net value added, representing the company's net return after taking into account its effect on the environment. In addition to a company's value added, environmental accounts also have to include the 'value lost', which is the cost of the company's environmental impact less its expenditure to control that impact.

The company's net value added is the difference between the value added and the value lost. Measuring value added presents no new problems, but the concept of 'value lost' could give rise to misunderstandings. We first have to determine precisely what a company's environmental impact covers.

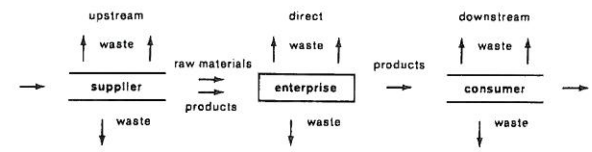
Because companies are intricately rooted in society and have very varied points of contact with that society, their ability to exert control also varies, with both negative and positive effects. Positive action includes motivating staff to operate in a more environmentally friendly way, introducing schemes which alleviate the impact of commuting and encouraging suppliers to develop more environmentally efficient operations.

For the time being, however, the negative effects will predominate – air, water and soil pollution due to discharges or emissions of hazardous substances, damage to wildlife and continuing consumption of finite resources, such as fossil fuels and minerals. We can make the list as long as we like.

What is difficult is to determine where a company's responsibilities and opportunities start and end. We first have to untangle a complex skein of direct and in-direct effects. Direct effects include the company's own pollution and the consequences of its own energy consumption. But there are also indirect effects. Every company consumes raw materials and products bought in from third parties. The production of some of these causes environmental damage. In other cases, excessive demands are made on natural resources. We can call this the 'upstream' impact.

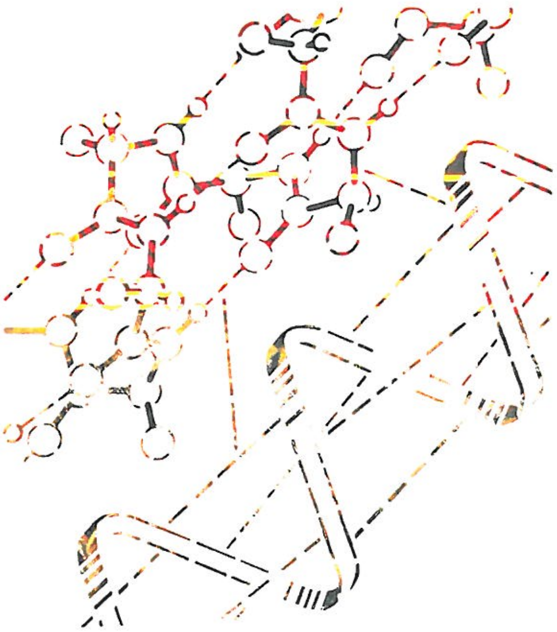
Other effects include pollution caused by products which the company sells, both during and after consumption. This could be anything from firelighters and mercury batteries to industrial packaging and ice-cream wrappers. This is the 'downstream' impact.

A company therefore actually has three ways of controlling environmental damage. It can take action in-house, for instance by installing pollution control units and taking steps to minimise energy consumption. It can influence the upstream impact through more selective purchasing, thereby encouraging suppliers to operate with greater environmental efficiency. Lastly, it can influence the downstream effects by supplying more energy-efficient products, containing fewer hazardous substances and packaged in more environment-friendly materials.



What should be included? This is a question of selection and is therefore no simple matter, but it would be helpful to consider the following arguments. In economics, value added is a cumulative quantity, in which the value added of an end product equals the sum of the values added by the individual companies which worked to produce it. To turn value lost into a macro-economic variable, without double-counting, we therefore have to take account only of the company's direct effects, not the upstream or downstream impacts.

The disadvantage of this approach is that a company would be able to whitewash its own environmental accounts by, for instance, replacing fuel oil with electricity. Its own emissions would be reduced, but power station emissions would increase. On the other hand, a company could generate positive upstream effects by, for instance, purchasing only recycled paper or ordering equipment produced by cleaner processes. Taking the separate cumulative approach, these positive effects are not reflected in the company's own environmental accounts. Environmental accounting can only work well if all companies in the production chain work together, on the basis of the same standards, and reflect environmental cost in their product cost.



BSO / ORIGIN

As BSO / ORIGIN is a service company and not a producer or supplier of goods, it produces little downstream pollution, but we hope that the systems we build sometimes lead to efficiency improvements, with both direct and indirect benefits for the environment.

The company's own environmental impact is confined to air pollution, water pollution and material waste. The nature of our company precludes noise pollution – unless our staff have an unusually boisterous day. And barring traffic risks and stress, we can also rule out occupational health and safety factors.

BSO / ORIGIN's upstream environmental impact occurs in the production of the goods and services we buy; paper, electricity, computers, copiers, cars, furniture, stationery, cleaning materials and so on. It is difficult to take these upstream effects into account. Often, too little information on these effects is available or they depend on the environmental efficiency of the supplier. Even if all the effects were known, only a proportion could be ascribed to BSO, in so far as the company is able to influence them through its purchasing decisions. That influence is limited.

The one significant exception is energy consumption. Generally speaking, different forms of energy are fairly easily substituted, for instance by switching from oil to gas or electricity. As we have seen, it is all too easy to reduce emissions from our own central heating boilers by switching consumption to the power stations. Energy consumption is a factor which carries a great deal of weight, because burning fossil fuels is the primary source of CO_2 emissions and therefore of the greenhouse effect. This phenomenon is increasingly seen as the main threat to our environment.

For all these reasons, BSO / ORIGIN's environmental accounts reflect not only the direct environmental impact, but also the pollution caused by the power stations generating each kWh consumed by the company (an upstream effect). This is a deliberate exception to the rule and no other upstream impacts are reflected in the accounts.

We realise that this is a mixed and arbitrary formula and this is made clear in the presentation of our environmental statements. Of course, we also have to agree on how we measure the company's environmental impact. We have proceeded on the premise that this should be downstream of the company's own pollution, i.e. at the point where our own 'waste pipe' discharges, and upstream of the third parties who process our pollution. The real costs incurred in this 'transfer' are set off only against the pollutant effect of the materials we pass on for processing. This avoids simply washing our hands of the matter by paying others to cope with our pollution. After all, experience has proved that good faith can be a variable concept in subcontracted waste processing, covering the spectrum from public service to organised environmental crime. This is, of course, yet another arbitrary principle, but the line has to be drawn according to conscience.

Preparing environmental accounts

Environmental accounts are comparable to income and expenditure accounts. The value added is stated on the credit side and the value lost to the planet on the debit side. This produces a net value added.

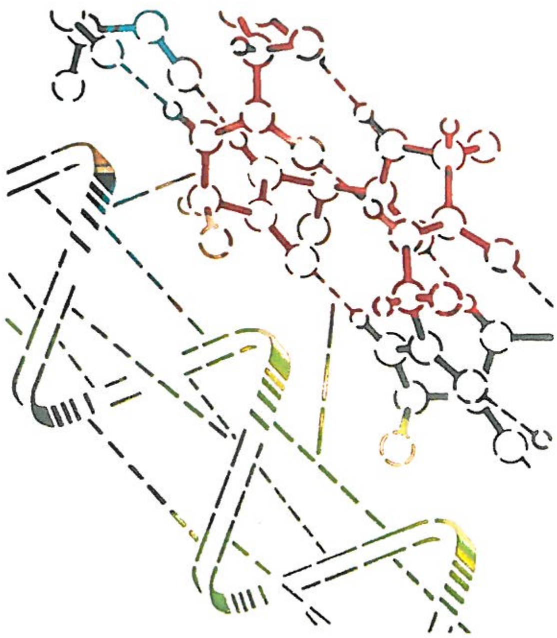
The value added is derived from the company's financial statements and is the sum of personnel costs, depreciation, downward value adjustments, provisions, financial charges, taxation and net profit.

The value lost comprises the costs entailed by the company's impact on the environment, less the company's expenditure on lessening this impact.

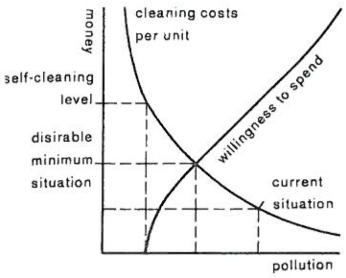
The costs of the company's environmental impact can be divided into two categories. The first covers the environmental costs relating to the treatment or processing of emissions by third parties (public or commercial), regardless of who bears the costs. Generally speaking, they relate to removal and treatment of waste water and transport and disposal of solid wastes.

The second category consists of the theoretical costs of the residual impact on the environment. Residual impact is the company's environmental impact after all purification and treatment processes have been carried out. Examples include pollution discharged into the atmosphere after flue-gas desulphurisation, the pollution remaining in water discharged by treatment plants and the pollution caused by sewage sludge and the dumping of unburnt residues from incineration plants.

The company's expenditure on reducing its environmental impact consists of payments for subcontracted environmental services and the environmental levies imposed on the company. Any environmental grants are deducted from these levies.



To determine the 'cost' of the residual effects, we looked at calculations made by a dozen economic institutes of the level of costs which the current economic system would be willing to bear. Surprisingly, it was substantially higher than the price society is actually paying at the moment. Although the acceptable cost level calculated by the economists is still too low in absolute terms, we must not allow the pollution of our planet to continue to increase. The theoretical costs of reducing all pollution to the point where the planet could absorb the remainder without difficulty are substantially higher than the economic level referred to above.



In short, we pay less than is considered reasonable and what is considered reasonable is not enough to be effective. Actually, therefore, BSO/ORIGIN is still getting off cheaply. But no beginning is easy.

Environmental accounts in the future

What we have described here is, of course, only a first step, a 'finger exercise' aimed at finding a method of economic operation which takes full account of the ecological pressures on our planet. This will only really work if environmental accounts are also given the place they deserve in business accounting. Only then will a new market develop for products and services that take these new parameters into account. And only then can we start to measure by new yardsticks, the real yardsticks of our economic system, part of which is our environment. Once we have established the real ecological cost of products and services, this will provide an impetus for effective recyling, effective control of energy consumption and ecologically efficient production. Or better still, the development of totally different products which do not harm the environment, such as services. We say this, not because we are a service company ourselves, but because there are so many opportunities in this area.

In short, what we are calling for is economic development in which the environment counts. The first signs are already there, both in government and in industry. The German Environment Minister Klaus Töpfer is contemplating a form of 'return deposit' on cars, so that owners take some responsibility for what happens to their vehicles later. Society may eventually impose a carefully calculated environment tax, based purely on 'value lost', a mature successor to the present, rather arbitrary system of fines and levies for the most productive companies which could genuinely 'reward' companies for environmental efficiency.

We should not underestimate the creative forces that will be released in this process. For instance, an industry that, in the space of a few years, is able to satisfy the demands of 'turbo mania' and then, with a change in public opinion, switch to competing in catalytic converters, must be able to do more. It's all a question of demand.

The next challenge is how to make the change structural rather than piecemeal. Although environmental accounts are, as far as we know, still quite rare and are bound to suffer teething troubles, the idea seems to lend itself to further development and wider application.

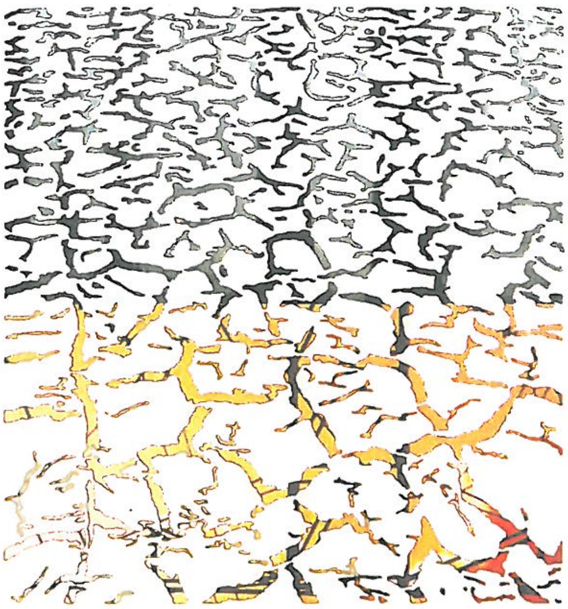
Just as corporate value added is calculated to determine gross national product, value lost should now be calculated to determine national loss. We could call the difference 'net national ecological product'. It would provide useful data for macro-economic calculations and serve as a basis for comparing national ecological performance, for instance within the EC.

A long way to go

Environmental damage is still growing, even in the prosperous Netherlands. As we illustrated with the formula at the start of this report, exponential growth appears set to continue. So far, we haven't managed to curb our present rate of growth, let alone started to reduce it. BSO / ORIGIN fully appreciates that its initiative is a mere drop in the ocean. But we have to start somewhere. And if you want to make a start, you have to take a structured approach based on structured facts.

BSO / ORIGIN is aware of the shortcomings of this hastily formulated approach, but if more companies took the condition of our planet seriously as an integral factor in development and prosperity, accounts which give as much weight to environmental debt as to any other item could become the most normal thing in the world.

And so it should be. What good, after all, is a profit and loss account that fails to take account of the costs of our own survival? And one that passes on the bills to future generations, without even an apology?



17 What people have been working on

Electric put options?

High tension on the floor of the stock exchange; turnover climbing to new records; prices rising; brokers running around in panic. With three telephones on his shoulder and one eye on his five screens, the dealer rattles his orders into a terminal at an awesome pace. Speed is the name of the game and millions are at stake.

This is the stereotype picture, familiar to many, of the share dealing which takes place every day on stock exchanges in New York, Frankfurt or Amsterdam. Only a few are aware, however, that there is a variant to this 'game'. The players of this version do not gather on the exchange floor, but are spread throughout the Netherlands. They do not buy paper shares, but the intangible phenomenon 'electricity'.

The electricity companies and bulk consumers of electricity have contracted a two-part price structure. Part of the charge is based on actual usage: this is in fact a payment for the fuels used in generating the electricity. The other element is a charge for the infrastructure. The scale of the infrastructure required, consisting of the high-tension network, distribution substations and generating stations, depends primarily on those few moments in the year when total consumption approaches its maximum. The share in these peaks of the companies concerned forms the basis for calculating the charge for the infrastructure costs.

At certain points in the country, electricity consumption is continuously monitored. The data are collected and during peak loads the relative share of the various electricity companies and bulk users is determined.

In the past, the consumption peaks occurred mainly on cold winter mornings at around 10 o'clock. Nowadays, with continuous consumption measurements being made available, to both consumers and producers via a realtime network, changes have taken place in this pattern, primarily because peaks have a high price tag. They no longer build up so rapidly, and consumption has levelled out. This is because a bulk consumer who sees a peak coming can temporarily halt his production process, causing his share in the total to fall. This has a twofold effect: the consumer limits his costs and the original peaks are considerably reduced, because he is not the only bulk consumer acting in this way.

A telecommunications network, for which BSO first wrote the definition and is now also drawing up the specification, gives those concerned a complete realtime picture of all electricity consumption in the Netherlands. This makes it possible in principle to 'deal' in electricity – for example, by switching off briefly at the moment that it appears that the consumption peak is about to be reached. 'Electricity trading' has become almost comparable with the stock exchange floor: even the stakes, amounting to many millions of guilders, are comparable.

BSO was commissioned by the organisation known as Sep, which represents all the electricity production companies in the Netherlands, to carry out a study of current procedures relating to this 'national loading indicator'. Included in the terms of reference was the way in which the existing network needs to be adapted to meet current and future demands and the changes necessary in the information systems. A definition study was completed first, and a technical specification was then drawn up. This was a complex commission which demanded not only knowledge of the state of the art in data communications, but also the solution of many technical and theoretical problems. The first report met with the client's approval, after which instructions were immediately given for a follow-up study to be completed in mid-1991.

Planning the electricity supply

BSO also received a number of other commissions from Sep in 1990; one of these concerned the information plan for the Planning and Research Section. This section plays a crucial role in the many tasks of Sep. For example, the so-called 'E-Plan' has to be drawn up every two years; this plan, in which the E stands for electricity, gives an indication of how electricity consumption and production is likely to develop over the next twenty years. It is therefore a document of great importance, not only for the electricity producers, but also, for example, for politicians. In preparing the E-Plan the Planning and Research Section makes use of torrents of information: figures relating to the market for domestic electrical appliances and trends in industry's installed base of machines; data on production technologies and fuel prices; the debates surrounding coal gasification and nuclear energy, for example - these are just a few of the sources. All these data are assembled and processed, mainly within specialised subsections, to construct predictive models for various areas such as production, consumption, fuels, environment and emissions. All the resulting models, analyses and forecasts are then brought together once again to form the single, comprehensive E-Plan.

The information plan for this vital Planning and Research Section takes account not only of the internal organisation and the use made of the information systems by the section itself, but also of the fact that the entire Sep organisation has to make wide use of the data collected here. An additional factor is that Sep is viewed by politicians as a 'watchdog', safeguarding the lowest possible energy prices. In consequence, Sep is much used as a source of information for 'The Hague', where energy management and the environment are seen as increasingly important. For this reason, there is a need to be able to give clear and reliable answers to political questions, as well as all the others, on the basis of the information gathered.

Surveying environmentally harmful substances

One of the greatest problems facing our information society is not so much the lack of information as the excess of it, something of which government licensing agencies are only too aware. For instance, it is virtually impossible to gain a clear insight into the risks for man and the environment involved in the use of any specific substance.

The stack of information which has to be studied to gain a reasonable picture of such a matter is often inches thick. Or else the only information the researcher has is a trade name, from which the actual composition of the substance can only be discovered with great difficulty. To make matters worse, there are around 100,000 'substances' which may be used by industry.

The information being sought is naturally highly dependent on the use. A local government official who grants licences will often be satisfied with knowing whether or not a substance is classified as harmful to the environment. At the level of the province, by contrast, there are specialists who will wish to determine on the basis of test results what risks are involved in the use of particular substances.

In close collaboration with toxicological experts (including those from regional water boards, provincial and local authorities and the Ministry of Housing, Physical Planning and the Environment), BSO and the consulting engineers Haskoning joined forces to draw up a plan for

the government for the development of a system in which selective data relating to particular substances are brought together. This information is tailor-made to the requirements of users in the various licensing agencies. In the preliminary phase, a lot of time was invested in determining the nature of the information needed. In collaboration with toxicologists, a decision was made at database level on which data should be included. Existing databases were used as the starting point for the design; of 200 such databases, a total of five were eventually selected and ranked. The first two are the Ministry of Housing, Physical Planning and the Environment's two important databases in this field, 'Notification of New Substances' and 'List of Standards'. The third in the sequence is the IRPTC database compiled by the environmental organisation of the United Nations, UNEP. For water pollutants, there is the AQUIRE database. Finally, there is the RTECS database, which contains limited information on some 100,000 general substances.

The result of each search is organised in a number of different ways. The first is a 'broad' approach, in which the data are summarised and evaluated before being included in the system. A subsequent stage provides greater 'depth', with the information becoming more and more detailed.

The system is being set up in stages by means of prototyping, with each stage being concluded by an evaluation. This result then refines the following prototype. Throughout the system, user-friendliness is one of the most important features.

In its present form, the system is offered to users on conventional computer media (hard or floppy disk); however, it will not be long before a CD-ROM version also becomes available. Each user will then receive regular updates on CD, for example four times a year.

Identification of organisms

That a shortage of information can be just as great a problem as an excess, is illustrated by the type of situation which may confront a doctor or foreign aid worker in Africa. There is sudden mass mortality, say, among the fish in the small river close to the village where he or she is stationed. Fish is a major component of the local diet; moreover, the population uses the river as its source of drinking water.

The doctor examines water samples, together with a few dead fish, and finds a micro-organism which is unknown to him or her.

If this situation were to occur today, there is a good chance that the medic or biologist would be unable to identify the organism. This is a problem with which many scientists and specialists are confronted 'in the field'. Their memories and textbooks enable them to identify organisms (ranging from plants and animals to micro-organisms) with a relatively high degree of accuracy. When confronted with an unknown organism, however, for example from a different class of animals, identification becomes considerably more difficult.

Many attempts have been made in the past to construct databases and develop computer programmes which can offer assistance here. To date, however, these have proved of little use: identification takes place on the basis of non-absolute data, while classic computerised aids function optimally only where they are supplied with absolute data, and preferably with figures.

In collaboration with the University of Amsterdam and supported by a subsidy from the Dutch government, the BSO subsidiary CAT Benelux is currently developing a system, based on database techniques that it has developed itself, which will enable users to identify an organism accurately, even using unclear – or incomplete – data. By employing a combination of several multimedia systems it will be possible to identify an organism on the basis of non-absolute data. Users 'in the field' and at institutes throughout the world will be able to use their own personal computers to address sections of the data which are stored in a very large central database. A selection from this central database could also be sent to the user on CD-ROM, facilitating refinement of the identification on site. To assist in this, the worker will have access not only to textual data, but also to sound and image material which has been recorded on the CD-ROM. By linking this 'expert system' to a database containing, among other things, ecological, environmental and medical data, a treasure house of data becomes directly available to a large group of users.

Safety at work

Although the computer, and particularly the personal computer, has penetrated virtually all disciplines and professions in recent years, there still remain some 'blank spots'. Until recently, for example, safety experts, in spite of the fact that their work involves dealing with large quantities of data and being able to find their way around those data very quickly – particularly in the event of disasters – had virtually no computerised aids at their disposal.

This led Philips to commission the development of a special programme for its own use, known as Persist, for the approximately fifty safety experts employed in the various Philips companies throughout the Netherlands. Using this programme, all occupational accidents resulting in injury or damage are recorded. From the records thus obtained, analyses can be made of the types of accident, injury and damage which have occurred within a given period. In addition, the programme can be used to generate official notices to the labour inspectorate.

More important than recording the incidence of accidents is, naturally, their prevention, and Persist offers the safety expert wide-ranging support in this area. All the 'P-sheets', containing the labour inspectorate's safety regulations, can be incorporated in the programme; once every quarter, the user receives a new version containing the latest amendments to these P-sheets. The user can choose to receive all the regulations, or only those P-sheets which are of importance to the particular organisation concerned. The keyword index included in the programme makes it possible to search very rapidly for information about particular subjects.

Predefined calculations can be performed within Persist. For instance, the noise level can be calculated for a given point in a production hall when a new machine is installed there. Calculations can also be performed for climate-control purposes. On the basis of the usual or prescribed clothing for a particular environment, for example, the climate-control parameters – and any additional measures needed to achieve them – can be determined. The system also allows the safety expert to record all of the enterprise's protective equipment (varying from earplugs and helmets to fire-resistant suits with gas masks), including the appropriate locations for use. The records of this information, too, are highly comprehensive, right down to the details of the supplier.

One of the many other uses of the system is to record and organise hygiene control measurements. In addition, its modular construction allows for further expansion in the future.

Although the system was originally designed for Philips, it has since become apparent that it also lends itself very well to use in other organisations. As a result, it is already in use in some twenty different organisations. The software package is marketed by the Nederlands Instituut voor Arbeidsomstandigheden (Netherlands Institute for Working Conditions - 'NIA') in collaboration with Philips and Origin. The Bureau Veiligheid (Safety Office) at Philips contributes the subject-area knowledge, Origin produces the actual software and NIA is responsible for the commercial aspects.

Although in 1990 the package was still only available in a completely Dutch language version, a number of sales were nevertheless made in other countries.

Multilingual knowledge bank

In recent years BSO has invested a good deal of time and money in the ambitious DLT research project, which has now been completed. The object of the project was to construct a prototype multilingual translation machine, and in this aim it achieved success. The knowledge and experience gained by BSO with the DLT project has since, to a large extent, spread throughout the organisation; in addition, the specific knowhow, in particular in the area of language technology, has been concentrated in a new BSO cell.

Within the framework of the European External Research Programme set up by leading hardware supplier Digital Equipment Corporation, BSO built a demonstration implementation of a multilingual knowledge bank. Such a knowledge bank can be used for translation computers, sophisticated spellcheckers and intelligent interfaces with data banks. Greatly simplified, a knowledge bank of this type can be compared with a number of identical texts in different languages – all linked to each other. In classic translation systems and spellcheck programmes, each word is coupled with another word or compared with other words. In a translation system, the word 'book', for example, would be coupled with the French 'livre'. With this approach, however, the translation of an expression such as 'I book a ticket', in which 'book' is a verb rather than a noun, can easily go awry.

A spellchecker will pick up a typing error such as 'bood', because this word does not agree with the word with which it is compared. In this case, however, it will at best be able to suggest a range of alternatives, such as 'blood', 'bold', 'bond', 'book', 'boom', 'boon', etc. The present generation of spellcheckers cannot indicate which is the correct spelling. Similarly, they will not spot an error such as 'I books a ticket'.

Another problem, apparently of a totally different order, will immediately be recognised by users of data banks: if a user wishes to search for an item concerning 'education', he or she will often not find those texts in which, say, the word 'school' or 'training' occurs, but in which the word 'education' itself is not actually mentioned.

In all these examples, the problem is that the system has no notion of the context in which a word or phrase occurs.

The knowledge bank developed by BSO not only couples word pairs, but also takes context, and corresponding structures and relationships in sentences and paragraphs, into account. As a result, the translations produced are considerably better. The system 'understands' from the context that the word 'book' in 'I book a ticket' is a verb rather than a noun. In addition, such a knowledge bank makes it possible to construct a spellchecker which analyses from the context whether a sentence such as 'I books a ticket' is correct or not. Similarly, the system 'understands' that a data bank user who is searching for the term 'education' is also likely to be interested in a text which contains the words 'school' and 'training'.

The development of translation systems and systems for language analysis are not the only possible applications, however. For example, a system which 'understands' natural language could also be used for the development of computer systems which are operated using natural language. And such systems also have a great future.

A business game is not child's play

It may be called a game, but the way in which the 24 managers take part suggests something different. Players compete with each other as if their lives depended on it. Four teams control four companies, all operating in the same market; this is not so much a game as a simulation of reality.

The computer plays a manifold part in this game. Since the companies operate in the same market, their decisions interfere with each other. For this reason, the actual simulation, just like the bank transactions and data communication, is centrally controlled. In addition, the managers each have PCs in which, besides the game software, there are also aids to help them in their analyses and decisions. Simulations enable costing, accounting and production planning operations to be carried out on the computer just as in real life. For optimum use of the game it is essential that the 'players' are able to use the system without any prior knowledge. They should also be relieved as far as possible from the need to input data, as this can quickly lead to errors. A good deal of attention has therefore been given to the man/machine interface. A series of help screens, combined with simple operation of the system, means that users are able to take 40 decisions an hour and choose from 400 numerical and logical options covering all areas of business management. As the player becomes more experienced, he will be better able to think ahead and to predict the consequences of certain decisions.

The game was developed by Origin France for the Philips Management Training Department in France. Participants on the course – and therefore also the client – are enthusiastic. In particular, the fact that a knowledge of computers is not necessary makes it enjoyable to take part; players can devote their full attention to strategy and planning, while the details, in particular the numerical calculations, are taken care of by the computer.

The end of paper filling

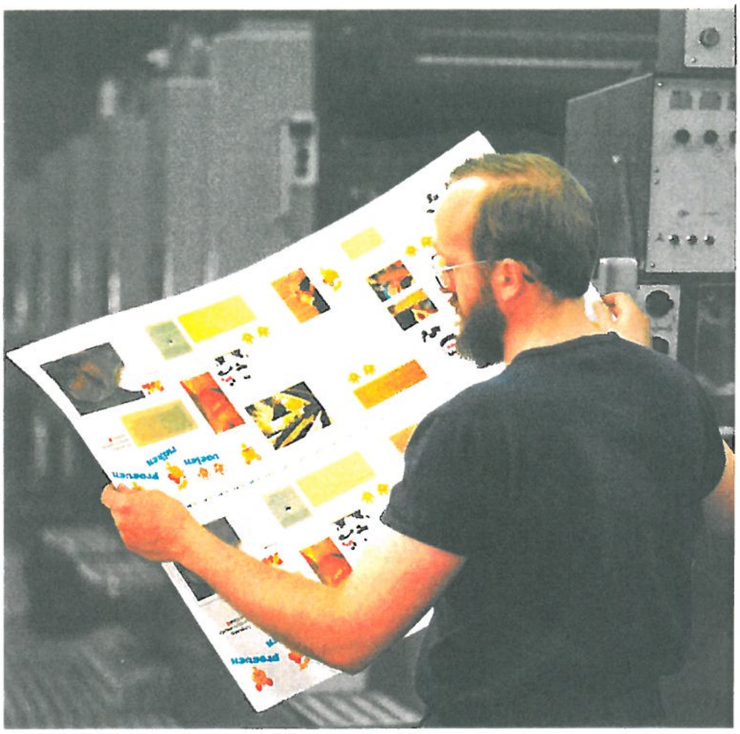
By their very nature, printers have an intimate relationship with paper. This does not mean, however, that they are blind to the limitations of this centuries-old medium. A classic filing system, for example, in which all the information is still recorded on paper, has many limitations. Such a system takes up a great deal of space and is essentially tied to one place. Especially if it is large, storage and retrieval may be very time-consuming.

The Eshuis printing firm had also come to this conclusion. Eshuis is one of the largest printers of self-adhesive labels in the Netherlands. Innumerable products both in the Netherlands and abroad carry a label produced by this Dutch printer. The large number of clients and the countless different labels which Eshuis has printed over the years ultimately generated a filing system which took up many yards of wall space and which housed all client and past order information. For every new order, a quotation was first prepared, followed by a job sheet containing client data, prices and details of the label to be printed. When Eshuis received a repeat order, the files had to be searched in order to retrieve the information relating to the original order. This information is obviously of vital importance to enable exactly the same product, with exactly the same colours and with exactly the same sizes to be reproduced.

Searching through the paper files was taking up too much time, however, given the large number of orders which Eshuis receives each year. The BSO subsidiary CAT Benelux was commissioned to develop a system which would permit all available data to be stored and retrieved easily. CAT Benelux specialises in making large quantities of information accessible with the aid of new technology and optical media.

Order details which are taken from the company's administrative minicomputer are recorded on optical disk and supplemented with data which are not present in the computer, such as telexes and faxes and records of visits by representatives – often handwritten. To facilitate this operation, a software package developed by CAT Benelux, Optifile, is used. The link between Optifile and the minicomputer was developed by CAT Benelux in collaboration with the supplier of the minicomputer.

The information can be called up via a PC network on



any of six workstations. Immediately after keying in the client, order or invoice number, for example, all the relevant details appear on the screen. Thanks to the introduction of this system, efficiency at Drukkerij Eshuis has increased still further, while the risk of data becoming lost has been virtually eliminated.

TV connections monitored

Operating a cable network involves more than simply keeping a record of subscribers and collecting their subscriptions. The task also involves maintaining an inventory of the connections in the various buildings and streets and the linking of administrative data with the technical infrastructure. The Belgian cable operator N.V. Radio Public has recently been able to automate this entire operation completely, thanks to the cooperation of Origin. Its programmes are received by some 250,000 subscribers in Brussels, Antwerp and Louvain. The computerised system (known as the TVD system) was first constructed in such a way that data from the various locations were recorded on magnetic tapes and batch processed in the central computer.

The TVD system has now been redesigned in such a way that a number of its functions are performed in real time. Terminals and printers at the various sites are controlled by the central computer via telephone links, thus enabling subscribers to be helped more quickly and efficiently. Some of the functions, such as the processing of subscription payments, invoicing and the provision of information required by law (licence fees), are still carried out in batch form.

The main problem facing the system is the enormous bulk of data, with more than 600,000 payments being processed every year. In addition, a whole range of other items have to be dealt with throughout the year, such as new connections and (temporary) disconnections. A record of the work schedule for the technicians is kept in the computer, and they are issued with work sheets on a daily basis. The result is an efficient service to the subscriber.

Autonomous units in optimum interplay

A manufacturing company stands or falls by its timing. It is therefore no wonder that large multinationals often seek to reduce their dependence on outside suppliers. This often leads to companies preferring to build the machinery for their production plants themselves rather than buying it from third parties. Philips, for example, has its own engineering works for this purpose, which make machinery for use at production sites.

As a result of the decentralisation of policy for these engineering works, a need arose at one of the plants (the M-plant) for the development of an information policy and plan of its own. In drawing up this information plan, the plant's management called in the help of Origin. The most important conclusion to come out of the information plan was the need for an integrated package to take care of order processing, scheduling and production control. The plan indicated that this package should be bought in, and selection is almost complete.

A feature of this plant is the presence of independently operating units each with their own responsibility for planning and output. In other words, there are effectively six small engineering units within the main plant, each of which must, however, be capable of optimum communication with the other units and with the rest of the organisation.

The choice of software was approached in consultation with a number of directly involved employees, using a practical as well as theoretical approach. Thus, for example, visits were paid to other factories which are confronted with similar problems, and the experience gained by these factories using similar packages was taken into account as far as possible; the vote finally went to S.A.P. The whole process is being directed and supervised by Origin, which is also involved in both the preparations for implementation and the actual commissioning.

Recycling software

Unilever is a company which employs sophisticated production technology in many fields and on a worldwide scale. This company, as well as the India Oil Blending Company, among others, has been supplied with a software package developed by Origin India for blend processing and production control.

Using this package, which was built on the instructions of Philips in India for use on Philips and VME equipment, it is now possible to define a 'formula' for a product, following which the system also controls the required production equipment for the manufacture of the desired quantity. It is even possible to define the materials handling lines in the factory.

The client made the development of the system an urgent priority. Through the use of sophisticated prototype techniques and reuse of some of the code which had been used for other industrial automation projects, it was possible to reduce the system development time to six months.

A screen management tool, also developed by Origin, was used in the development of the user interface. Once the 'look and feel' of the software in the form of the interface had been accepted by the client, the underlying software could be constructed on the basis of a combination of reused and newly written codes and subroutines.

From process control to management procedures

When confronted with the term slaughterhouse, many will be inclined to think of a more or less traditional and in many respects rather old-fashioned branch of industry. This is an image, however, which – certainly in the Netherlands – is often completely unjustified. Dutch export slaughterhouses, in particular, are extremely modern industrial enterprises often employing a high degree of automation. The actual slaughtering is in fact only one element in the total industrial process, with the meat also immediately undergoing further processing and packaging; for this reason, the term 'meat processing plants' is preferred to 'slaughterhouses'.

One rapidly growing business in this industry is the veal processing company EKRO in Apeldoorn. With a turnover of several hundred million guilders a year, EKRO is the largest veal processing plant in Europe and is also one of the most highly automated enterprises of its type. In recent years EKRO has built up a close relationship with BSO, a relationship which began with the development of a computerised system to support the classification of incoming calves.

To support the process control operation, BSO also developed a fully automated production system for the slaughtering line, cold rooms, cutting areas and shipping department. The production control system in the plant runs via a network which includes, in addition to the server, some sixty PCs, thirty PLCs, several weighing machines and a hook identification system. This system provides the control for the many changeovers and transfer points between the various production lines in the plant, monitors progress and records the entire goods flow, including the computerised weighings. This ensures that the correct carcasses, selected for sales quality, are taken from one of the 74 lines in the cold rooms and moved via a complex system of conveyers and changeovers into the production halls at the right time and in the right place.

The completion of the production control system did not represent the whole of BSO's involvement in 1990; an audit was also carried out of all computerised functions in this plant. Attention was focused on the degree of integration of the company's automated systems, including sales, logistics, production and management procedures. On the basis of this audit, a long-term plan was then drawn up which is designed to enable EKRO to achieve a considerable improvement in productivity.

Stocks in the pharmaceutical industry

Stock control, particularly in trading and production companies, is an essential element in the logistical process. The age-old problem, however, is that, while it is financially attractive to maintain low stocks, it is commercially important to carry sufficient stocks to ensure that it is never necessary to say 'no' to the customer. In the pharmaceutical industry, in particular, stock control demands an especially high level of attention. The stocks in this branch of industry often have a limited shelf life, while medicines must be available at a moment's notice.

Until 1990, the stocks and production facilities of one of Spain's largest pharmaceutical companies, Laboratorios Dr. Esteve, were spread throughout a number of warehouses in and around Barcelona. When the company decided to centralise its production and warehousing operations, a radical approach was adopted with regard to logistics. Within the context of this new approach, Origin Spain received a commission for the development and construction of two logistics systems.

Origin developed a weighing and local management system for the new and highly automated warehouse, and also designed a Warehouse Management System.

The weighing and local management system in the new warehouse controls formulation, sampling, making up, order picking and administration. The Warehouse Management System manages and controls the computerised warehouse and all the pallet locations and pallet movements within the warehouse. Thanks to these systems, staff at Laboratorios Dr. Esteve now have a very detailed picture of the complete production process, from the arrival of the raw materials, via processing, up to and including dispatch. In terms of production automation (CIM), Laboratorios Dr. Esteve now has one of the most sophisticated systems of any pharmaceutical company in Spain.

Europe '92 is already here

The great amount of attention which has been devoted to Europe '92 in recent times has led not only to academic discussions and fine newspaper articles, but also to concrete results. For a variety of organisations, for example, Europe '92 forms the framework for projects which anticipate European unification. One such project, which involved collaboration between the Dutch government and Nederlandse Philips Bedrijven (Netherlands Philips Companies), got under way as early as 1987. For Philips, the concern was to optimise the goods flows both to and from the EC and within the EC itself – an area with a total of more than 10 million commercial transactions a year. From the government's point of view, this project offered an opportunity to develop and test a methodology for use in large and integrated companies.

The aim of the project is to develop an infrastructure to direct all data on all goods transactions to one point. To this end, two sorts of data communications records are attached to every transaction: a movement record detailing all the physical characteristics of the goods, and a financial record. In the central database (Database Trade Transactions), the data are processed into a form in which they can be distributed in a range of ways. The processed data are sent to Customs, the CBS (Central Statistical Office) and the Centrale Dienst In- en Uitvoer (Central Import and Export Department). In addition, it is possible to connect into other electronic transaction systems. On the basis of this system, Nederlandse Philips Bedrijven received a special licence from the Ministry of Finance permitting customs movements to be verified largely by documentary checks. Philips was the first company in the Netherlands to receive this licence, which was given the name Geïntegreerde Douaneregeling (Integrated Customs Control).

The project, which has now been completed, has brought a number of clear benefits for Philips: the physical goods flow has been speeded up, the number of formalities and the administrative and other costs have been reduced, partly because documentation has been simplified and standardised, and last but not least, the system guarantees that the declaration of the various import duties is totally correct. The system was delivered at the end of 1990. As a result, Europe '92 has become a reality for Philips in The Netherlands long before European unification actually takes place. The government is now considering making this methodology available to other companies. At the moment, possible ways of making the basic information in the central database available for internal use at Philips are still being assessed.

The gigantic scale of this project becomes apparent when it is realised that an average of 20 people were kept occupied developing the system for a period of $3\frac{1}{2}$ years.

International stock control

Internationally operating companies are often faced with a difficult stock control problem. After all, the great advantage of international operation is that the materials required can be obtained from those countries which can supply them most cheaply, most rapidly or with the best quality. The stocks then have to be coordinated in one way or another.

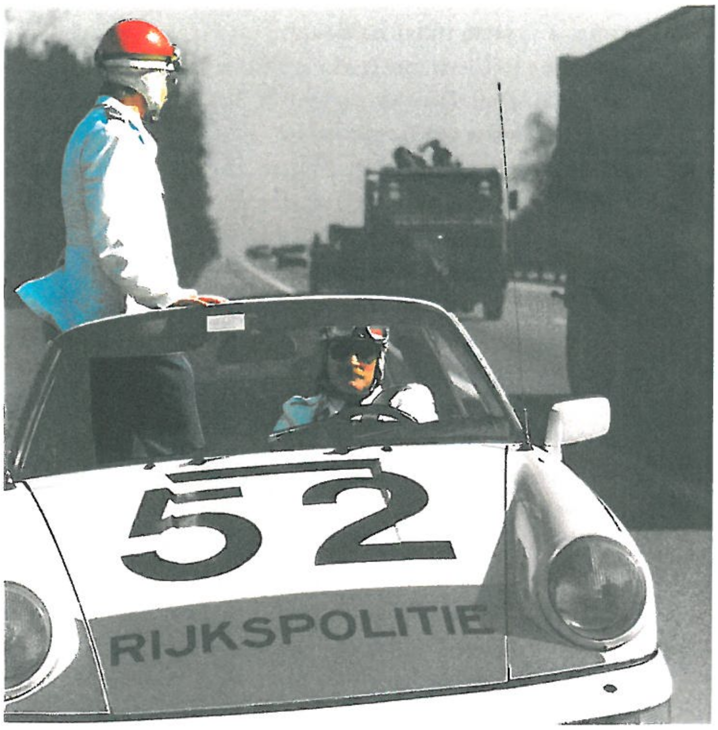
Philips was also confronted with this problem. This company operates with storage locations which are stocked from a range of countries. The 'Home Office' department therefore commissioned Origin to develop a central ordering system, known as Centor.

Centor communicates with both the national sales organisations and the suppliers. The sales organisations place their orders via Centor, which then ensures that delivery can be effected from stock and immediately replenishes the stocks by placing orders with suppliers. The great advantage of this system is that stock control is centrally coordinated. In addition, tedious jobs such as copying and filling out numerous forms, tasks which can also be a source of errors, are no longer necessary.

The first prototype was ready after four months; after evaluation, a second version has since been delivered.

Continuous traffic management

Every Dutch driver who has sat in a traffic jam knows how the warnings from the Algemene Verkeersdienst (Central Traffic Department) in Driebergen always come after the event. Time and again the motorist's 'own' jam is not mentioned, or is only mentioned once it has already cleared. For the business world, the expense of problems like this can quickly mount up. For this reason,



the Department of Transport began years ago to compile a register of bottlenecks. At various points, electronic detectors were fitted into the road surface. This allows continuous measurement of the number of vehicles passing these points, and the system is also able to distinguish between cars and trucks. Recording is continuous, but the data are stored in a computer which sends the information to a central system once a day via a telephone link.

In this way, a precise picture of the bottlenecks emerges, and this is used as a basis for determining policy measures, such as road-widening schemes and the building of tunnels and bridges.

It is a great pity, however, that nothing further is done with these data. By passing them straight on, 'Driebergen' could give immediate notification of the formation of traffic jams, warn about drivers on the wrong side of the road, and so on. In addition, if the system were linked into the warning system, traffic could be diverted far ahead of holdups.

In order to develop such a sophisticated system, the first step is to increase the number of registration points in the road network, and several hundred measuring points will be installed throughout the Netherlands. At the same time, a system must be developed for passing on data in real time to the interested parties, at both a regional and a national level. How these parties deal with these data will depend on the applications. For example, the Department of Transport will wish to use the data for statistical analysis, simulations and policy matters. Regional directorates of the Ministry of Public Works will be able to match their roadworks activities very closely to traffic situations. In the future, the information from the system will also ensure that the most up-to-date information can be received directly by radio. Finally, in the National Police's traffic control centre ('Driebergen'), the information could be used to provide immediate assistance in the event of traffic jams, etc.

The design of the system is now complete, and actual construction will begin in the course of 1991. For communications, use will be made of the network which is already present in the Highways Telecommunications Network, i.e. the emergency telephone network. Once the entire network is complete and functioning, it is possible that others (such as large haulage companies) will make use of the information. An additional benefit of this network, which is being implemented in connection with the TRAFFIX programme in which BSO is working together with the consulting engineers DHV and with Intercel, is that it can go on to form the basis of future traffic guidance systems.

Monitoring fuel consumption

Fluctuating fuel costs make it more and more important for haulage contractors to control fuel consumption. However, monitoring consumption is not a simple matter. Shell has responded to the need with a computer system known as Shell Fuel Logic. This system is intended for use by haulage contractors to keep a record of consumption either per vehicle or per driver. Besides the data from their own tanks, companies receive a diskette twice a month notifying the fuel quantity/value for every refuelling stop at Shell filling stations. Transactions data are recorded at these stations with the aid of a magnetic-stripe card; these data are then linked via the card number to the licence plate, the driver, the cost centre, etc. When the driver fills up at a filling station of a different company, the information can be entered separately.

Shell Fuel Logic uses this information, together with a number of other data which can be fed in by the user himself, to perform an analysis of the fuel consumption. Since the majority of haulage contractors operate internationally, automatic currency conversion has naturally been provided for. The programme was developed by BSO, who are also introducing the system to potential users. The guiding principle here is that it would seem to be of little use simply to send a floppy disk to the user without proper documentation and training.

BSO/Business Communications has therefore been commissioned to produce a promotional video for companies which are thinking of purchasing the programme. This video is followed up by a demonstration tape, which uses practical examples to explain how the programme works. The user training course, which BSO/Instruction Technology has developed for the entire system, is introduced at the same time. If this course is followed step by step, the programme becomes crystal clear. Account has been taken of the fact that the user usually has little experience of computerisation. A special handbook has therefore been put together, and BSO has also arranged for online help functions to be incorporated in the programme. Shell is seeking to market the programme in several European countries; this means that software maintenance and support services (such as a help desk) must be provided in each of these countries. Since the BSO subsidiary Origin operates internationally, this company will take care of both maintenance and support, as well as being responsible for installation on the premises of the various clients. In view of the fact that this is obviously a marketing tool for Shell, they are taking charge of the total marketing of the programme, which is offered as a service to the managers of vehicle fleets.

Support for metro traffic controllers

Public transport is currently enjoying a great deal of interest, and all the expectations are that this will increase still further in the coming years. The Dutch government is playing an active role here, not only in order to limit pollution, but also in order to reduce the daily tally of traffic jams and to relieve the overcrowded inner cities. Nevertheless, the increasing number of passengers itself imposes substantial new demands. To take account of all these factors, the infrastructure must be planned and built well in advance.

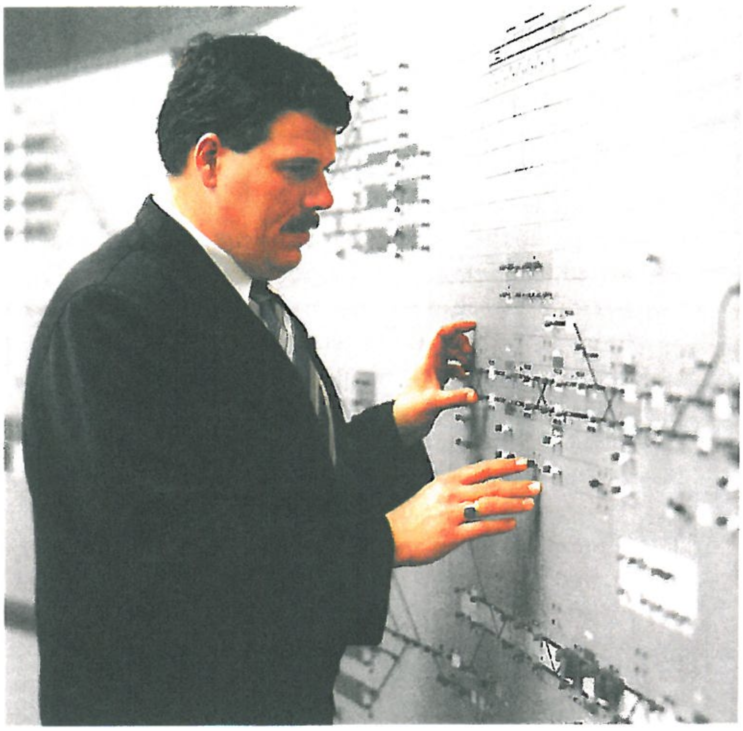
Rotterdam has already taken the necessary steps, starting in 1989 on a radical modernisation of the traffic controllers' system for the metro (underground railway system). The metro network now consists of two routes, with a total of 38 stations and three marshalling yards, over which 46 metro trains travel during peak hours. Several existing plans discuss a considerable expansion of the metro network and the train movements.

These train movements are carefully tracked from a central control point by traffic controllers using a large wall chart – on which each train is indicated by a lamp – and a number of screens. In the case of deviations from the timetable, it is possible to contact the drivers from the central control point and to inform passengers at stations by means of signboards.

This traffic control system is now some fifteen years old, however, and it is no longer possible to expand it as necessary. BSO was therefore commissioned by the Rotterdam Municipal Transport Authority ('RET') to prepare a functional and technical design for a new system. Major requirements included easy expandibility through structural standardisation (open system architecture), optimum support for the tasks of the traffic controllers, a high level of reliability and maximum user-friendliness. A crucial element in these fixed price commissions was the selection of the hardware and the system software.

The design of the system was accepted by RET in the course of 1990, following which BSO received the order to construct the system. Completion and installation, on a turnkey basis, is expected to take more than a year.

The definitive switchover will take place after a period in which the old and new systems will be used side by side.



Not only will the Rotterdam traffic controllers then be relieved of a number of routine operations and be able to follow all train movements on screen, but the movement of trains will also be under complete control at all times, even with a greatly increased traffic density.

As the working conditions of the traffic controllers had to be altered as little as possible by the introduction of the new system, all those concerned were closely involved at all stages of the development, right from the first designs, and a great deal of attention was devoted to making prototypes and allowing the users to test them.

Responding to private initiative

What should a government do with private initiatives? Particularly where they relate to matters which are close to people's hearts, such as traffic jams? The Department of Transport regularly receives proposals for solving this 'problem'. For example, there have to date been a large number of serious initiatives for car pooling. This is seen as an attractive possibility, because the environment and mobility obviously have a high priority at the Department.

It is therefore desirable to evaluate such initiatives and to implement the better ones in the form of pilot projects. The Department's Telematics Coordination Unit asked BSO, as an independent advisor, to assist in the evaluation of ideas. BSO was chosen partly because of its specialist knowledge of traffic and transport problems.

One of the most important, though often underestimated, problem areas of car pooling is marketing. There is a certain degree of resistance to car pooling, and this must be given the necessary attention. This resistance is related to the privacy which people would have to give up, but also to the lack of flexibility. One of the central points in a good plan is therefore the 'matching system', i.e. the way in which 'prospects' are put in touch with each other.

Just how difficult it is to assess these initiatives becomes clear when it is realized that, besides the purely objective and measurable criteria, factors which cannot be measured can play a major role. The various ideas differ widely in terms of scope and it is therefore not possible to compare them directly. Some plans would be extremely simple to implement, while others are highly complex.

In the evaluation of the various initiatives, it is also apparent that the focus of attention can vary widely. One plan may be geared more to the organisational consequences, while another concentrates on automation. In contacts with those putting forward the initiatives, therefore, particular effort is made to provide specialist knowledge relevant to car pooling but not, or not adequately, reflected in the initiatives. The most important aspects here are likely effectiveness, cost and implementation time, without forgetting economic and technical feasibility.

The assessment will lead to a selection of the projects with the best chance of success; following this, it is hoped that a number of pilot projects will be started. BSO will supervise not only the design of the projects, but also their implementation and final evaluation.

Environmental Accounts 1990

Glossary

Value added	=	personnel costs + depreciation, provisions + financial expenses + taxation + net profit (or – loss).
Net value added	=	value added less value lost.
Value lost	=	costs of the environmental effects caused by the company's operations, less the company's expenditure on mitigating these effects.
Cost of environmental effects	=	environmental costs relating to the processing or treatment of emissions + costs of residual effects.
Residual effects	=	environmental effects remaining after all treatment and processing activities have been performed.
Cost of residual effects	=	residual effects expressed in monetary terms.
Environmental expenditure	=	payments to third parties + environmental taxes – environmental grants
Payments to third parties	=	payments for subcontracted environmental activities relating to the company's emissions (water removal and treatment, waste collection and disposal).
Marginal costs	=	unit costs of treatment and/or processing of emissions at a given emission level.

Valuation difficulties

Estimating the cost of environmental damage is an ambitious undertaking. An accurate valuation would be the ideal way of managing the environment and by far the best means of expressing the relative significance of different kinds of environmental impact, enabling policy priorities to be set. However, the difficulty of being accurate has discouraged many experts from attempting such an assessment. The problem is our lack of knowledge of the nature and extent of the damage, compounded by the fact that environmental damage has no market price.

We have therefore taken an indirect approach, working from a number of assumptions which are explained below. For the reasons given above, however, the evaluation is less than perfect, and indicates orders of magnitude rather than precise values. Although the cost estimates are rough, they were assigned numerical values in order that a total for all the individual effects could be arrived at.

Assessing the environmental cost

The accounts cover a number of different types of residual emissions, of which the individual components are expressed in guilders. First, there are the company's own emissions due to the consumption of energy (nitrogen oxides and carbon dioxide) and the pollution generated by cars and aircraft. Second, there are emissions by power stations in the form of sulphur dioxide, nitrogen oxides, carbon dioxide, dust and fly ash. Third, watertreatment plants leave residual pollution in the water they discharge, and produce sewage sludge. And last, there are the emissions from incineration plants (sulphur dioxide, nitrogen oxides, hydrogen chloride, dust and ash).

Costing residual effects

We decided on a pragmatic approach, taking as our basis the marginal cost of emission-reduction measures. This approach takes as its basic premise that society will adopt a rational attitude to environmental problems and is willing to take measures to protect the environment up to the point where the marginal cost of these measures equates to the marginal benefits. In a number of areas, however, this will not be the case. The problem therefore lies in establishing the marginal cost of environmental protection which corresponds to optimum environmental health.

Determining 'optimum' environmental health

Environmental cost is calculated on the basis of the marginal cost of measures to control emissions, in accordance with current social standards of 'optimum' environmental health. We have taken the following approach: The marginal cost of controlling emissions of acid gases (sulphur dioxide and nitrogen oxides) has been estimated at roughly twice the level indicated in the Dutch National Environmental Policy Plan Plus (NEPP-Plus). Under this plan, emissions of nitrogen oxides are to be reduced by 56% and emissions of sulphur dioxide by 70% between 1985 and 2000. The target for emissions of carbon dioxide is a reduction of at least 60%, in line with the recommendations of the Inter-Governmental Panel on Climate Change (IPCC). Waste-water purification is required to meet the standards for drinking water. For waste incineration, we have calculated the cost of air pollution and dumping of ash, based on the assumption that a percentage of the waste can be recycled and the remainder will be fully incinerated.

NO_x emissions

Emissions of nitrogen oxides (NO_x) together with sulphur dioxide (SO_2) and ammonia (NH_3) emissions, cause acid rain, which kills forests, acidifies the soil, degrades the quality of ground water and attacks agricultural crops and all kinds of other materials. At BSO/ORIGIN, NO_x emissions are produced by the consumption of fossil fuels by central heating systems, power stations, cars and aircraft. These emissions have environmental consequences at two different scales: on the one hand, a continental or regional scale, on the other a local scale, in people's immediate environment. A distinction is made here between emissions from stationary sources (central heating, electricity generation) and emissions from vehicles. It is assumed that pollution caused by emissions from stationary sources is general and regional only. Emissions from central heating systems produce low concentrations, the flue gases are readily dispersed and they have little effect below a given minimum height. Emissions from power stations involve very large quantities discharged from a single point, but occur at great heights (high chimneys) at some distance from people and in relatively low concentrations.

The situation regarding motor-vehicle emissions is quite different. These not only contribute to general air contamination but also cause localised pollution, particularly in large cities. Concentrations are higher than for stationary sources and emissions reach a peak in rush hours. Consequently, different costs were assumed for NO_x emissions from stationary sources and those from cars.

The estimated cost of NO_x emissions from stationary sources takes the following facts into account:

a The cost of the measures proposed in the NEPP (for new and existing furnaces and gas turbines) lies between NLG 3 and NLG 7 per kg NO_x.
b The NEPP is based on the Interim Evaluation of Acidification Policy, which states that selective catalytic reduction (SCR) 'is definitely not feasible' for new boilers of less than 20 MW, as the cost of removal is estimated at between NLG 10 and 20 per kg NO_x.
c The Acidification Control Plan rejects the use of SCR in gas-fired boilers as 'insufficiently cost-effective' in comparison with technical modifications to burners and combustion chambers ('The cost of this additional cleaning could rise to NLG 60 per kg NO_x').
d On page 93 of the report by the Clean Air Forum of the Society and Business Foundation, entitled 'Towards a National Policy on Acidification Control', we read that 'The cut-off points for acceptance (of cost per tonne of acid pollution removed) lie at NLG 6 000 per tonne (current practice) and NLG 11 000 per tonne (the perceived upper limit)'.
e The Acidification Control Plan does call for the use of SCR in power stations (average cost NLG 5 per kg NO_x) and for low-NO_x burners and flue-gas recirculation in existing industrial boilers (NLG 7 per kg NO_x).

In the light of these figures, we have used a value of NLG 10 per kg NO_x. As we have said, NO_x emissions by motor vehicles cause more environmental harm than those from stationary sources. Unfortunately, the specific costs of reducing NO_x emissions by motor vehicles are more difficult to calculate, as there is less information available. Emissions depend, for instance, on the type of traffic (time of travel, city or motorway traffic, speed and style of driving). To complicate the matter still further, catalytic converters reduce not only NO_x emissions, but also emissions of carbon monoxide and hydrocarbons. With these technologies, it is not easy to analyse the costs for each pollutant. In order to still base our costing on the cost of control, we have estimated the cost of the environmental impact of these three components of motor-vehicle exhausts globally and expressed it per unit of NO_x emission. The cost of a modern catalytic converter can be roughly estimated at NLG 0.025 per km. Such a converter is already compulsory in the Netherlands. For a vehicle which runs on liquefied petroleum gas (which gives lower emissions than petrol), the cost is about NLG 20 per kg NO_x.
On the basis of the above considerations, the marginal cost of the damage due to all motor-vehicle emissions (with the exception of carbon dioxide) has been put at NLG 40 per kg NO_x.

SO_2 emissions

In principle, the environmental cost of SO_2 emissions can be calculated in the same way as for NO_x. Given the margin of uncertainty inherent in this calculation, however, the figure we arrive at may bear little relation to the costing for NO_x. The physical and chemical effects of SO_2 and NO_x emissions differ and so, therefore, does their environmental impact. Their effects are complex and we do not yet know enough about them. In the Netherlands, the impact of both SO_2 and NO_x from stationary sources is essentially associated with acid rain. Therefore an implicit link can be found between these two types of emission. Acid rain is expressed in environmental targets in terms of acid equivalents. Since 1 kg SO_2 contains 1.44 times the acid equivalent of 1 kg NO_x, its environmental impact can be calculated on a proportional basis, giving a costing of 1.44 x NLG 10 = NLG 14 per kg SO_2. This is the value we have used for SO_2.

The ratio of 1.44 between SO_2 and NO_x is higher than is generally assumed for the relative toxicity of these two substances. However, in the Netherlands the toxicity of SO_2 is less important than its contribution to acidification, given the low concentrations of the emissions.

The cost of the measures foreseen in the NEPP to reduce SO_2 emissions by 70% between 1985 and 2000 is considerably lower than the figures we have used.

CO_2 emissions

Many methods of controlling CO_2 emissions can be envisaged, including energy-saving, fuel-switching, nuclear energy, reafforestation and promotion of renewable energy resources, in addition to efforts to redirect economic activity and a slower economic growth. Cost estimates for CO_2 reduction can therefore vary quite widely. The cost of certain energy-saving measures can actually be negative, but this is due to existing economic inefficiency and so cannot be taken into account in calculating the environmental cost. The marginal cost of emission control also depends on the degree of reduction envisaged. Anyhow, it remains very uncertain.

In estimating the cost of CO_2 emissions, we took the following facts into account:

a The IPCC states that CO_2 emissions have to be cut by more than 60% from the 1990 level if we are to stabilise atmospheric CO_2 concentrations by the middle of the next century.

b The NEPP aims to stabilise CO_2 emissions at the 1990 level (182 million tonnes) by 1995 and to reduce emissions to 175 million tonnes by 2000 (At current rates of growth, emissions will reach 220 million tonnes by 2000.) At the international level, the NEPP is also calling for a reduction of 20% by the industrialised nations by 2005.

c Kram and Okken of the Netherlands Energy Research Centre (ECN) estimate the average cost of a 50% reduction in the Netherlands by 2020 at between NLG 36 and NLG 42 per tonne CO_2.

d Blok, Hendricks and Turkenburg of the University of Utrecht estimate the cost of removal and storage of CO_2 in depleted Dutch gas reservoirs at between NLG 30 and NLG 62 per tonne. These estimates are probably on the low side.

e Macro-economic models (both national and global) recently analysed by the Organisation for Economic Cooperation and Development (OECD) indicate that a CO_2 levy of between NLG 50 and NLG 200 per tonne would be needed to achieve a reduction of 50-75% but, once again, this cannot be predicted with any certainty.

As we have said, reductions in CO_2 emissions are coupled with other reductions (such as SO_2 and NO_x). The cost of reducing CO_2 emissions alone will therefore be lower. The environmental cost of CO_2 emissions has been estimated at NLG 100 per tonne.

CO emissions were explicitly taken into account only in the case of motor vehicles. Those emitted by 'stationary sources' are of relatively minor importance. The CO_2 produced by incineration plants has been valued at zero cost, since it originates chiefly from biomass and does not represent a net emission.

Waste water

Waste water production is stated in Dutch 'inhabitant-equivalents', based on the company's water consumption. Inhabitant equivalent transport and treatment costs have been based on average costs for these services in the Netherlands. The environmental cost of the effluent discharged by treatment plants has been calculated in terms of the additional treatment needed to turn it into drinking water. It is technically possible to purify domestic waste water to a point where it can meet drinking-water standards. According to a designer with experience in this field, the capital cost would be about twice that of existing treatment plants. The level of treatment required for turning treated domestic waste water into drinking water can be expressed as a number of treatment units connected in series, each working at an efficiency equal to that of existing treatment plants. This would mean roughly two units to eliminate oxygen demand and between one and 2.8 units to remove heavy metals (with the exception of cadmium and nickel, for which the current removal efficiencies of 25% and 60% respectively are relatively low).

On that basis, the environmental cost of residual water pollution has been roughly estimated at twice the average current water treatment costs. The error in this estimate is not particularly important, since this cost forms only a small percentage of the company's total estimated environmental cost.

Waste production

The waste produced by BSO/ORIGIN consists largely of paper (computer and ordinary office stationery, newspapers and periodicals). We have assumed that 50% of this can be recycled and does not therefore need to be included in the company's direct environmental impact. The other paper is regarded as normal domestic waste. The estimate of the environmental cost of this waste stream has been based on the assumption that it will be processed at large incineration plants. The residual impact on the environment therefore consists of air pollution from incineration plants and the effects of dumping of combustion ash. The environmental cost is therefore made up of (1) the collection costs, (2) the incineration costs and (3) the costs of the residual air pollution and ash dumping. The collection costs are based on average costs in the Netherlands (NLG 80 per tonne).

Processing costs are based on the average costs of a large incineration plant (NLG 100 per tonne). The environmental cost of bottom ash, fly ash and sewage sludge is put at NLG 100, NLG 200 and NLG 500 per tonne of dry matter, respectively.

Limitations of the assessment

Assessment method

This evaluation of BSO/ORIGIN's environmental accounts is only a first attempt. It was prepared in a short space of time, without the benefit of extensive research, and still has a number of shortcomings. Attention was focused chiefly on the main emission streams, or combinations of streams. It was not possible to take certain factors fully into account, such as the precise make-up of waste streams and the heavy-metal content of the various emissions. The environmental impact of nuclear power generation has also been deliberately excluded. Too little is still known about the emission streams themselves, and this can be blamed to some extent on the shortage of field measurements and statistical data. The waste flows have been calculated separately for each location, but these are no more than rough estimates. Water pollution has been estimated on the basis of consumption and average concentrations in domestic waste water. The methods, the collection of data and the translation into financial terms will be refined in the future.

Specific circumstances

One of BSO/ORIGIN's characteristics is that a large number of our staff are not employed at BSO/ORIGIN's own offices, but at those of our clients. Of course, they cause some environmental impact there, such as waste production in the form of continuous stationery, air pollution due to energy consumption and water pollution through their use of the sanitary facilities. This external pollution is not included in the environmental accounts, because it is classed as pollution by client companies.

BSO/ORIGIN owns over a thousand personal computers, which will create waste when they come to the end of their lives. For a number of technical reasons, these computers are indeed not suitable for recycling. However, instead of scrapping them, BSO/ORIGIN generally hands them on to schools and other organisations which have a use for them. Therefore they do not count as waste generated by BSO/ORIGIN and are not shown in the accounts.

The environmental accounts are consolidated in the same way as the financial accounts. Consequently, the environmental impact of the ORIGIN offices acquired in the course of 1990 are included on a pro rata basis as from the date on which they became a part of BSO.

At the end of its useful life, leased equipment also generates waste and therefore has an environmental cost. In accordance with the 'lost value' principle we have already discussed, it is important to avoid duplication and these effects must therefore not be assigned simultaneously to both lessor and lessee because the lost value would then not add up.

BSO/ORIGIN leases two main types of asset: cars and copiers. It has been assumed that, where the leased equipment is not purchased by BSO/ORIGIN on expiry of the contract, the related environmental effects are reflected in the lessor's accounts and therefore need not be included in BSO/ORIGIN's accounts. This applies only to the equipment itself, not to consumables, so pollution due to the fuel consumed by the company's leased cars is attributed to the user, in this case BSO/ORIGIN.

Gathering data on emissions

A questionnaire was used to collect the basic data on emissions from about sixty locations. The questionnaire asked for information on the number of employees, the average number of employees actually at the location, the floor area, energy and water consumption, paper purchases, consumption of office supplies, number of company cars, kilometres travelled per year (including private cars used on company business), the number of flights (divided into continental and intercontinental), details of office equipment (such as computers and copiers), waste production (and the types into which the waste is immediately segregated) and the various environmental taxes and expenditure categories.

Not all of these statistics are visibly reflected in the accounts. Some were used for verification purposes. A number of offices were unable to answer all the questions, either because certain information was unavailable or because certain types of consumption were difficult to estimate. One example is energy consumption by offices which are integrated in large factories. However, the number of replies to each individual question was large enough to enable us to calculate averages and make extrapolations.

Cost of environmental effects

in thousands of guilders

Atmospheric emissions

	Emission	Unit cost	Dfl.	Total
Natural gas for heating purposes				
NO_x	456 kg	10 Dfl./kg	5	
CO_2	483 t.	100 Dfl./t.	48	
Total				53
Electricity consumption				
SO_2	7 934 kg	14 Dfl./kg	111	
NO_x	6 202 kg	10 Dfl./kg	62	
Particulate emissions	667 kg	10 Dfl./kg	7	
CO_2	2 515 t.	100 Dfl./t.	252	
Total				432
Road traffic				
NO_x	20 585 kg	40 Dfl./kg	823	
HC	14 948 kg			
CO	55 452 kg			
CO_2	7 232 t.	100 Dfl./t.	723	
Total				1 546
Air traffic				
NO_x	1 160 kg	10 Dfl./kg	12	
CO_2	317 ton	100 Dfl./t.	32	
Total				44
Waste incineration				
SO_2	300 kg	14 Dfl./kg	4	
NO_x	369 kg	10 Dfl./kg	4	
Particulate emissions	254 kg	10 Dfl./kg	3	
HCl	692 kg	13 Dfl./kg	9	
CO_2	277 t.	0 Dfl./kg	0	
Total				20
Subtotal				2 095

	Emission	Unit cost	Dfl.	Total
Atmospheric emissions (subtotal)				2095
Waste water				
Water treatment	277 inh.eq.	48 Dfl./i.e.	13	
Transport	277 inh.eq.	12 Dfl./i.e.	3	
Residual water pollution			27	
Total waste water				43
Waste				
Company waste production				
Quantity	377 t.			
Recycled paper	– 146 t.			
Net waste	231 t.			
Collectiom	377 t.	80 Dfl./t.	30	
Incineration	231 t.	100 Dfl./t.	23	
Residual waste after incineration				
Bottom ash	23 t.	100 Dfl./t.	2	
Fly ash	7 t.	200 Dfl./t.	1	
Subtotal			56	
Power station waste production				
Fly ash	64 t.	200 Dfl./t.	13	
Water treatment waste production				
Sludge	4 t. dry matter	500 Dfl./t. dry matter	2	
Total waste				71
Grand total				2209

Environmental expenditure

in thousands of guilders

		Dfl.
Fuel levies (Netherlands)		
Natural gas (heating)	1	
LPG (cars)	18	
Power station fuel	8	
Total		27
Water treatment and refuse collection charges, sewerage charges and other environmental taxes		138
Private-sector waste processors		51
Total		216

Value lost

in thousands of guilders

	Dfl.
Cost of environmental effects	2 209
Environmental expenditure	- 216
Value lost	1 993

Net value added

in thousands of guilders

	Dfl.
Value added	255 614
Value lost	- 1 993
Net value added	253 621