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Level of Disclosure of Environmental Information in the Electricity Sector: An Empirical Study of Brazil and the Iberian Peninsula

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Abstract- Electricity markets currently face shared global challenges in the search for sustainable energy: security of energy supply, protection of the environment and maintenance of competitiveness. Together these three factors help produce cleaner and more compatible energy with sustainable development. One way of assessing the environmental performance and disclosure level of a company is the use of metrics. The Global Reporting Initiative (GRI) indicators are the most accepted ones in previously published literature. In the first decade of this century there was an increase in social and environmental disclosure in the electricity sector in Brazil, following trends set elsewhere in the world. The stakeholders' request for both environmental information and accountability resulted in the dissemination of sustainability reports, especially in the more environmentally sensitive industries. During the privatization of the Brazilian electricity sector, some of Iberia's largest energy firms began to invest more in Brazil as a result of the European liberalization process that was already under way. This paper aims to identify the Environmental Information Disclosure Level (EIDL) of Brazilian companies and Iberian companies, which published sustainability reports using the GRI indicators. The main conclusions show that Brazilian companies are in the process of improving their disclosure level while Iberian companies have remained constant at a higher level. An analysis of the level of disclosure of different firms and their different locations suggests that Iberian companies have better performance than their Brazilian counterparts when it comes to environmental issues.

Keywords: disclosure, GRI, environment, electricity, power generation.

I. Introduction

World statistics and global trends continue to indicate that the generation of electricity will remain the main source of growth in CO_2 emissions in the XXI century. Therefore, challenges in global markets for electricity remain, including security of energy supply, protection of the environment and competitiveness in the search for sustainable energy (IEA, 2012).

In order to monitor and evaluate this, it is essential to analyze the environmental information disclosure of firms using important metric systems such as those indicators included in the framework Global Reporting Initiative (GRI), G3. These indicators are used worldwide in all economic sectors, and are disseminated in the form of a report, which consents to the monitoring of a company's performance in the economic, social and environmental dimensions (Ethos, 2010).

After the privatization of the electricity sector in Brazil, which attracted both domestic and foreign investors and led to the creation of the regulatory agency, the National Electric Energy Agency, ANEEL, companies began to show higher levels of information disclosure related to financial, economic, social and environmental data. An increasing number of Brazilian Electricity companies also started to publish GRI reports.

At the same time, Europe was increasing its Internal Electricity Market, which required the use of an unbundling process in Portugal and Spain, two Member-States that had not at that time completed their liberalization processes. Accordingly, the largest players in the Iberian Peninsula energy sector made larger investments in Brazil. These companies were already experienced in environmental regulation due to the European regulatory system. (Eugénio, 2010).

This article aims to analyze the relationship between the Environmental Information Disclosure Level (EIDL) and the location of companies, considering their regulatory systems, their different market structures, and their diverse economic, social and geographical dimensions.

To the best of our knowledge the study here in provided is the first one to present a database relying on environmental variables concerning Brazilian and Iberian electric utilities.

Thus, we are able to build and EIDL that allows us to concluide on the main drivers and challenges that the electricity sector has to deal with.

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The Environmental Information Disclosure Level of 21 Brazilian companies and of 10 Iberian companies was used in this study. This represents all the firms that the GRI publishes on its website and accounts for the specific G3 indicators during the period 2006 to 2009 (GRI, 2010).

Furthermore, this study proposes to answer the following four questions: *i*). How has environmental disclosure evolved on an individual basis? *ii*). What was the EIDL of Brazilian, Portuguese and Spanish electricity companies from the 2006 to 2009, considering the set of different characteristics of each country?, *iii*). Who are the main stakeholders of the companies under study? And, finally, *iv*). Which communication channels are used by the companies for announcing their sustainability reports?

This study is divided into five sections. The next section describes the importance of environmental information disclosure in reports using the GRI indicators while considering the concepts of energy sustainability and cleaner production. The third section explains the methodology used and identifies the samples; the fourth section states the results of the analysis; and, finally, conclusions are made in the fifth section.

II. Environmental Information Disclosure – Literature Review

a) *Brazil and The Iberian Peninsula: the energy context and environmental disclosure*

With the transnationalization of the companies in the global market, the capital of a business is often centred in one country and the company in another. The privatization of the electric power market in Brazil produced companies with different corporate structures and with foreign capital. In this context, a synergy among the Brazilian, Portuguese and Spanish capital, and the companies located in these countries in different economic, social and geographical contexts emerged.

i. *The Brazilian energy market context*

According to ANEEL (2010), in 2010, there were 2,238 enterprises in operation in Brazil, 134 under construction and 435 granted between 1998 and 2010. From the 1,339 power plants in Brazil, 76% use fossil fuels; 20% use biomass and 4% use other types. The most commonly used types of fuels are: diesel (596 plants), sugarcane bagasse (252) and natural gas (85). Brazil shows a historical framework of hydroelectric generation. However the government has invested in the diversification of energy sources to solve the problem of the rain shortage and the serious environmental and social impacts caused by the construction of Hydroelectric Energy Plant (HEP).

The energy model in Brazil is private and public. The private companies with public services concession contracts according to article 175 of the Federal Constitution/1988. This model has two structures, and the second one is headed by ANEEL, the agency responsible for regulating and inspecting the electric sector and that was created in by Decree N° 2.335/97. ANEEL's work is directly linked to the National Power System Operator (ONS) and to the Chamber of Commercialization of Electric Power (CCEE). In 2010, the Brazilian energy market had 2,238 companies (ANEEL, 2010). The production and power frequency conversion of the Brazilian energy market is shared with countries from the Southern Common Market (MERCOSUR).

ii. *The Iberian Peninsula energy market context*

The Iberian Market of Electricity (MIBEL) was created in The Iberian Peninsula to integrate the Portuguese and Spanish energy markets. The main achievement in MIBEL in 2008 was the growth of energy production using renewable energy sources and the combined cycle aimed at meeting the goals of reducing CO_2 emissions and increasing independence from fossils fuels (ERSE, 2010).

The Spanish energy market experienced a decrease in energy demand in 2008, registering a slight increase of only 0.8%. However, between 2002 and 2006 there was an increase of 4% and another of 3.2% in 2007. Energy demand is strongly related to the growth of the Gross Domestic Product (GDP) in each country (Red Elétrica, 2009).

The Portuguese energy policy is focused on the implementation of clean energy, especially wind, photovoltaic micro-generation and small hydro-electricity plants. The aim here is to offset the cost of installing wind farms with the savings made by reduced imports of the oil and gas needed for thermal generation.

One of the biggest challenges facing the energy sector of the Peninsula arises from the complexity of the system, which now has to operate in inter-regional transportation (Super Grids) and local distribution (Smart Grids) systems. It is necessary to deal with the instability of the generation of alternative energy sources (i.e.: Wind Power), with the energy consumption complexity and with the electrical mobility program to supply power to electric cars. It is also necessary to deal with the difficulties of storing energy, the efficiency of public transport, the costs and the technological challenges involved in the installation of offshore wind farms and the search for an intelligent digital distribution system that would allow one to buy and to sell the energy (bidirectional) and provide real time information. The Iberian electricity supply industry comprises only privately owned companies.

The European Directive 2003/54/EC and lately the European Directive 2009/72/EC reviewed the European Directive 96/92/EC, which for the first time established common rules for the various electricity markets in Europe, based on the liberalization of the sector without prejudice of the public service required and the access by the generators and consumers to the transmission and distribution grid. These requirements are guaranteed by regulation authorities established in each country (Silva, 2007).

In 2001, the Governments of Portugal and Spain decided to create an integrated Iberian Electricity Market (MIBEL). In July 2007, the Portuguese electricity generators operating under the so-called Ordinary Regime (OR) started bidding systematically into the Iberian Electricity spot market operated by Operador de Mercado Elétrico (OMEL); both Spanish and Portuguese generators also bid regularly into the Iberian electricity derivatives market operator - Operador de Mercado Elétrico-Pólo Português (OMIP). Entidade Reguladora dos Serviços Energéticos (ERSE) and Comisión Nacional de Energía (CNE) are the independent regulatory agencies that have been established in Portugal and Spain, respectively.

iii. *Environmental Disclosure in Brazil and in Iberian Peninsula: mandatory versus voluntary*

The fundamental need of electricity for economic and social development does not exclude this industry of the category the activity of high environmental impacts. This highlights the need for increased specific industry environmental regulation and its consequent disclosure (Braga et al, 2009; Liu and Anbumozhi, 2009; Rover et al, 2009; Sangle and Babu, 2007).

The publishing of environmental information is normally carried out trough websites and/or printed reports in Brazil and The Iberian Peninsula (Bolívar, 2009; Jose and Lee, 2007; Sarmento and Durão, 2009; Skouloudis et al, 2010).

The disclosure of environmental information in an annual report is defined as a subset of the Corporate Social Responsibility (CSR), which includes information on waste management, recycling programs and environmental control (Ahmad et al, 2003).

The environmental issues disclosed in the reports, including the GRI model, highlight the commitment of a company to a system of cleaner production and environmental sustainability.

This publication usually includes both mandatory and voluntary environmental information provided to the broad group of stakeholders that has a relationship with the company (Brammer and Pavelin, 2006; Holland and Foo, 2003; Hosssain and Hammami, 2009). In Brazil environmental disclosure is not mandatory.

There are nevertheless several recommendations for its dissemination given by entities information through groups such as the Securities and Exchange Commission, the Institute of Independent Auditors of Brazil and the Federal Accounting Council. Furthermore, there is extensive environmental legislation at all levels of government (Rover et al, 2005).

In Brazil the corporate legislation in use adopts the accounting, economic and financial concept, and only the financial statements are considered mandatory for publication. These aspects favour the disclosure of environmental information by the entities, which may happen in either a voluntary or mandatory way (Simnett et al, 2009). Gibson and O'Donovan (2007) concluded the existence of a global trend in the rise of environmental disclosure. Accordingly, Braga et al, 2009; Calixto et al, 2007 and Rover et al, 2009 confirm that Brazil is in alignment with this worldwide tendency.
Sarmento and Durão (2009) also found an increase in the publication of sustainability reports in Portugal, and Bolívar (2009) observed the same trend through the Internet in Spain.

In Spain, the disclosure of environmental information in annual reports has been mandatory since 1998, with the sectoral adaptation of the Charts of Accounts of the electricity companies. In addition, Resolution No 6389 dated March 25, 2002, of the Institute of Accounting and Auditing (IAA) approved standards of recognition, evaluation and information for the environmental aspects included in annual statements (Eugénio, 2010).

In Portugal, Accountant Financial Reporting Standard No. 26 - Environmental Matters (IAS 26) has been in force since January 1, 2008. This guideline applies to environmental information disclosed in both individual and consolidated accounts.

In addition to their mandatory disclosures, the Portuguese and Spanish electricity companies have published their own environmental information voluntarily in sustainability reports using the GRI indicators. The adhesion to the GRI methodology began in 2000 with Energias de Portugal (EDP) and Endesa, two Portuguese and Spanish companies respectively, who are the pioneers in this field. In Brazil, the pioneering company was CPFL Energy, which released its first report in 2002.

b) The reporting and disclosure of environmental indicators

In Portugal, Spain and Brazil, the context of corporate disclosure is based on financial disclosure, which is regulated by law, and regulated by agencies such as *Comissão de Mercado de Valores Mobiliários* (CMVM*), Commissión Nacional del Mercado de Valores* (CNMV) and the *Comissão de Valores Mobiliários* (CVM), which follow the book publishing of listed companies.

The companies' adaptation to the environmental practices required by the stakeholders has been reflected in their management strategy and in the manner by which companies disclose their effect on the environment. Thus, final information disclosure comprises both mandatory and voluntary issues, which are related to the competitiveness of the business (Aerts and Cormier, 2009; Berns et al, 2009).

In this sense, it has been noticed that a constant demand for further disclosure, accountability, good corporate governance practices and ethical behaviour by companies referring to environmental information is necessary (Rover et al, 2009).

Companies are used to publishing their environmental information in a specific environmental report, one that covers social and environmental sustainability, together with financial statements (Simnett et al, 2009; Jose and Lee, 2007).

Companies shape their reports voluntarily for many reasons. One of them is to provide information to stakeholders and to reduce the symmetry between the information content of the company and of the market. The report also reveals the organizational commitment, the management of risks and the desire to build a corporative reputation. Reliability is an important factor in this process (Hossain and Hammami, 2009; Simnett et al, 2009).

The disclosure of CSR and financial information can be motivated by countless factors, such as: legal provision, origin of stock control (Monteiro and Aibar-Guzmán, 2010); stakeholders' pressure (Liu and Anbumozhi, 2009); ethical aspects (Almeida, 2007); cultural considerations (Simnett et al, 2009); the need to gain legitimacy (Jose and Lee, 2007) and media exposure (Reverte, 2009).

It has been noted that, despite the importance of the environmental information provided there is a lack of structural order in the disclosure when it is made voluntarily (Bolívar, 2009).

NGO's and technological advances offer innovative solutions to the problems arising from the lack of content standardization in the environmental reports, as well as the uniformity at an international level (Jose and Lee, 2007). Internationally, Global Reporting Initiative orientations are used (Brown et al, 2009; Skouloudis et al, 2010). In this piece of research the publications using the GRI G3 indicators are analysed. The indicators include responses with both qualitative and quantitative aspects (i.e. monetary and non-monetary). The way these indicators are published in the report structure should be according to the GRI orientations and be compatible with the perception of its stakeholders.

As for the frequency of disclosure reports, entities should define a consistent cycle and establish a date to produce their report. This is most commonly done annually.

Another important aspect of disclosure is the definition of material support and dissemination. According to Jose and Lee (2007), the Internet has emerged as low cost, quick and easy-to-access tool. In addition to disclosures made on websites, companies offer print versions of complete reports and/or summaries and also give information on CD-ROM (Bolívar, 2009; Calixto et al, 2007; Jose and Lee, 2007; Rover et al, 2009).

c) Cleaner production in the electric sector

The process of industrialization, large-scale production and technological advances has led the consumer market to the age of disposable products. These products have an ever shorter life cycle, which results in a rise in the level of environmental impact: increased use of products results in a rise in the use of raw materials and in the need for waste disposal.

This creates new industries, resulting in an increase in energy consumption, including electricity. The great challenge nowadays is to manage these issues while preserving human life and the environment. Part of the solution could be to introduce a model of corporate management for cleaner production, which is the integrated environmental strategy applied to processes, products and services in order to increase eco-efficiency and reduce risks to human life and damage to the environment. This concept was presented by the United Nations Environmental Program (UNEP), in1989 (WBCSD and UNEP, 1997).

In the electricity sector, the largest amount of waste and the most severe environmental impacts arise from the production of energy. Some energy sources cause further damage, such as those generated from nuclear energy, from coal and oil.

Beyond the serious health risks caused by air, soil and water pollution, energy production generates greenhouse gases, noise, ash, slag, toxic waste and the spillage of hazardous products.

The transport of workers prominently employed in transportation and the distribution of energy also generates emission of substances that destroy the ozone layer. Companies must disclose the amount of fines paid and the amount of non-monetary sanctions taken for noncompliance with environmental laws and regulations. It is also important that they publish the total investment made in environmental protection.

An analysis of the GRIs is important for monitoring the environmental management of these organizations and for ensuring cleaner production in industries classified as sensitive because of their negative environmental impact.

III. Methodology and Sample Identification

This section describes the sample identification method and data analysis techniques used in the research: content analysis and Correspondence Analysis (CA). The chosen methods proved to be the most appropriate ones, considering the sample characteristics and the aim of the study.

They are also widely accepted in the most up-to-date literature. For content analysis, see, for instance, Monteiro and Aibar-Guzmán, 2010; Múrcia, 2009; García-Sánchez 2008; Jose and Lee, 2007; Cormier et al, 2004; Cormier and Magnan, 2003; García-Ayuso and Larrinaga, 2003; Holland and Foo, 2003; Milne and Adler, 1999. For more information on Correspondence Analysis see Múrcia, 2009; Lima, 2007.

The criteria used to select the sample were: a) companies of the electric energy sector located in Brazil, Portugal, and Spain, and b) companies that disclosed the report in the GRI website in the period between 2006-2009. The sample totals 31 companies (GRI, 2010). The companies that make up the Brazilian sample are presented in Table 1, the Portuguese sample in Figure 1, and the Spanish sample in Figure 2.

Table 1 : Environmental Information Disclosure Level, electric power sector, Brazil, 2006-2009

	2006	2007	2008	2009
AES Tietê S A		0.2941		
Endesa Cachoeira		0.7353	0.5882	0.8529
Eletronorte		0.2647	0.5000	
Furnas Centrais Elétricas		0.3529	0.4706	
Itaipu Binacional	0.4412	0.7647	0.8824	0.9706
Tractebel Energia		0.5588	0.7647	0.7059
CTEEP			0.3824	0.3529
AES Eletropaulo		0.5294	0.5588	
Coelba		0.4412	0.5588	
Coelce	0.3824	0.5588	0.8235	0.7941
Ampla	0.5588	0.5294	0.7059	0.7647
Elektro	0.4412	0.2941	0.3529	0.4706
Cosern		0.2941		
Cemig	0.3529	0.4706	0.5294	0.5882
Copel	0.6471	0.5882	0.6765	0.7647
Energias do Brasil	0.4118	0.6765	0.8529	1.0000
CPFL Energia	0.7941	0.2059	0.7353	
Eletrobrás			0.4706	0.6471
Light S.A.		0.6176	0.7059	0.7941
Endesa Brasil		0.6471	0.7941	0.7941
Grupo Rede		0.4412		

Source: Own computations.

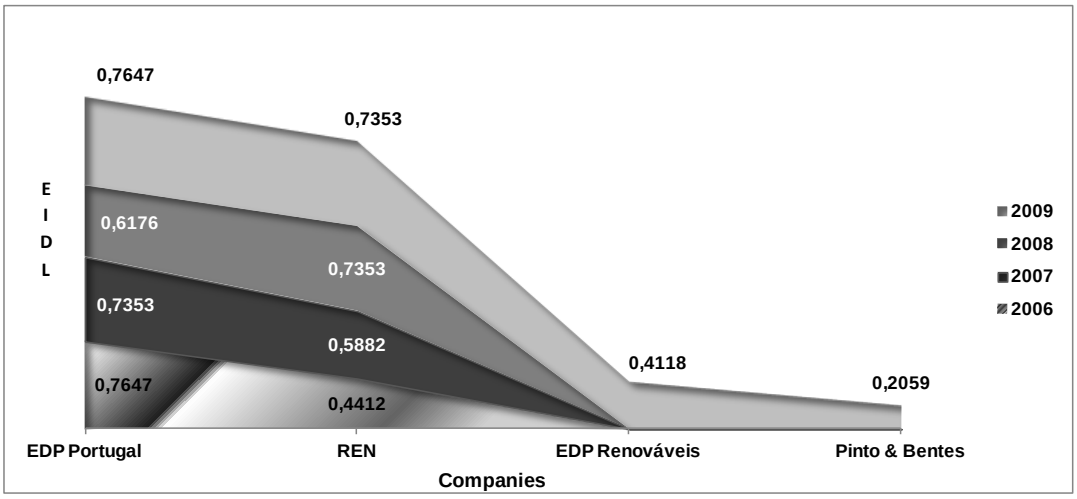

Figure 1 : Environmental information disclosure level, GRI, Portugal, 2006 to 2009

Source: Own computations.

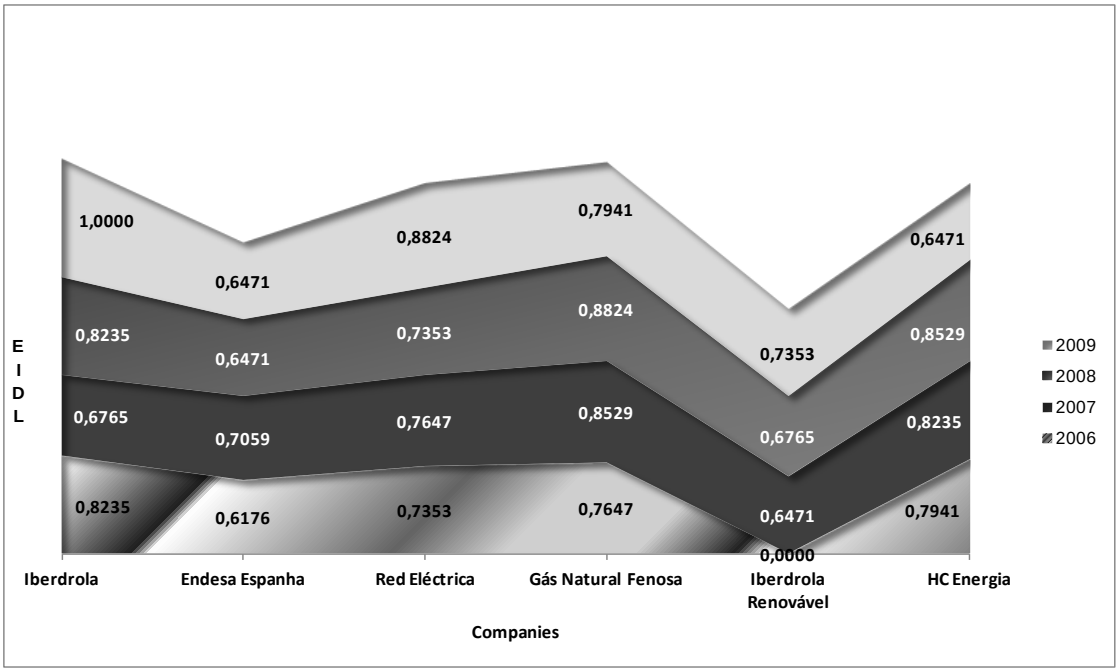

Figure 2 : Environmental information disclosure level, GRI, Spain, 2006 to 2009

Source: Own computations.

Table 2 puts together information concerning not only firms belonging to the four segments of the value chain of the electricity supply industry (ESI), i.e.: generation, transportation, distribution and supply, but also the major holding firms. Column 'GRI' shows the number of reports by country, while the 'Electric sector' column gives the same information but exclusively for companies in the ESI.

Table 2 : Disclosure of the GRI orientations, electric sector, Brazil and Iberian Peninsula. 2006-2009

	2006		2007		2008		2009	
Country	GRI	Electric Sector	GRI	Electric Sector	GRI	Electric Sector	GRI	Electric Sector
Brazil	18	8	32	21	71	20	67	15
Portugal	6	2	18	2	25	2	28	4
Spain	120	6	128	7	138	6	118	6
Total	144	16	178	30	234	28	213	25

Source: Own computations based on GRI October 2010 data.

Brazilian (21) and Iberian (10) companies in the sample show contexts with both similar and different characteristics, as shown in Table 3. The electricity sector has oligopolistic characteristics. It consists of a small number of companies controlled direct, or indirectly, by large private or state economic groups. Given the characteristics of high value fixed assets/intangible and specific assets used in operating activities, it is an industry made up of huge companies.

Table 3 : Characteristics of the companies in the sample

Aspect	Brazil	Iberian Peninsula
Geographic area of the country of origin.	Huge territorial extension. Brazil 8.511.965 Km².	Small territorial extension. Portugal: 92.389 Km² and Spain 504.782 Km².
Number of consumers (*) in the country.	63.892.929	Portugal: 6.316.180 and Spain: 23.759.685.
Quantity of companies listed in	23	10

the website Global Reporting Initiative – GRI – 2006 to 2009.		
Market concentration	Oligopoly	Oligopoly
Companies sizes	Large company	Large company

(*) In 2008 – social exercise adopted as reference to the calculation of the sample.

Source: Own computations based on ANEEL (2010), GRI (2010), CNE (2009), ERSE (2009).

However, they use the same methodological approach to the analysis of corporate sustainability: the Global Reporting Initiative.

Previous studies by Liu and Anbumozhi, 2009; and Jose and Lee, 2007 provide the general framework metrics. Complementarily, findings by Skouloudis et al, 2010; Liu and Anbumozhi, 2009; Brown et al, 2009; Panayiotou et al, 2009; Gallego, 2006 and Morhardt et al, 2006 allowed us to account for GRI indicators in the metric. The investigation outlines a metric of 34 environmental indicators (17 essential indicators, 12 additional and 5 specific), as shown in Table 4.

Table 4 : Metric with dimensions, sub-dimensions and indicators for calculating EIDL

		Environmental Performance Indicators
		Aspect: Materials
Core	EN1	Materials used by weight or volume
	EN2	Percentage of materials used that are recycled input materials
		Aspect: Energy
Core	EN3	Direct energy consumption by primary energy source
	EN4	Indirect energy consumption by primary source
Add	EN5	Energy saved due to conservation and efficiency improvements
	EN7	Initiatives to reduce indirect energy consumption and reductions achieved
		Aspect: Water
Core	EN8	Total water withdrawal by source
Add	EN9	Water sources significantly affected by withdrawal of water
	EN10	Percentage and total volume of water recycled and reused
		Aspect: Biodiversity
Core	EN11	Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas
	EN12	Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas
SU	EU13	Biodiversity of replacement habitats compared to the biodiversity of the affected areas
Add	EN13	Habitats protected or restored
	EN14	Strategies, current actions, and future plans for managing impacts on biodiversity

	EN15	Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk
		Aspect: Emissions, Effluents, and Waste
Core	EN16	Total direct and indirect greenhouse gas emissions by weight
	EN17	Other relevant indirect greenhouse gas emissions by weight
Add	EN18	Initiatives to reduce greenhouse gas emissions and reductions achieved
	EN19	Emissions of ozone-depleting substances by weight
	EN20	NOx, SOx, and other significant air emissions by type and weight
Core	EN21	Total water discharge by quality and destination
	EN22	Total weight of waste by type and disposal method
	EN23	Total number and volume of significant spills
Add	EN24	Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annex I, II, III, and VIII, and percentage of transported waste shipped internationally
	EN25	Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the reporting organization's discharges of water and runoff
		Aspect: Products and Services
Core	EN26	Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation
		Aspect: Compliance
Core	EN28	Monetary value of significant fines and total number of non-monetary sanctions for noncompliance with environmental laws and regulations
		Aspect: Transport
Add	EN29	Significant environmental impacts of transporting products and other goods and materials used for the organization's operations, and transporting members of the workforce
		Aspect: Overall
Add	EN30	Total environmental protection expenditures and investments by type
		Aspect: Local Communities
Core	SO1	Percentage of operations with implemented local community engagement, impact assessments, and development programs
SU	EU20	Approach to managing impacts of involuntary displacement

	EU21	Measures for contingency planning, management plan and training programs for disasters / emergencies, and plans for recovery / restoration
		Organizational Profile
SU	EU1	Installed capacity (MW), broken down by primary energy source and the regulatory system
SU	EU5	Allocation of permissions (allowances) emissions of CO_2 equivalent, broken down by market structure of carbon credits

Source: GRI (2010).

Several approaches are possible when developing a scoring scheme to determine the level of disclosure in annual reports, and traditionally both a weighted disclosure index and an non-weighted disclosure index have been used by researchers. Those, such as Hossain and Hammami, 2009 and Cho and Patten, 2007, adopted dichotomous procedures in which an item scores one if disclosed, and zero if not disclosed, and this approach is conventionally termed the non-weighted approach. This study followed such dichotomous procedures.

The EIDL index of each company was calculated by adding individual scores and then dividing the result by the total maximum score that could be obtained in each case i.e. 34 points.

The method of calculating the disclosure score of each company can be expressed according to equation 1. (Hossain and Hammami, 2009).

Equation 1

$$EIDL = \sum_{j=1} \frac{d_j}{n}$$

where:

EIDL: the aggregate disclosure score;

d_j: 1 if the jth item is disclosed or 0 if it is not disclosed; and;

n: the maximum score each company can obtain. In this case, the key factor is whether or not a company discloses an item of information in the annual report.

The binary encoding technique was used for the content analysis. The technique of content analysis not only analyses the text, but also the details of context and inferences regarding the communication process with the aim of understanding the causes and background of the message, as well as its effects and consequences. The research is exploratory and uses the method of content analysis (Milne and Adler, 1999), together with the technique of documentary research for the analysis of sustainability reports published on websites of the companies in order to calculate the Environmental Information Disclosure Level.

Data analysis was performed with correspondence analysis. CA is an exploratory multivariate technique that converts frequency tables into graphical displays in which rows and columns are depicted as points (Greenacre 1984, 1989). Thus, CA is a method of visually representing the associations between different categorical variables, and it is most often employed as it is used here: a method for portraying data for visual inspection and analysis, rather than a method for testing statistical significance.

The analysis of the relationship between EIDL variables and country of location of a company used an interdependence technique called Correspondence Analysis (CA) in panel data, with a sample of 31 companies and 124 pieces of information regarding the period from 2006 to 2009.

Although the sample be characterized as small, it represents the entire universe of companies that published the report according to the GRI model and reported on the GRI website, except for a Brazilian company.The number of companies researched is compatible to other studies on the subject of voluntary environmental disclosure (Skouloudis *et al.*, 2010; Hossain e Hammami, 2009; García-Sánchez, 2008; Días-Sardinha e Reijnders, 2005; Campbell, 2004; Morhardt *et al.,* 2002).

A reliability test of the methodology was then performed. It is the Cronbach's alpha reliability coefficient that assesses the consistency of the entire range. This is the most widely used measure in exploratory studies such as these (Churchill Jr., 1986). The result shows that the metric of the study shows considerable consistency, considering that the values of Cronbach's alpha were always above 0.966 in the four periods.

The analysis of the organization profile was based on the year 2008 and GRI indicators were checked for the organizational profile. The indicator

4.14, which informs the list of stakeholders of the organization, deals with stakeholder engagement and the management aspect of communication between stakeholders and the company.

IV. Results Analysis

The analysis of the results is divided in two parts. The first one addresses the descriptive statistics and the second one focuses on the CA.

a) Descriptive analysis

The analysis reveals that the companies in Portugal showed improvement in disclosure, see Figure 1. This is most notable with Energias de Portugal (EDP), which in addition to pioneering publication is also a reference on the quality of the report and the identification of indicators, Figure 1.

EDP Renováveis and Pinto & Bentes started their publications in 2009, and are, therefore, in the process of structuring data for the first period of evaluation of three years, where consistency and materiality reinforce one another.

In Spain, reports from Iberdrola, Red Eléctrica and Gás Natural Fenosa stand out at the level of both disclosure and presentation of the indicators. And, consequently, they had the greatest disclosure levels in 2009, as shown in Figure 2.

The environmental information disclosure level with the GRI model in Brazil showed a positive evolution in both quality and quantity, as shown in Table 1.

The disclosure report with the GRI indicators carried out by the companies of the sample is consistent. In 2006, only eight (8) Brazilian companies had done the disclosure. However, seven (7) companies maintained consistency of disclosure in the period from 2006 to 2009, as shown in Figure 3.

The Portuguese and Spanish companies also maintained consistency publishing in the four years. The disclosure was done by five (5) and two (2) companies, respectively.

With three (3) publications, there was also a consistency of one (1) Spanish company and five (5) Brazilian. This fact practically repeats the number of companies with two (2) report publications, which includes one (1) Spanish company and six(6) Brazilian. Portugal has two (2) companies that started to publish in 2009 and because of this they have only one publication.

In the Brazilian group, three (3) of them published a report only once (1) and show discontinuity of dissemination in the GRI.

Various companies have published the indicators' index, and its equivalent with the principles of the Global Compact. Some companies identify the indicator in the text of the page indicated in the index. However, there are still inconsistencies in this type of information in the reports surveyed.

The reports of the companies with more experience in disclosure show specific identification of the indicator in the report text and in the index. It is worth mentioning here the reports of Endesa (in Brazil and in Spain) and Iberdrola (in Brazil and in Spain) and the following companies: Companhia Energética de Minas Gerais (CEMIG), Energias do Brasil, Companhia de Transmissão de Energia Elétrica Paulista (CTEEP), AES Eletropaulo e Companhia Paulista de Força e Luz (CPFL) located in Brazil.

As for the identification of stakeholders for companies, there is a striking similarity between what is regarded as disclosure in Brazil and in the Iberian Peninsula. The analysis was conducted in 2008, considering a sample of 18 Brazilian companies and 8 Iberian companies. The shareholders/investors, consumers/clients, employees and community/society in general are the priority stakeholders. But it is not told how these stakeholders communicate their business interests.

The report lists the group of stakeholders, which is identified as being priorities for the sustainable management of the company. However, it is not known how these stakeholders communicate their interests to the companies.

It is important to mention that Brazil adopts a non-mandatory model of environmental disclosure whereas Portugal and Spain use a mandatory model. However, the structure of the GRI report, and its voluntary publication, show some similarly in all three countries.

This suggests that the use of GRI indicators favours a process of uniformity in the disclosure of environmental information.

b) Correspondence analysis

To examine whether there is a relationship between the country where a company is located (variable country) and the environmental information disclosure level (variable EIDL) the CA and the division in quartiles were used. The content analysis reveals that the maximum EIDL value of the sample is one, and the minimum is zero. A value of zero shows that the company has failed to publish a particular indicator.

The results given in Table 5 highlight a balance between the bad and regular, and good and very good categories. It is clear, in Table 5, that there is an even distribution of results between the two pairs of categories. This means that the sum of 'bad' and 'regular' categories in percentage terms (52,42%) is almost the same as the sum of 'good' and 'very good' categories in the same percentage terms (47.58%).

Table 5 : Contingence table, Country x EIDL, Brazil, Portugal and Spain, 2006-2009

Country	Environmental Information Disclosure Level (EIDL)				Active Margin
	Bad	Regular	Good	Very Good	
Brazil	26	29	14	15	84
Portugal	6	3	5	2	16
Spain	1	0	11	12	24
Active Margin	33	32	30	29	124

Source: Own computations.

The high number apparent in the bad category (33) is explained by the number of non-published reports by the companies involved during the period of study. This has no individual qualitative representation because the first time the organizations published their GRI reports they were consistent in the publications and in the disclosure of their indicators and advanced in materiality. As 14 Brazilian companies did not publish any sustainability reports during the period under study, the "bad" category shows a result of 78.79%.

The very good category of 29 companies makes up 23.4% of the total of the sample. Brazil is highlighted in this category with 15 reports, Spain with 12 and Portugal with 2. Considering each individual sample, Spain holds the leading position with 50%, followed by Brazil with 17.9% and Portugal with 12.5% of the published reports.

The graphical representation of the EIDL variables and country of the companies' location is presented in the perceptual map, Figure 4.

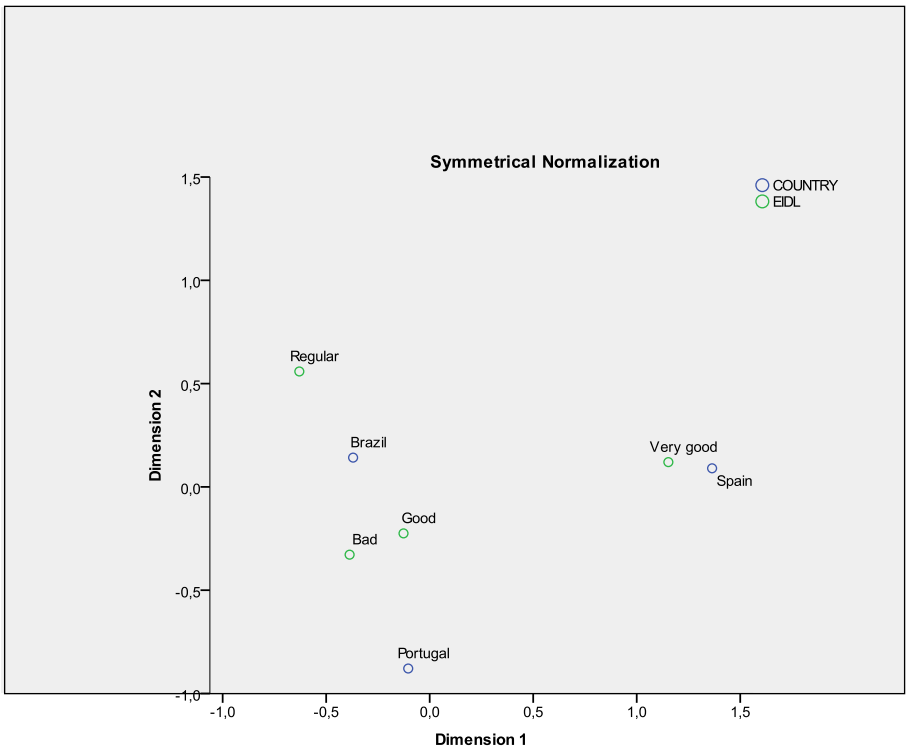

Figure 4 : Perceptual Map

Based on this graph, it is possible to see that the companies' disclosure level regarding the electric power sector in Brazil comes between regular and bad. While in Portugal it is between 'good' and 'bad', Spain shows results close to 'very good'.

The performance of the Spanish companies is more balanced, focusing on good and very good. Spain has a law that enforces environmental disclosure. A large number of companies publish in accordance with

the guidelines of the GRI and the energy sector is less concentrated in Spain than in Portugal.

Brazilian companies produced 58 publications in the period, but already show a trend in the disclosures with very good disclosure level. In 2006 and 2007, there was a publication each year considered to be very good; in 2008 there were five (5) and in 2009, eight (8).

Despite correspondence analysis not being able to explain a cause and effect relationship between variables, the historical context of the electricity sector in Brazil suggests that the use of environmental information for shareholders and investors, the performance of the regulatory agency (ANEEL) and government regulation in respect environment may be contributing to improve the performance of environmental disclosure in the sector in Brazil. The stakeholder analysis shows that the Brazilian market and the Iberian Peninsula have a focus on the shareholder/ investor. The participation of companies on the stock exchange contributes to an increase in the level of both social and environmental disclosure (Brown *et al.*, 2009).

V. Conclusion

Entities started to incorporate the philosophical concept of sustainable development into their strategies and to use the GRI indicators as a methodological approach to follow the environmental performance.

The results obtained show that the Spanish companies' reports have a very good disclosure level, the Portuguese companies have level of disclosure that is regular and the Brazilian companies show values between regular and bad.

Analysing the individual results over a period of time, it seems that Brazilian companies are in the process of improving their disclosure level, while the Iberian companies are maintaining theirs. This is because the number of Brazilian companies is higher than in relation to the Iberian Market, due to the diversity in its geography and the number of its consumers.

The identification of priority stakeholders to the companies is similar in all three countries. As for companies' communication processes with these stakeholders some similarities have been noted. The main communication channels in use are the telephone, e-mail and/or the use of websites. The conclusions are limited to the sample and the period under study and to the methodology used. It is important to note that the results obtained are site-and industry-specific, and therefore should not be generalized. Nevertheless, they have the merit of serving as the grounds for future research into environmental disclosure in other sensitive industries and might also influence the regulatory policy in the electricity sector

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Abbreviations

ANEEL	National Electric Energy Agency
CA	Correspondence Analysis
CCEE	Câmara Comercialização de Energia Elétrica
CEMIG	Companhia Energética de Minas Gerais
CMVM	Comissão de Mercado de Valores Mobiliários
CNMV	Commissión Nacional del Mercado de Valores
CPFL	Companhia Paulista de Força e Luz
CSR	Corporate Social Responsibility
CTEEP	Companhia de Transmissão de Energia Elétrica Paulista
CNE	Comisión Nacional de Energia
CVM	Comissão de Valores Mobiliários
EDP	Energias de Portugal
EIDL	Environmental Information Disclosure Level
ERSE	Entidade Reguladora dos Serviços Energéticos
ESI	Eletricity Supply Industry
GDP	Gross Domestic Product
GRI	Global Reporting Initiative
HEP	Hydroelectric Energy Plant

IAA	Institute of Accounting and Auditing
MERCOSUR	Mercado Comum do Sul
MIBEL	Iberian Market of Electricity
OMEL	Operador de Mercado Elétrico
OMIP	Operador de Mercado Elétrico-Pólo Português
ONS	National Power System Operator
OR	Ordinary Regime
UNEP	United Nations Environmental Program

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