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ENVIRONMENTAL INFORMATION AND COMPANY BEHAVIOUR

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by

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1. Introduction

Environmental policy is traditionally based on two sets of tools: i) command and control regulations; ii) economic or market instruments, such as environmental taxes, emission charges, tradable permits, etc. The two sets of instruments have been adopted in subsequent waves, partly in response to economic analysis that shows command and control environmental policies are not cost-effective or incapable to achieve the desired objectives in many circumstances.

In the last few years, some policy makers, the business community and the media have increasingly emphasised the role of the so-called information-based environmental instruments. Such instruments, which are typically voluntary, range from *company environmental reports* to *environmental audit and management schemes*, such as ISO 14000, EMAS and related award and compensation systems.

Information-based environmental policies are the subject of a lively debate. Their supporters claim that environmental reports and environmental management schemes are fundamental instruments to achieve the desired environmental quality. Their critics claim they are only "greenwashing", basically ineffective and devoid of any real effect.

This paper tries to shed some light on the companies' behavioural response to information-based environmental policies, dwelling on two building blocks: an original database, at the company level,

collected by Fondazione Eni Enrico Mattei since 1995; and some recent literature on information and incentive schemes within companies.

The paper is divided into seven sections. Sections 2 and 3 briefly describe the main information-based environmental management tools and recall the theoretical rationale for their adoption; Section 4 describes the database and identifies a subset of homogeneous companies in three polluting industries: i) oil & gas; ii) petro-chemicals; iii) power generation. Sections 5 and 6 present some empirical results on the relationship between information-based environmental strategies, economic performance, and environmental performance at the company level. Section 7 contains some concluding remarks.

The paper presents preliminary work that needs refinement: information-based environmental policies are still in their infancy and their history is too recent to allow for a sound econometric analysis. The existing data, and the relevant theory, however seem to support the hypothesis that information-based environmental policies are indeed an instrument to change company behaviour and to implement environmental policies and regulations.

2. The theoretical background

In the textbook institutional setting, governments set environmental standards and companies comply. In addition to this, companies try to follow sound environmental strategies in order to avoid litigation and the emergence of future environmental liabilities. In some industries, such a strategy may also establish a good environmental reputation, which can be a powerful tool in the relationship with consumers, communities, and environmentalists. In the two latter cases, far-sighted companies may even exceed environmental standards.

In the situation we have just described, information plays a crucial role. In a world with imperfect information, regulators, investors, consumers, and other stakeholders want to know the companies' environmental performance, the achieved results, the remaining problems and the schedule to solve them. Companies, symmetrically, need to communicate their environmental strategy and performance, in order to deal with their shareholders, stakeholders and regulators. Against this background, the communication aimed at the external stakeholders has been widely discussed in the recent literature (Tietenberg, 1997; Lanoi et al., 1997; Khanna-Damon, 1997; Mc Intosh et al., 1998). The same flow of environmental information, moreover, can play a key role in re-shaping company behaviour, and this is the focus of our paper.

A useful starting point can be found in two papers, by Brehn-Hamilton (1996) and Pfaff-Sanchirico (1999), which claim that the lack of internal information - i.e. ignorance -is often responsible for the non compliance of environmental regulation by big companies and for their wrong assessment of environmental damage: hence, the need of information tools and self-audit. The issue, however, is more complex than this.

For many years companies (as well as regulators and the general public) have somewhat neglected environmental issues, concentrating their efforts on the economic and financial performance. But neglecting environmental standards, particularly in the traditional industries, has gradually created hidden liabilities which can seriously harm shareholders' value through different channels: trials and litigation about health, safety and pollution; loss of reputation with clients and consumers; conflict with local communities and environmental groups; etc. Such new issues - which are well-known to shareholders and companies' Chief Executive Officers - require a change in company behaviour that can be pursued using *information based environmental strategy* that aim at a change in company behaviour through appropriate flows of information, audit, and incentives. (Desgagné-Gabel, 1997, Prendergast, 1999)

Given the nature and the objectives of information-based environmental strategies, governments and regulators too have a clear interest in promoting their standardisation and wide adoption sometimes propose guidelines themselves to define such schemes and make them mandatory. In such cases we can refer to *information-based environmental policies*.

3. Some information-based environmental management tools

The best known environmental management tool adopted by firms is the *Corporate Environmental Report*, published annually by companies to audit and communicate the most relevant environmental issues related to their operations (emissions, effluents, wastes, as well as expenditure and investment in the environmental area).

The number of companies publishing environmental reports has been rapidly growing from 1992 to 1998 (Figure 1). Data show that the release of environmental information, which actually began in 1990, was started by firms in highly polluting industries, such as chemicals and oil & gas. But environmental reporting quickly spread to other industries such as the auto-motive and transportation industries, telecommunications, electronic appliances, financial services and consumer goods.

FIGURE 1

As previously mentioned, the quality of published environmental reports can vary substantially across companies and time. The earlier reports typically included many statements and very few data, typically referred to hot-spots in the company operations while recent reports include most

comprehensive environmental data, together with environmental indicators and analyses which usually cover all the companies' activities.

In order to conduct a quality analysis, a specific rating system has been defined by Fondazione Eni Enrico Mattei within the Environmental Reporting Monitor, and published regularly since 1997. If we adopt such system we can easily see shows that the quality of environmental reports has been constantly increasing (Fig.2).

FIGURE 2

Following the publication of environmental reports, in the mid'90s companies began to introduce more sophisticated *environmental audit systems,* aiming at promoting continuous improvements in the environmental performance of their operations.

In order to facilitate and standardise the implementation of such audit systems, in 1993 the European Commission adopted the EMAS (Eco Management Audit Scheme) Regulation. This scheme recommends the voluntary participation by companies and gives them guidelines, with the objective of promoting better environmental performance at the site level. Similarly, at the world scale, the International Standard Organisation launched the ISO14000 scheme for the certification of corporate environmental management[ii] at the company level.

Since the mid-Nineties, the number of companies that certify their environmental management systems against EMAS and ISO 14000 has been constantly increasing. Since 1996, year of the publication of the first five ISO 14000 standards, 10,439 companies have been certified. Since 1993 more than 2,790 sites have been certified against EMAS.

A similar growth can be seen in our sample (Fig. 3)

FIGURE 3

In addition to environmental reports and auditing schemes, other management tools, such as *compensation programmes and award schemes*, have been gradually introduced by many big companies in order to link environmental performance to economic incentives. In this respect, the adoption of award and compensation programmes related to environmental results can be viewed as an incentive compatible strategy for integrating environmental issues within the company's management.

Compensation and award schemes quickly spread and now they are common practice for almost all big companies. In our sample, the percentage of companies that implemented a compensation programme increased from 2% to 73% from 1994 to 1997 (Figure 4).

FIGURE 4

From the theoretical point of view, environmental reports, audit schemes, and compensation mechanisms can be viewed as components of an integrated *information-based environmental strategy*, aimed at changing company behaviour. Let us see how these instruments work, by analysing an appropriate database at the company level.

4. The Database

Our database covers 476 Corporate Environmental Reports published in the world from 1993 to 1997.

To carry out a meaningful empirical analysis we selected a sample which includes 39 big firms, based in 16 countries and belonging to three highly polluting industries that produce comparable emissions (such as NOx, SOx) using similar feedstocks: i) petro-chemicals, ii) oil & gas and iii) electric power generation (Appendix 1) for the period 1993-1997.

In addition to the Corporate Environmental Reports, we gathered information on whether the companies adopted any environmental management system (i.e. ISO 14000 and/or EMAS), on companies' environmental compensation and award schemes, and collects data on the main economic variables at the company level (the latter being extracted from the standard annual reports).

Starting from the above data we built a panel that include several variables: i) a standardised index of pollution; ii) measures of the size and of the economic performance of the company; iii) an indicator of the quality, comprehensiveness and transparency of the environmental information; iv) an indicator of the adoption of one or more environmental audit, compensation or award schemes; vi) several control variables, at the company, industry, and country level (Appendix 1 and Appendix 4).

The panel is obviously affected by a sample selection bias, because it includes only companies that voluntarily decided to publish Corporate Environmental Reports. Our analysis, however, focuses on the effects of more detailed instruments within this population of relatively caring industries[iii]. In this case the sample selection critique does not apply as publishing an environmental report does not imply the adoption of the environmental management tools we are considering.

The environmental performance variable (LPOLL) is defined on an annual basis as SOx plus NOx emissions per unit of output[iv]. The indicators have been chosen on the basis of their impact on the environment and on data availability. SOx is a main indicator used by the regulators as a base for the environmental taxation system and NOx plays a major role in land acidification. At this stage we could not consider data on waste and water discharges because classification across countries and regulations on waste has significantly changed over the last five years, and the currently available data do not account for the damage associated with different discharged pollutants (a firm emitting a large quantity of a relatively harmless substance would be ranked as a larger polluter than another firm emitting a small quantity of a very toxic substance).

The size of the company (WORK) is proxied by the number of employees, which also indicates the complexity of the agency problems within the organisation while the economic performance (OPERATING INCOME) is measured by the operating income in current US$[v].

The quality of the information disclosed in the environmental reports (INFO) is measured by a score system, developed by the Environmental Reporting Monitor at Fondazione Eni Enrico Mattei (Appendix 2 and Appendix 3). The system evaluates the descriptive information contained in the report (i.e. mission, objectives, strategy, organisation, programmes), the quality of environmental variables and indicators (e.g., some reports contain data on emissions but omit economic data, such as defensive and environmental expenditure while others include indicators, but do not publish raw

data for emissions, effluents and wastes) and the thoroughness of the report (for instance, many reports cover a subset of sites or ignore some foreign countries where the company operates).

The information-based environmental management is measured by a 0-3 index (henceforth EAC - Environmental audit, Award and Compensation) which is the sum of three dummy variables: the first (E) records the adoption of EMAS and/or ISO 14000[vi]; the second (A) records the existence of an environment-related award system, which does not give immediate benefits but directly influences the future career of the managers and the employees; the third (C) records the adoption of an environment related compensation scheme[vii].

A more detailed description of the variables we use in our analysis can be found in Table 4.

We are well aware that both company variables and indicators are rather raw and must be improved but environmental reports have not been published for a long time now and the data we can collect are quite limited. In addition to company data, some control and regulation data have been collected at the country level.

5. A first look at the data

Do information-based environmental policies work? How do they influence company behaviour? Some preliminary answers to such questions can be found by broadly comparing companies which adopted some information-based environmental strategies (henceforth "EAC" companies) between 1993 and 1997 with companies which did not adopt such schemes.

At a first glance, we observe that on average the companies that have implemented compensation and award schemes and have certified environmental management systems present better environmental performances. A t-test performed on the mean shows that although the difference is

not significant at the standard 5% or 10% level (except for 1997) EAC companies do perform better (Table 1). Table 2 reports the average pollution growth rates for EAC companies versus the whole sample year by year. Once again, EAC companies are observed to perform better, as their average pollution rate is lower than the one of the whole sample for two out of three years.

TABLE 1

TABLE 2

When we consider average pollution rates (see Figure 5) we can observe that EAC companies pollute much less than the total sample, and reduce pollution throughout the time span we considered while in the overall sample we can observe that pollution drops from 1994 to 1996 but there is an upward trend between 1996 and 1997.

FIGURE 5

To clarify this point we select three important case studies among the companies in our sample: BP Chemicals (petrochemicals); ELF (oil & gas); PowerGen (electric power generation). According to our data base and the score system, such companies were among the first to adopt EAC in their industries and to produce the highest quality environmental reports.

We look at their environmental performances considering their emissions' reduction rates before and after the EAC adoption. We also relate their emissions to the quality of the environmental information produced to see whether information quality and quantity are related to emission reduction.

TABLE 3

The analysis of emissions at BP Chemicals shows that the introduction of environmental awards and compensation programmes did influence the pollution growth rate, which has been diminishing faster since the implementation of a pioneering award scheme in 1994. The negative trend in emissions, after a slow down in 1995, was strenghtened by the introduction of a certification and compensation scheme in 1996 (see Table 3 and Figure 6)

Elf is an equally interesting case. The company sequentially introduced an award scheme in 1995, and a certification-compensation scheme in 1996, constantly improving its environmental performance (see Table 3 and Figure 7)

PowerGen adopted in sequence an environment related award scheme, a compensation mechanism and finally a certification system; its emissions constantly diminished at increasing rates, from –0.084 in 1993-1994 to –0.136% per annum in 1994-1997 (see Table 3 and Figure 8).

In these case studies, we can also observe a negative relationship between the quality of corporate environmental information and the emissions index. Figures 6, 7 and 8 illustrate these findings, highlighting the year of adoption of the various management tools.

FIGURE 6

FIGURE 7

FIGURE 8

The above results seem to be consistent with two ideas: i) the adoption of information-based environmental tools improves company environmental performance and ii) such management instruments are complementary with each other.

Critics of information based environmental strategies, could object that our findings are possibly spurious, because the analysis neglects standard environmental regulation, taxation, and several other variables which may influence emissions together with EAC.

To overcome this objection, we try to carry out a statistical analysis which also includes other policy variables, together with some control variables. For this purpose, our panel is disturbingly small. But we believe that, at this stage, it is worthwhile to present, with many caveats, some tentative results.

6. A statistical analysis

We perform a cross-country analysis for 16 countries assuming that governments adopt environmental policies based both on command and control and economic instruments; companies comply and may also pursue a tighter environmental strategy to avoid future risks and liabilities. In this setting, we check whether environmental policies (command and control instruments and energy taxation) affect the companies' economic and environmental performance. We also check whether the adoption of information-based environmental strategies (EAC) affects this relationship, influencing company behaviour, *given* the energy tax burden and the severity of environmental legislation.

It is generally acknowledged that environmental policy reduces pollution but harms economic performance. This trade-off, however, can be eased by information-based environmental policies. We want to test whether information-based environmental policies, which affect company behaviour, can make compliance more effective and less costly. The variables used in our estimates are listed in Table 4.

TABLE 4

We chose to estimate a random effects model. In fact, even if our database contains many companies which produce environmental reports in the three industries under review, we are still far from including all the environmental reports in the three industries world-wide. This implies that we can assume that individual firms appearing in our sample are randomly chosen and taken to be representative of a larger population of firms and that the differences we observe across firms are stochastic disturbances around the population mean. Thus we allow the intercept to vary across firms, but we assume that it is constant over time.

The we want to estimate is:

$$y_{it} = \bar{\beta}_1 + \sum_{k=2}^{K} \beta_k x_{kit} + \varepsilon_{it} + \mu_i$$

We estimate the random model using an instrumental variable (IV) procedure as we cannot include all the variables simultaneously in our estimation, because of the endogeneity of the operating income with the dependent variable.

At first we estimate the link between operating income (OPERATING INCOME) and EAC (the existence of environmental certification, award and compensation schemes) and the energy taxation

burden (TAX). We take into account the company dimension by using the number of employees (WORK) as a control variable. Secondly we relate the environmental performance of companies (the logarithm of company pollution LPOLL) to the quality of environmental information at time t-1 (INFO) to their economic performance (the instrumented operating income, IOPINC) and to the enforcement of legislation (ENFORCE)

The results of the estimated random effect model are shown in Table 5.

TABLE 5

As we expected OPERATING INCOME is positively related to EAC and to the company size (WORK). The quality of environmental information is non-significant.

Table 6 shows the results of the regression of the logarithm of company SOx plus NOx emissions (LPOLL) at time t on the instrumented OPERATING INCOME at time t, on the quality of environmental information (INFO) at time (t-1), on the enforcement of legislation (ENFORCE), and the burden of energy taxation (TAX) and the industry dummy (SECTOR).

TABLE 6

LPOLL is negatively related to the IV operating income (IOPINC) , which is consistent with the idea that the adoption of EACs is reducing emissions. Moreover, the quality of environmental information (INFO) is negatively related with pollution, suggesting that managers' and employees' efforts on environmental matters is significantly influenced not only by the presence of EACs but also by the accuracy of environmental information. SECTOR is positively related with LPOLL, simply reflecting the structural and technological characteristics of production in the three industries

under review. Finally, the relation between ENFORCE and LPOLL is negative but not significant (p-value .480).

7. Concluding remarks

Information-based environmental strategies play a significant role in our sample: given environmental regulation, which is costly, they positively influence operating income and negatively influence pollution. Being primarily implementation tools, they need to be complemented by more traditional policies, and cannot substitute them. But, given this *caveat*, governments which recommend such policies, are probably right.

Our findings are consistent with a whole class of models on environmental information, incentives and company behaviour.

In our panel data estimation, the accuracy of environmental information is negatively related with pollution and the relation is significant. That is, information quality is crucial for companies' environmental management and there are explanations for corporate non compliance that are not related to the level of the penalties but to the company's scarcity of internal information (Brehn Hamilton, 1996).

On the contrary, from our results we cannot infer the role of environmental information accuracy on financial performance. In our analysis we used operating income as a proxy of companies' financial health, since we wanted to investigate the existing relation between environmental management tools and company results in the short period. Existing literature on environmental information and corporate financial performances finds significant relation between these variables, but it refers to external environmental information (information provided to external stakeholders) and to long

term performances such as shareholder value or liabilities (Tietemberg, 1997, Lanoi et al., 1997, Khanna & Damon 1997). These differences help in understanding the differences between our analysis and prior analyses.

However, generic pleas to better and wider "environmental information" or "eco-management" are too vague and may be misleading. In order to exert a positive influence, environmental information needs to be integrated with a set of incentives, as recommended by economic theory for any company objective. This explains the nature of many integrated environmental and management schemes (such as ISO 14000 or EMAS) adopted by firms and recommended by policy makers.

Our empirical model confirms the positive role of self-regulated environmental audits and compensation programmes on corporate environmental performance, and this is consistent with an emerging research field that explores the possible pattern for integrating environmental issues with concrete management system (Sinclaire-Descgagné and Gabel, 1997, Pfaff and Sanchirico,1999).

The above conclusions, of course, are just tentative, given the preliminary nature of our empirical analysis. In order to reach more robust conclusions, better data have to be collected and better estimates have to be carried out. But the preliminary results we obtained so far seem to be consistent with economic theory and with common sense.

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[ii] It should be reminded that the first national standard on environmental management was the BS 7750, developed in the UK in the early '90ties.

iii Although in this case our sample has no sample selection bias, it is worth noticing that while for environmental information accuracy data are available for the whole period under consideration (1993-1997), for more recent tools such as the environmental audit, compensation and award systems, the sample includes many zeros in early years.

[iv] The output is expressed in tons of oil equivalent – Toe –which seems to be a suitable measure in the three industries under review.

v We used companies' annual reports to collect data on their operating income. Unfortunately most financial statements are expressed only in local currency. In order to make them comparable we decided to convert all financial variables into current US dollars by using the nominal exchange rate of the local currency against the dollar.

vi Data on companies' environmental management certification were obtained from EU EMAS official register and ISO14000 competent body in each country.

vii To gain information about Environmental Compensation Programmes and Award Schemes we relied on Corporate Environmental Reports and Annual Financial Reports and, only for US listed companies, also on official disclosure required by the US Security Exchange Commission (deliveries like 10K for American Companies quoted at New York Stock Exchange and 20F for not Americans quoted at the New York Stock Exchange). Whether those information were not available in corporate publications, we directly interviewed companies environmental managers and external relation managers.

Table 1 Average Pollution Rates

	1994	1995	1996	1997
EAC=0	0.0038	0.0028	0.0036	0.0052
EAC>0	0.0014	0.0011	0.0009	0.0007
t-test	0.78	0.81	1.34	1.87

Table 2 Average Pollution Growth Rates

	1994-1995	1995-1996	1996-1997	Average 1994-1997
Whole sample	-0.39688	-0,086121	0.068504	-0,1618
EAC	-0,20206	-0.21496	-0.14913	-0,18921

Source: see Appendix 4

Table 3 Average Pollution Growth Rates – Case Studies

BP Chemicals	
Average growth rate 93-94	-0,1202683
Average growth rate with EAC 94-97	-0,0204621
ELF	
average 93-95	-0,1074995
average with EAC 95-97	-0,1729896
Powergen	
average 93-94	-0,0842359
average with EAC 94-97	-0,1358968

Source: see Appendix 4

Table 4 – Variables used in estimation

VARIABLE	Description
LPOLL	Logarithm of company pollution, computed as SOx+NOx per Toe
CERTIFICATION	Dummy which is 1 when the company Environmental Management System is certified against ISO14000 standard and/or 1836/96 European Regulation EMAS
COMPENSATION	Dummy which is 1 when an environmentally based compensation programme at company level is implemented
AWARD	Dummy which is 1 when an environmentally based award programme is implemented
EAC	Sum of CERTIFICATION, COMPENSATION, AWARD (index 0-3)
INFO	Index ranging from 0 to 100 which to assess the accuracy of company environmental information
WORK	Number of employees per firm.
OPERATING INCOME	Annual operating income in current US $
ENFORCE	Country index of environmental regulation enforcement
TAX	Country index of burden energy taxes/GDP
SECTOR	Sectoral index whose value is 1 for the electrical sector, 2 for oil and gas and 3 for chemicals

Table 5: OPERATING INCOME

Dependent variable: OPERATING INCOME

Mean of dep. var. = 1889.92

Std. dev. of dep. var. = 2489.03

Sum of squared residuals = .381484E+09

Variance of residuals = .374004E+07

Std. error of regression = 1933.92

R-squared = .421142

Adjusted R-squared = .404116

LM het. test = 17.1105 [.000]

Durbin-Watson = .075581 [.000,.000]

Variable	Estimated Coefficient	Standard Error	t-statistic		P-value
EAC	413.964	81.1986	5.09818	**	[.000]
WORK	.050996	.948368E-02	5.37726	**	[.000]
INFO(1)	6.01047	9.13842	.657715		[.511]
C	-77.6047	766.808	-.101205		[.919]

Hausman test of H0:RE vs. FE: CHISQ(3) = 29.548, P-value = [.0000]

TABLE 6: POLLUTION

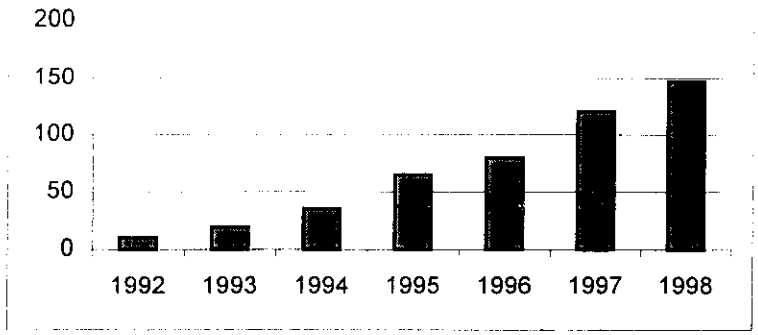
Dependent variable: LPOLL

Mean of dep. var. = -8.95649		R-squared = .276393	
Std. dev. of dep. var. = 3.49287		Adjusted R-squared = .234806	
Sum of squared residuals = 812.667		LM het. test = .015806	[.942]
Variance of residuals = 9.34100		Durbin-Watson = .022598	[.000,.000]
Std. error of regression = 3.05630			

Variable	Estimated Coefficient	Standard Error	t-statistic		P-value
IOPINC	-.186477E-03	.108226E-03	-1.72303	*	[.085]
INFO(1)	-.025010	.977345E-02	-2.55899	**	[.010]
ENFORCE	-.110039	.155892	-.705866		[.480]
SECTOR	2.61997	.911784	2.87345	**	[.004]
TAX	-.818044	.967608	-.845429		[.398]
C	-9.18296	3.70121	-2.48107	**	[.013]

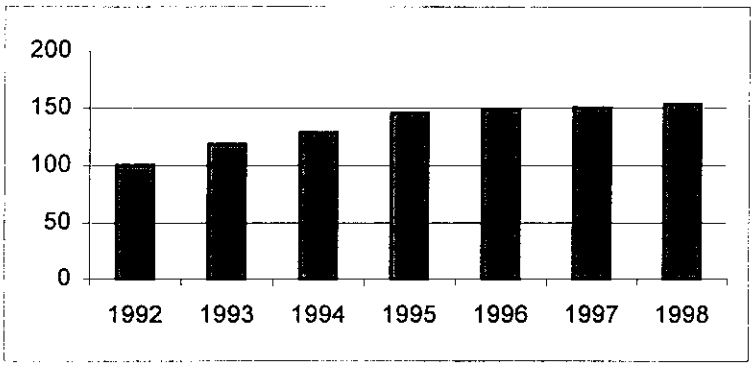
Hausman test of H0:RE vs. FE: CHISQ(2) = 5.2067, P-value = [.0740]

Figure 1- Number of Companies producing CER – World, 1992-98



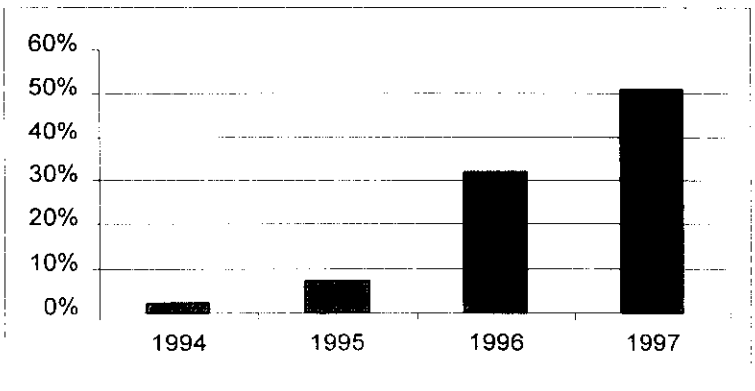
Source: Environmental Reports Monitoring, FEEM, 1999.

Figure 2 - Average quality of CER (1992 =100) - World, 1992-98



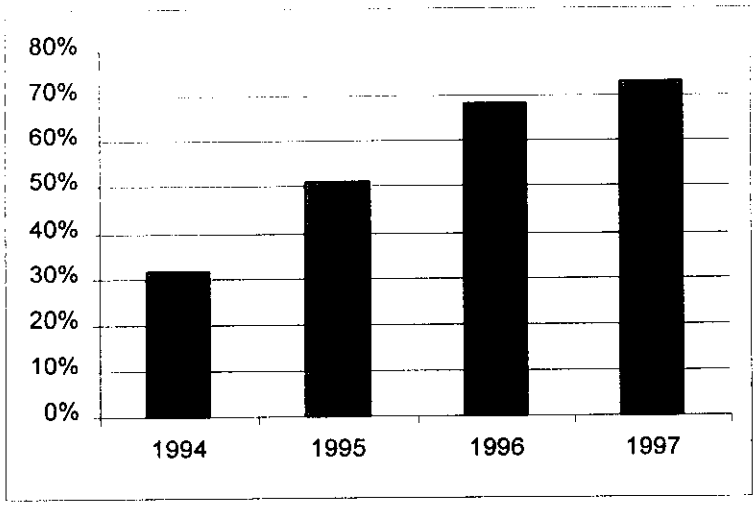
Source: ERM, Environmental Reports Monitoring; FEEM, 1999

Figure 3 – Number of EMAS or ISO 14000 certified companies – World, 1994-97



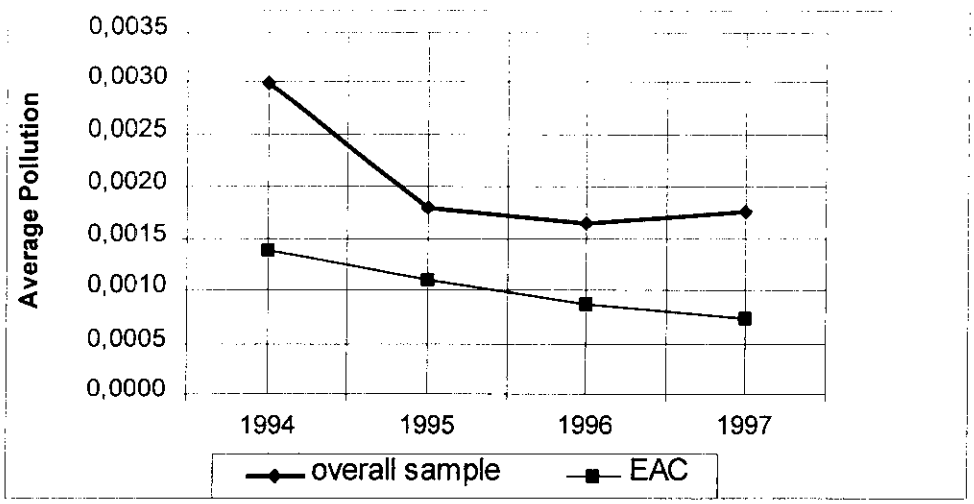
Source: ERM, Environmental Reports Monitoring; FEEM, 1999

Figure 4 – Number of companies adopting compensation programme and award schemes – World, 1994-97



Source: ERM, Environmental Reports Monitoring; FEEM, 1999

Figure5 – The impact of information based environmental policies: EAC companies vs. total sample in three selected industries – World, 1994-97



Source: see Appendix 4 (the average pollution has been calculated without considering the values of two outlier companies)

Figure 6 BP Chemicals - The impact of information based environmental policies, 1993-97

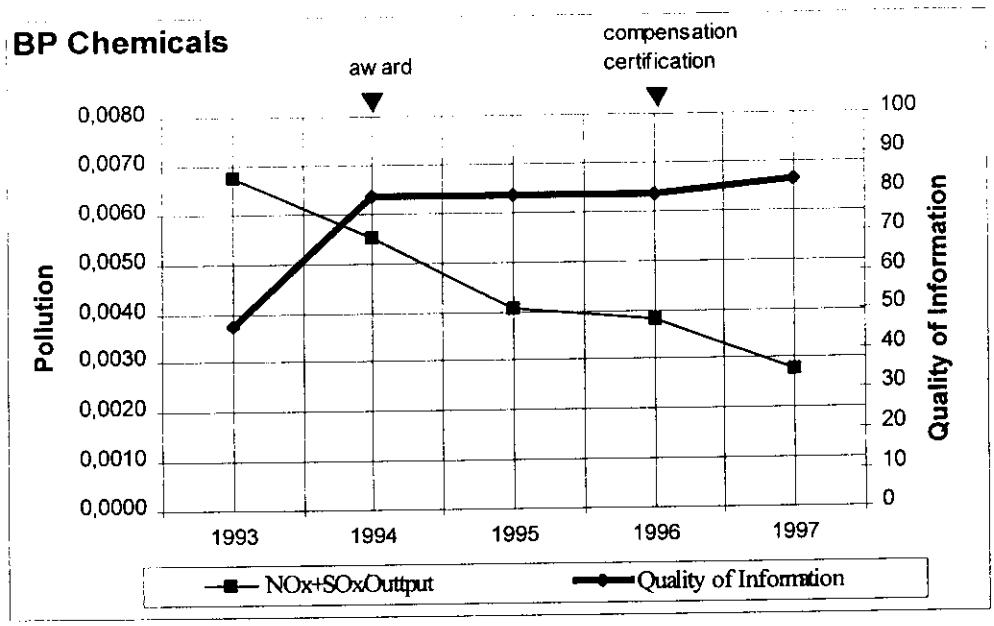


Figure 7 ELF - The impact of information based environmental policies, 1993-97

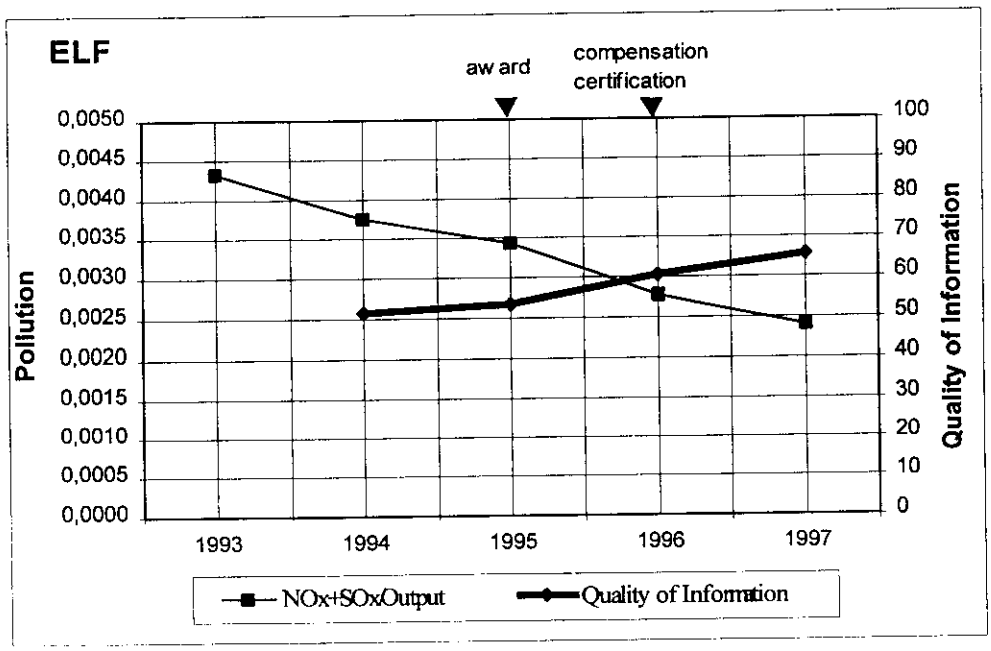
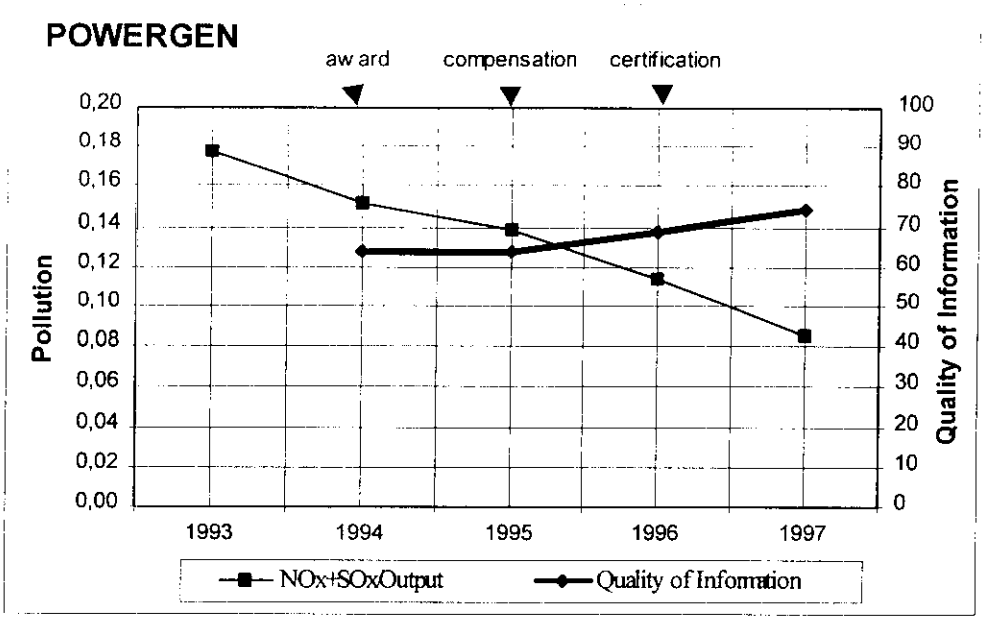


Figure 8 PowerGen - The impact of information based environmental policies, 1993-97



APPENDIX

APPENDIX 1

List of the Companies

Company	Sector	Country	First year of CER Publication	First year of EMAS or ISO14000 implementation	First year of Award Scheme Adoption	First year of Compensation Program Adoption
AGIP	OG	ITA	1995	1998	1994	1996
AGIP PETROLI	OG	ITA	1993	n.i	1994	1996
APS	OG	USA	1994	n.i	1994	1996
BAYER ITALIA	C	ITA	1994	1996	1994	1995
BG	OG	UK	before 1993	n.a	n.a	n.a
BP	OG	UK	before 1993	1996	1994	1996
BP CHEMICAL	C	UK	before 1993	1996	1994	1996
CIBA	C	CH	before 1993	1995	1994	1995
CONOCO	OG	USA	1993	1998	1994	1995
DONG	OG	DK	1994	n.i	n.i	n.i
EDISON	E	ITA	1994	n.i	1998	1998
ENEL	E	ITA	1995	1998	1994	1997
ENI	OG	ITA	1995	1998	n.i	n.i
EXXON	OG	USA	1995	1998	1994	n.a
ELF	OG	FRA	1994	1996	1995	1996
ESKOM	OG	SA	1994	n.i	1995	n.a

IVO	E	FL	1996	1997	n.a	n.a
MOBIL	OG	USA	1995	1996	1995	1996
NATIONAL POWER	E	UK	1994	1995	n.a	n.a
NESTE	OG	FL	before 1993	1997	1997	1996
NESTE CHEMICALS	C	FL	before 1993	1997	1997	n.a
NORSK HYDRO	OG	FL	1995	1995	1995	n.a
NOVO NORDISK	C	DK	1993	1998	n.a	n.a
ONTARIO HYDRO	E	USA	1994	1997	1995	n.a
PETROFINA DOWNSTR.	OG	BEL	1994	1997	1995	n.i
PG&E	OG	USA	1995	1996	1994	n.a
POWERGEN	E	UK	1994	1996	1994	1995
REPSOL	OG	SPA	1996	n.i	n.a	n.a
ROYAL DUTCH/SHELL GROUP DOWNSTR.	OG	UK	1996	1996	1996	n.i
SHELL INT E&P B.V.	OG	NL	1996	1997	1996	n.a
SHELL CHEM	C	UK	1994	1997	1996	n.a
SHELL UK	OG	UK	1993	1997	1996	n.a
SNAM	OG	ITA	1993	n.i	n.i	n.i

TRANSPORT.						
SNAM GAS	OG	ITA	1993	n.i	n.i	1996
SOLVAY	C	BEL	1994	1996	1995	n.a
STATOIL	OG	NOR	1993	n.i	1995	n.i
TEPCO	E	J	1994	n.a	n.a	n.a
TEXACO	OG	USA	1994	n.i	1996	1997

Source: ERM, FEEM, 1999

Legenda:

C= Chemicals; E= Electrical Power generation; OG= Oil & Gas

n.a.= not available

n.i.= not implemented

APPENDIX 2

Forum on Environmental Reporting Guidelines

In order to guarantee a minimum standard of Corporate Environmental Reports (CER) as voluntary document, the Fondazione Eni Enrico Mattei (FEEM) organised in 1994 the Forum on Environmental Reporting (FER) by inviting some large companies emerging in the field of environmental management and reporting, and some of interested target groups for environmental reports, environmental groups and public administration to work together to draw up guidelines. The aim of the FER is to set guidelines for companies seeking to produce an effective environmental report, providing stakeholders with the information needed from other similar initiatives for the consensus approach.

Here follows the list of Minimum and Recommended Requirements to be included in CERs. These requirements have been used as the basis for the Environmental Reporting Monitor-ERM score system, aiming at evaluating the quality of environmental information

Qualitative Information (Notes to the Environmental Balance-Sheet)

1. COMPANY DESCRIPTION

a. Company size and activities	***Minimum Requirement***
b. Number and location of production sites	***Minimum Requirement***
c. General description of production processes	***Minimum Requirement***
d. Description of the main environmental issues related to production and distribution	***Minimum Requirement***

2. ENVIRONMENTAL POLICY

a. Year of introduction of environmental policy and content	***Minimum Requirement***
b. Expected achievements	***Minimum Requirement***
c. Achievements monitoring (comparison with previous reported objectives)	***Minimum Requirement***

3. ENVIRONMENTAL MANAGEMENT SYSTEMS

a. Organisation structure (environmental department and relationships with other business units)	***Minimum Requirement***
b. Programmes for environmental policy implementation	***Minimum Requirement***
c. Training activity	***Recommended Requirement***
d. Implementation level of environmental management system and certifications (EMAS, ISO or UNI)	***Recommended Requirement***

4. RISK MANAGEMENT

a. Audits, measures taken and achievements regarding risk management	***Recommended Requirement***
b. Description of Clean-up operations carried out	***Recommended Requirement***
c. Description of major accidents	***Recommended Requirement***

5. COMPLIANCE WITH ENVIRONMENTAL LEGISLATION

a. Description of the way the company ensures compliance with environmental regulations (in relation to previous violations as well as to prevention measures)	***Recommended Requirement***
b. Description of measures adopted to comply with new environmental regulations (EU, national, local) that became operational during the period which the report refers to	***Recommended Requirement***

6. *PRODUCT POLICY*

a. Description of products life cycle and of the related impacts and description of the most relevant measures to mitigate them	***Recommended Requirement***
b. Product innovation	***Recommended Requirement***
c. Products energy efficiency (when relevant)	***Recommended Requirement***
d. Company responsibility at the end of product use	***Recommended Requirement***
e. Co-operation programmes with consumers and clients	***Recommended Requirement***
f. Eco-label (where applicable)	***Recommended Requirement***

7. *CONSERVATION OF NATURAL RESOURCES*

a. Energy saving programmes	***Minimum Requirement***
b. Water saving programmes	***Minimum Requirement***
c. Other programmes for the protection of natural heritage	***Recommended Requirement***

8. *STAKEHOLDERS RELATIONS*

a. Participation in voluntary agreement schemes	***Recommended Requirement***
b. Relations with stakeholders (public administration, environmentalists, universities, ...)	***Recommended Requirement***
c. Department or name of the person to contact for further information	***Minimum Requirement***

9. *CERTIFICATION*

a. External certification	***Recommended Requirement***
b. Certification by EMAS accredited verifiers	***Recommended Requirement***

Quantitative Information (The Environmental Balance Sheet)

1. ENVIRONMENTAL EXPENDITURES

a. Data on environmental expenditures	***Recommended Requirement***
b. Explanation of accounting criteria	***Minimum Requirement***

2. EMISSIONS AND CONSUMPTION OF RAW MATERIALS

a. Site by site quantitative information (for main sites)	***Minimum Requirement***
b. Raw materials	***Recommended Requirement***
c. Energy as input	***Minimum Requirement***
d. Wastes, air emissions, water discharges and soil pollution and other pollutants relevant for company's activity	***Minimum Requirement***
e. Quantity of products or a relevant figure to describe production level	***Minimum Requirement***
f. Impacts (scientifically accounted) related to production activity	***Recommended Requirement***
g. Reduction objectives for: raw materials, energy, pollutants and impacts	***Recommended Requirement***

3. ENVIRONMENTAL PERFORMANCE INDICATORS

a. Environmental performance indicators compared with previous periods	***Minimum Requirement***

Source: FER, FEEM, 1995

APPENDIX 3

Environmental Reporting Monitor – ERM

Starting from the Forum on Environmental Reporting guidelines the FEEM has set up an Environmental Reporting Monitor defining a three sections check-list as a score system. The first two sections are the representation of the two parts of the report: the first section checks for the qualitative information, the second one the quantitative information, following the Forum on Environmental Reporting requirements (see Appendix 3); the third one is the comment section, better explained below. The structure of the check-list is as follows:

- qualitative section: it verifies if 4 minimum requirements and 11 recommended requirements are met. The score: the report can rank from 0 to 2 points for every minimum requirement met; from 0 to 1 for every recommended requirement met.
- quantitative section: it verifies if 9 minimum requirements and 5 recommended requirements are respected. The score: the report can rank from 0 to 2 points for every minimum requirement respected; from 0 to 1 for every recommended requirement respected.
- comment: first of all it checks if the Corporate Environmental Reporting structure complies with the Forum on Environmental Reporting guide-lines. Then it checks whether the report is complete or not. For data quantity: if it is exhaustive it gets 2 points, if medium 1 point, if it is not enough 0 points. For data quality: whether the environmental report refers to a sample or not, whether the report maker used a specific methodology for the data collection and whether an audit has been implemented to check the data or not (for any of these four, from 0 to 2 points). Finally, it checks report legibility (from 0 to 2 points), it verifies whether the report gives other information and whether there is a positive evolution in act from the last reports to the present one (if yes, 1 point).

Each Corporate Environmental Report can rank till 19 points in the first section, 23 points in the second one and 16 points in the comment section. The maximum score is 58 points. For this paper propose each score has been normalised.