

## **Green Accounting – A Proposition for EA/ER Conceptual Implementation Methodology**

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### **Abstract:**

Many countries have their own policies for the implementation of environmental reporting. However, no country has regulations in place requiring companies to issue a company-wide, stand-alone report on environmental performance that can affect zonal, regional and global communities. This article explores the concepts of environmental accounting and the possibility of broadening the applicability of the environmental reporting concept to be utilized by governments to make businesses more responsible for their externalities. The first part discusses the importance of environmental accounting as part of the accounting education, overviews the past and the current regulatory and mandatory status of environmental accounting and its relationship to different professions. The second part proposes a mandatory environmental filing system and explores its potential characteristics and benefits. The ultimate purpose of the filing system is to follow the whole life cycle of each major resource and to measure the effect of businesses on its hosting society.

Keywords: Environmental Accounting (EA), Environmental/Sustainability Reporting (ER), Resource Sharing, Waste and Material Reporting, Environmental Filing.

## **1. Introduction**

The environmental accounting (EA) is a proposed discipline that deals with the consideration and ultimately the inclusion into the customarily accounting procedures general and specific issues related to environmental and social impacts, regulations and restrictions. Safe, environmentally sound, and economically viable energy production and supply should be essential part of accounting and management issues. The start of this proposed consideration and inclusion of EA should be in college syllabus in the form of collateral reading assignments, case studies and public and scientific student awareness in intermediate and advanced accounting courses in order to explore current state and future issues of environmental accounting and reporting.

Although greater attention is slowly paid to environmental issues in accounting education in many high-ranked universities, yet the general impression about the implementation and application of the EA in real life is lagged far behind. This lag stems from two main causes: (1) lack of or incomplete understanding of the environmental and social impacts of EA and (2) the shortage of necessary accounting and auditing tools and procedures to implement the EA in real applications. As regards to the real implementation, lack of the adaptation of EA stems from three reasons: (1) the absence of clear-cut regulations and tools to implement the EA; (2) the dispersed responsibilities of implementing and imposing the EA among legislatures, accounting standard setters, professional organizations, and governmental accounting, environmental and social agencies and (3) the lack of experienced corporations' personnel to describe fully and forthrightly the environmental activities in either corporations' annual reports or in stand-alone environmental disclosures. Besides, there are no standardized formats for the presentation of environmental information, either in stand-alone reports or as components of annual reports.

In regards to accounting profession, there are 4 reasons for the lack of EA adaptation: (1) the profession has failed to maximize its potential for leadership; (2) the sufficient expertise to participate in environmental partnerships remains undeveloped; (3) the attestation to environmental reports is still not regarded solely as an accountant's function and (4) the official standards with respect to most EA/ER issues and/or verification engagements continue to be lacking.

Stevenson's survey (2002) indicated that accounting educators feel that their willingness to teach environmentalism is impeded due to students' lack of awareness of environmental issues especially in their early studies. In the 1980s, the literature focused on reporting issues, specifically health, safety, and environmental (HSE) reporting. Elkington (1998) wrote that TBL measured economic prosperity, environmental quality, and social justice. Currently, very few countries worldwide have any substantial ER requirements. Furthermore, up-to-date, the different and diverse regulations and restrictions are not well-defined and accepted in a global or at least regional sense, and hence there are no standardized formats for the presentation of environmental information, either in stand-alone reports or as components of annual reports.

To bridge the gap between the educational aspects of EA and its real application, the following steps are proposed: (1) The formation of EA agencies or societies to be in charge of (a) studying and reviewing the huge scientific and case studies literature on EA, (b) unifying common global or regional EA aspects and terminologies, (c) designing standardized formats and templates for EA, (d) setting starting points and directions for the educators, governmental, environmental, social and managerial personnel for adapting the EA; (2) To establish necessary legislature for the implementing and assessing the EA in corporations reports and the recognition

of liabilities for environmental remediation. (3) To enhance taxation policies for the inclusion of EA incentives. The importance of implementing the EA is becoming a growing issue in many countries, as explained in the coming section.

## **2. Present Status of EA/ER**

**2.1. EA/ER Implementation Awareness:** Many countries have their own policies for the implementation of EA: One method for holding businesses responsible for their behavior is to require them to report on their actions. The level and breadth of business reporting on environmental matters has increased dramatically over the past 20 years or so as a result of governmental regulations, accounting standard setting, and voluntary reporting. Today, external reporting on environmental performance occurs primarily through Pollution Release and Transfer Registers (PRTR), as components of traditional financial reports or in stand-alone, corporate environmental reports.

The need for corporate reporting of environmental as well as financial performance has some potential to give a greater degree of visibility to corporate environmental activities and consequences and casting light on what is often invisible. It is also important to recognize that visibility is not the only possible consequence of corporate reporting in this area, but rather its future prospects for sustainability and development. Indeed, it is possible that such reporting can even reduce what is known as negative effects about a company and its environmental activities. Also, companies are interested in the possibilities for environmental reporting to increase their legitimacy in the wider world.

**2.2. Stand-Alone EA/ER Implementation:** Currently, no first world country has regulations in place requiring companies to issue a company-wide, stand-alone report on environmental performance that can affect zonal, regional and global communities. Since 1996, companies in Denmark with significant environmental impact have been required to publish a “green account”, detailing significant consumption of energy, water, and raw materials. In legislation introduced in 1989 in Sweden, all operations sites that require special permits due to the presence of environmental hazards must submit an annual environmental report to the authorities. The Netherlands, in 1999, began requiring that companies with substantial environmental impacts produce environmental reports for both the government and public on identified operating sites. The contents of the government report, which are verified by governmental authorities, are specified and include information on emissions, soil pollution, soil clean up, and the company’s environmental policy.

The number of companies which voluntarily issue stand-alone reports that include environmental performance information have been increasing as has the diversity of the types of reports issued. Many reporting companies prepare a HSE report; however, in recent years, companies are also focusing on social issues. A survey conducted by Maasland KPMG (2002) analyzed the level of reporting health, safety, social, and/or environmental issues by the top 250 companies in the Global Fortune 500 (GFT 250) and the top 100 companies from 19 countries which showed that most companies prepared an HSE report.

**2.3. EC Mandated EA/ER Annual Reports:** Information included in traditional, annual financial reports is mandated by many national governments, accounting standard-setting bodies, and stock exchange regulatory agencies. In the realm of environmental disclosure, intervention

by governmental or profession regulators is necessary since, critical scholars (e.g., Gray and Milne, 2004) argue that voluntary ER will just not work. Second, the most pressing “accounting issue” related to EA was the disclosure of potential liabilities associated with environmental clean ups.

Currently, a company that is subject to the Annual Accounts Act (AAA) is required to include in its directors’ report, disclosures on the environmental impact of the company’s operations and the use and disposal of its products. Additionally, firms are to report those measures in place to prevent or reduce negative environmental impact, as well as their energy and raw materials usage. In May 2001, the EC published a recommendation encouraging member states to promote increased levels of issues of recognition and measurement of environmental liabilities, assets, expenses, and contingent liabilities to form an integral part of a company’s policies and its environmental protection improvements, resource consumption, and emissions. Further, beginning in 2004, companies must disclose certain non-financial information including information related to environmental matters so that annual report users may gain an understanding of the company’s development, performance, or position in its industry (e.g.: Hibbit and Collison, 2004; PwC, 2004). The statement applies to all companies whose financial position and results are impacted by environmental issues (PwC, 2004). In May 2005, the UK Accounting Standards Board (ASB) issued Reporting Standard 1: Operating and Financial Review (OFR). The standard requires the preparation by company management of an OFR as part of its annual report and accounts beginning with fiscal years ending on or after April 1, 2005. The standard requires the inclusion of information about environmental matters where appropriate. The implementation guide accompanying the standard acknowledges that the appropriate level of disclosure on environmental matters is industry-specific, but suggests that, minimally, all companies face issues associated with water and energy use, waste, and climate change (ASB UK, 2005). The Modernization Directive 2003/51/EC mandates that by 2005 all EU member states require listed companies to prepare their financial reports in accordance with international accounting standards. Australia also has recently passed legislation related to mandatory environmental reporting within annual reports. In summary, the level of mandatory environmental disclosures in traditional annual reports has increased dramatically in the past ten years.

**2.4. EA/ER in US:** In the US, disclosure requirements focus primarily on the impact of environmental issues on the financial results and position of the company, while regulations in many European countries and those mandated by the EU require disclosure on resource consumption and environmental policy in addition to the financial disclosures. Staff Accounting Bulletin (SAB) #92, issued by the Securities and Exchange Commission (SEC) in 1993, and Statement of Position (SOP) 96-1, issued by the AICPA in 1996, specifically addresses the financial reporting issues associated with superfund cleanup. These directives resulted from large disparities in the timing of the recognition of liabilities for environmental remediation and the presentation of these liabilities in financial reports (AICPA/CICA, 2002; SEC, 2003). Item 103 mandates that companies disclose either pending proceedings or those known to be contemplated by governmental authorities related to environmental issues. A group including environmental organizations, socially responsible investors and analysts, public interest and community groups, and over 60 companies (including 13 Fortune 500 firms) have endorsed the “CERES Principles”, a ten-point code of conduct on environmentally responsible behavior. Companies endorsing these principles submit an annual report that adheres to the CERES Report Form,

detailing their progress toward the environmental goals embodied in the CERES Principles (CERES, 2002). To receive EMAS registration, an organization must conduct an environmental review, establish an effective environmental management system (EMS), carry out an environmental audit, and prepare a statement of environmental performance outlining its progress on previously established objectives.

**2.5. EA and ISO:** In 1987, the IOS issued ISO 9000, a standard primarily concerned with quality management. ISO 14000 is primarily concerned with environmental management, with ISO 14001 addressing environment management systems specifically.

### **3. Standards for EA/ER**

**3.1. Global EA/ER Concern:** Some in the environmental arena suggest that mandatory reporting requirements at this stage in the development of ER may be premature (Burritt, 2002; Nyquist, 2003). If ER is voluntary and companies are permitted to select what they report, some companies may report only the “good news”, and firms that present the good with the bad will be disadvantaged. Further, without standards, verification of ER is problematic. The initial establishment of financial accounting standards began at a time when most business activities did not cross national boundaries. Thus, it was natural that accounting standards were highly country-specific. As a result, international financial accounting standards are being developed, albeit slowly, and, to some degree, are being accepted worldwide. Burritt and Welch (1997), citing Gray et. al (1993), speak of the “awesome indifference” of financial markets to environmental issues. Meanwhile, Thomas (2001) finds excess positive stock market returns for firms upon the adoption of an environmental policy and significantly negative returns for companies upon the announcement of their prosecution by environmental agencies. Meyer (2000) confirms that this company is not alone in its forward thinking in that environmental responsibility pays dividends in the recruitment process. Perhaps most importantly, an honest environmental program identifies an ethical corporation (Epstein 1996).

**3.2. Role of Profession in EA/ER:** Gray and Milne (2004) characterize current ER as virtually meaningless. For the auditor, the vision is an understanding of environmental management controls, processes and systems, which will enable an auditor to provide a true verification of environmental accounts. In three significant ways, the profession has failed to maximize its potential for leadership: (a) sufficient expertise to participate in environmental partnerships remains undeveloped; (b) the attestation to environmental reports is still not regarded solely as an accountant’s function and (c) official standards with respect to most ER issues and/or verification engagements continue to be lacking (Beets and Souther, 1999).

Engineering firms are more directly involved than public accountants in many processes related to ER. The Modernization Directive of the EU and the OFR standard in the UK mandate environmental disclosures, albeit unspecified as to content, in annual reports. These annual reports are required to be subjected to attestation by public accountants. As more standard-setting bodies worldwide require the inclusion of environmental performance information in annual reports, public accountants will need to develop the necessary expertise to audit these disclosures. In recent years, major public accounting firms have advertised themselves as “all-purpose business advisors”. The recent expansion of ER requirements abroad will force global accounting firms to expand operations in this area. An effort to increase public accounting’s

share of the ER business would be immeasurably enhanced if external verification becomes required as it is with financial statements. Wallage (2000) makes a strong case in support of the potential for large financial accounting firms to develop the expertise needed for environmental assurance. The evidence gathering techniques necessary for ER assurance parallel accounting's auditing methodology. Although accounting practitioners are guided by strict independence rules, yet public accountants have developed expertise in the processes of assurance and always have the backing of well-developed and influential professional organizations. However, external validation of an environmental report without defining standards would create an independence dilemma.

**3.3. Managerial Accountancy and EA/ER:** Epstein (1996) and Milne (1996) have written extensively about the negative impact on decision making and product costing when managers fail to take into account environmental costs. To be sure, these sectors are potentially the worst environmental polluters, but the development of environmental codes across international boundaries is reflective of strong managerial associations. While most cost accounting textbooks do not even address environmental issues, Hansen and Mowen (2003) have constructed a model for inducing action. They suggest the preparation of a report in which costs are presented in four categories: (1) environmental prevention costs (those aimed at preventing pollution and waste); (2) environmental detection costs (those associated with determining compliance with regulations); (3) environmental internal failure costs (those incurred in preventing pollution and waste from being discharged into the environment) and (4) environmental external failure costs (those incurred in cleaning the environment if pollutants are released). The costs classified above are then transferred to what might be called an environmental income statement where they are compared to the estimated annual benefits of expanded environmental action ("eco-efficiency"). There is one further piece of ammunition available to management accountants trying to provoke a greater proactively on environmental issues. Krut and Moretz (2000), likewise urging a joint-venturing approach, cited British Petroleum as an example of one company that retains both a major public accounting firm for attestation and a consulting firm to solicit feedback on its environmental performance. Internal accountants, working in concert with environmental engineers, will be schooled in the methodologies required for environmental accountability and the statistical techniques needed to measure compliance with ER regulations. The "balanced score card" will come to incorporate measures of environmental responsibility.

#### **4. EA/ER Conceptual Implementation Methodology**

**4.1. EA/ER and Sustainable Development:** Most governments are concerned with their ability to maintain sustainable development (which is usually defined as the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs). Given that some researchers argued that many of the implicit and explicit assumptions that underlie the current economic model are invalid when judged against observed social and ecological reality (cf. Rees 1988; Daly and Cobb 1989; Pierce and Turner 1990; Worster 1993) and that many of the accounting conventions for measuring economic growth reflect and create perverse incentives that increase the pace of environmental degradation. Besides, governments have to establish an integrated comprehensive reporting

requirement for newly establishing business that includes all the aspects of its nonfinancial performance and its externalities effect.

There are a large number of environmental, social and economic indicators being developed to assist with sustainability assessment (see, for example, CRISP, 2003; Deelstra and Boyd, 1998; Mega & Pedersen, 1998; Warhurst, 2002; Wong, 1995). Generally however, these indicators are usually used in isolation to analyze the performance of projects, companies, sectors and countries as they relate to one of the three dimensions of sustainability (i.e.: environmental, social and economic). No robust model has integrated all three dimensions into a single framework currently exists. (Xing et al. (2009)). The Global Reporting Initiative's (GRI) have improved the reporting and that the sustainability reporting guidelines' updates guidance has become the basis for reporting sustainability performance by organizations worldwide. While the GRI framework has, over the years, become much more detailed regarding the performance indicators that companies are urged to measure and monitor, yet the issue here is that the GRI framework is not an officially mandated and so it will not help governments to determine the whole effects of the outcomes of the manufacturing businesses.

**4.2. Proposed Mandatory Environmental Filing System:** Environmental accounts usually rely on a standardized framework for reporting environmental and resource losses, and in most instances, they have linkages to traditional economic indicators through the social accounting matrix (Gilbert 1990). When environmental and resource losses are monetarized and subtracted from the traditional measure of economic output—that is, the Gross Domestic Product (GDP) for a given area such as a nation, state, or regional economy—environmental accounts give governments and decision-makers an enhanced understanding of the true costs of economic growth, many of which are misrepresented and underestimated in traditional economic accounts (Bartelmus 1996).

What we propose in the present paper is an accounting based environmental filing system to be used by governments to make businesses account for their perceived externalities from the point of establishment and as long as they continue operations. Proposed characteristics of the mandatory environmental filing system are given below. In what follows, the word **“company”** will mean any industrial, agricultural, residential, commercial, .... etc. companies, institutions or establishments, agencies, ... etc.:

**A) Contents of Environmental Filing:**

1. All companies, other than small, present to the affiliated governmental agency an integrated environmental filing that reasonably reflects its detailed activity within a reasonable time-span (i.e.: 5 years, 10 years, ...) in order to have official approval for their initiation, establishment and later commencement of operations. In that respect, justification for the establishment of such company in proposed locality is given in regards to present and future local and regional developments in economical, social and environmental levels.
2. The filing shows company usage of: raw/non-raw materials, water and energy in regards to: types, quantities, continuous/intermittent rates, local/regional/import availabilities, present/possible/generated/recycled resources, current/possible/future needs and expansions.

3. The filing shows all solid, liquid and gaseous wastes in regards to: types, quantities, rates, physical/chemical compositions, health implication, dumping/recycling methods, short/long term demographic changes ...etc.
4. The filing shows company's actions/counteractions to meet presumed economic/social/environmental/sustainable development guidelines set forth by concerned entities (government, society, environmental agencies and local/regional/global concerned groups).

**B) Method of Filing:**

1. Entries of each category of filing are substantiated by descriptive analysis, measurable units and monetary values depending on each item in the file.
2. Both minimum and maximum limits for each entry are highlighted based on local/regional/global standards and on similar acceptable legitimate activities around the world.
3. Subsequent annual filling should be added the original baseline for follow-up purposes.

**C) Approval of Filing:**

1. Upon submission, affiliated governmental agencies, composed of specialists in each major aspect of the filing, thoroughly review filling contents and discuss with company's entities other economic/social/environmental available better/possible alternatives.
2. Alternatives might include possible usage of alternative sources of the inputs, further processing of waste and byproducts possible arrangements with other businesses to utilize the byproducts and wastes.
3. Affiliated agencies set rules, regulations and possible liabilities for the externalities on the society based on the pre-established limits.
4. Approval of the filling as official documents for the government/company agreement.
5. This filing will be the baseline for any subsequent annual reports for such companies.

**D) Objectives of Filing:**

1. Filing should allow decision makers to analyze the environmental, social and economic costs and benefits in monetary and quantitative terms at different stages in the life cycle of the production process of each business unit.
2. The filing will depict the framework suggested by GRI guidelines.
3. Affiliated government agencies will have pre-established outlines of acceptable sector/zone/region ranges of each externality based on the nature/size/extent of the company and the past experience of best practices.
4. The affiliated agencies will specify the form and amount of penalty to be imposed upon exceeding the pre-established externalities limits.
5. The business will be required to fulfill what was stated in the original filing and to file annual feedback each year for follow up, control and any future necessary economics/social/environmental remedial actions.



6. The filing will compile quantitative information for many different industrial businesses and will allow the government to create a network of industries with the possibility of byproduct and resource sharing among businesses across the entire country.

**4.3. Assumptions:** While the applicability of the proposed filing requirement could be considered irrational as business operations vary widely based on the sector and the zone of operation, and because of the expected high costs associated with annually preparing such filing, yet utilizing the following assumptions could improve the applicability and acceptance of the proposal:

a) First, each government will classify the required environmental filings based on different levels in the geographic hierarchy (e.g., states, metropolitan areas, cities, census tracts) (Steel and Holt 1996), and within each level will classify businesses by sector and size. Then, the government will indicate the acceptable level of externality for each sector and size. See Table (1) below.

b) Second, specific boundaries of the unit of analysis may influence variation in environmental costs in these units. This is called the “zoning effect.” Even at the same scale, observed spatial patterns might be a function of the zonal boundaries chosen for analysis, rather than of the underlying spatial pattern.

c) Third, the cost accounting system with its focus on inputs, conversion factors and outputs is a ready source of quantity based data. These inputs, such as energy, raw materials, feed and additives, as well as the outputs in terms of product and by-products are often expressed in quantity terms such as megawatt hours, gigajoules, liters, tones and cubic meters. For example, megawatt hours of electricity are converted to tones of carbon dioxide using accepted conversion factors. (Fernandez, 2008).

d) Forth, we assume that the overall cost of preparing the proposed filing will decrease overtime because once business start to capture this data more efficiently, they will realize that they can function like 'traditional' performance management, in that it gives them current information they can actually use to make decisions about emissions, energy usage, and other critical business matters. Not only that, but also they can also have an interest in using reporting to facilitate the construction of a new and different image of the company (Leibs, 2007).

We believe that this filing will have some potential to give a greater degree of visibility to businesses environmental activities and consequences, and will allow governments to cast light on what is often invisible. Some of the implementations that further illustrate how the proposed filing could be applied and that discuss the importance of its application in four main aspects of environmental reporting: material, waste, energy, and gas emissions are listed below.

Table (1) Example of a chart that can be used by governmental agency to classify Sectors by their effect on environment and indicate Acceptable Level of externality for each sector:

Low Intensity				Medium Intensity				High Intensity			
Sector	AL(%)*			Sector	AL(%)			Sector	AL(%)		
	S1**	S2	S3		S1	S2	S3		S1	S2	S3
General Financial				Personal Goods				Electricity			
Media				Beverages				Industrial Metals			
Telecommunications				Household Goods				Industrial Transportation			
Insurance				Tobacco				Oil and Gas			
Banks				Aerospace & Defense				Mining			
Residential				Pharmaceuticals & Biotechnology				Food Producers			
Educational				Food & Drug Retailers				Support Services			
Recreational				Healthcare Equipment & Services				Construction			
				General Retailers				Chemicals			
				Software & Computer Services				General Industrials			
								Travel & Leisure			

\*AL: Acceptable level of Emission which will be based on different factors including the zone in which the company is established, the availability of resources, the size of the business (\$ capital investment)  
 \*\*S1, S2, S3: The size of the business as a dollar amount of capital investment or equity. For example: S1: business less that \$50 million investment, S2: business from \$50 million to \$100 million dollar, and S3: business above \$100 millions.  
 Note: This chart is based on the Environmental Reporting: Trends in FTSE 100 Sustainability Reports © Spada Limited 2008

**4.4. Material, Waste, and Land EA/ER:** Some resources are available in finite supply and are irreplaceable. Through the local reuse of secondary materials, industries can lessen demand for virgin production, save energy in manufacturing, and avoid long transport distances. In almost all cases, the processing of secondary materials requires less energy and results in less pollution than production of equivalent quantities of virgin material (Eckelman, M., & Chertow, M. 2009). In general, using secondary materials for production has fewer life cycle environmental impacts than using primary (or virgin) materials because the former are already partially refined and so have embedded much of the needed material and energy. Chertow and Lombardi (2005) conducted an economic and environmental analysis of an industrial cluster in Guayama, Puerto Rico, including a coal-fired power plant, a wastewater treatment plant, and a petrochemical refinery. They found that resource sharing saved the system four million gallons per day of fresh water and led to significant reductions in gas emissions. Another example would be the substitution of virgin paper by recycled mixed paper also has large environmental benefits overall. virgin paper requires roughly 8 GJ/ton more primary energy than recycled paper and produces approximately three times as much SO<sub>2</sub> and twice as much NO<sub>x</sub>.

Agricultural land and water falls into the finite supply category. Once converted from agricultural to urban or industrial uses, it is unlikely that such lands will produce food again. A study estimating the value of agriculture land losses in San Diego between 1990 and 1995 using an average price estimate for agricultural output and discount rates ranging from 0 to 5 percent found that the present value of the losses ranges from 0.18 percent to 1.8 percent of the total economy (Jerrett, M., Rey, S. J., Dufournaud, C. and Jones 2003).

For example, the gradual depletion of groundwater supplies due to overuse by multiple users eventually results in water shortages and the need to seek more expensive supplies. Table (2) is a sample form that will list the materials used in the business operation in a monetary and quantitative terms, list the amount of waste from each material, the percentage and amount of

reuse and recycle, and the possibility of substituting the material with a byproduct from another business. an example of a chart that can be used by governmental agency to allow business to identify the byproducts of their operations and to assess their ability to substitute for it. The sharing of material, energy, and water resources among proximate firms, known as industrial symbiosis, has been touted as a way to reduce the environmental impacts of industry.

Up to now, there is no reliable country wide estimate of generation or disposal made by each major industry. The proposed filing will compile quantitative information for different industrial symbiosis and will create a network of industries and byproduct sharing across the entire country. Governments will be able to maintain residual waste database to record and analyze both the generators of waste as well as the destination type for that waste. Using this analysis but considering instead the total generation of all usable residual waste, the statewide potential environmental benefits are roughly four times as large as those currently enjoyed,

Table (2) Example of a chart that lists the materials required for the business operations, the waste from each , the reuse and the possibility of using substitutes.										
Primary Material*	\$	Unit	Waste/byproduct			Reuse/Recycle		Secondary Material Substitute***	\$	Unit
			Unit	%	Destination**	Unit	%			
Sand								Coal-derived bottom ash		
Lime								Coal-derived fly ash		
Gypsum								FGD residue		
Sand								Other ash		
Sand								Foundry sand		
Cement								Slag		
refractory material								Refractory material		
Virgin steel								Ferrous scrap and dust		
Virgin nonferrous								Nonferrous scrap and dust		
Compost								Water/wastewater treatment sludge		
Animal feed								Food waste and sludge		
Fuel/ engine oil								Oil/oily sludge		
Sand								Generic sludge		
Hydrochloric acid								Lime-stabilized spent pickle liquor		
Ethylene glycol								Machine coolants		
Coal/ mulch								Wood wastes		
Mixed paper								Paper products		
Textiles								Textile waste		
Glass								Glass cullet		
Mixed plastic								plastic waste		
Asphalt								Asphalt		
Sand								Ceramic waste		
Steel drums								Containers		
Sand								Baghouse dust		
Drywall								Used drywall		
metal catalysts								Spent catalysts		
Sand								Debris and sediment		
Lead								Nonhazardous batteries		

\*Primary Material: Are the materials in its raw form without any processing. It also called virgin materials.  
 \*\*Destination: There are 8 disposal destination types as follows: surface impoundment, incineration, landfill, on-site storage, treatment, underground injection, and on-site and off-site wastewater treatment. (ECKELMAN, M., & CHERTOW, M. 2009).  
 \*\*\*Secondary Material: Are byproducts materials of other businesses and can be used as an efficient substitute of the virgin material.  
 Note: This table is based on Eckelman, M. J. and Chertow, M. (2009).

**4.5. Energy-Based EA/ER:** It is of crucial importance for businesses to report on their usage of different sources of energy in a regular basis. It is stated in the report on energy resources announced by the World Energy Council in 2001 that "there are sufficient resources in every region of the world that would satisfy the growing energy demand even in the 21st century; however, there are no new special technologies that would markedly reduce the part of organic (fossil) fuel in the general energy balance in the nearest future" (World Energy Council, 2001). It is also the only commodity that cannot even in theory be recovered and reused.

Due to the unique position of energy among the other industrial commodities and the growing price of energy resources and expensive infrastructure, researchers argued that energy influences the speed of economic growth of countries. Economic development is directly related with energy infrastructure adapted to industrial development possibilities and supply of energy resources. Many scholars suggested as early as 1922 that the price of a commodity should reflect the energy used directly or indirectly to produce it.

Engineers usually differentiate between the different types of energy based on the exergy content of the type. The concept of exergy can be simply stated as follows: Certain types of energy (e.g.: electricity, wind, hydraulic, mechanical, .. etc.) are considered of high grade and have high exergy value because they can do direct mechanical work and motion, while other types of energy (e.g.: thermal, chemical, solar, nuclear, .. etc.) are considered low grade because they can't do direct mechanical work or motion and hence they have low exergy value. Based on this definition, two equal amounts of different energy types should be priced differently based on their exergy values.

The side effect of the current activities of energy production, transmission and distribution however is the rapid use of nonrenewable resources resulting in a negative impact on the surrounding environment. An abundant supply of, mostly non-renewable, energy and an increased output per energy unit are driving our present industrial society. Although not really lost in physical terms, energy is degraded to the extent that no more useful work can be extracted from it. Even with the technical improvements in the production system, the energy gains achieved through improved production efficiency are counterbalanced by the increase in volume and complexity of the production system.

E/R filing of the energy aspects should consider the conventional/nonconventional energy resources (i.e.: fossil resources (oil, coal, natural gas); biological resources (agricultural products and residues biogas, forest products, livestock and aquatic products); generated resources (electricity, nuclear) and renewable resources (solar, hydraulic, wind). Local/regional/global availability and consumption rates and quantities of each energy type and expected future needs should be clearly stated. The following two tables present filing guidelines to be adopted in energy filing. The first table includes space to report values of exergy of each energy type.

**Table (3). Filing guidelines of energy types and quantities usage by the company.**

Resources	Energy type	Quantity of energy										Total		Exergy value	
		Available		Extracted		Stored		Imported		Exported		Q	\$		
		Q	\$	Q	\$	Q	\$	Q	\$	Q	\$				
<b>Fossil</b>	Coal														
	Oil														
	Petroleum product														
	Natural gas														
<b>Biological</b>	Biogas														
	Agricultural residues														
<b>Generated</b>	Electricity														
	Nuclear														
<b>Renewable</b>	Hydraulic														
	Wind														
	Solar														
<b>Total</b>															

Q = quantities of energy type (MJ, Barrel, Tons ...) and \$ = cash value of energy amount.

**Table (4). Energy usage by each activity.**

Resources	Energy type	Textile	Wood	Paper	Iron and steel	Nonferrous metals	Nonmetals	Chemicals	Food	Farming	Transport			Total
<b>Fossil</b>	Coal													
	Oil													
	Petroleum product													
	Natural gas													
<b>Biological</b>	Biogas													
	Agricultural residues													
<b>Generated</b>	Electricity													
	Nuclear													
<b>Renewable</b>	Hydraulic													
	Wind													
	Solar													
<b>Total</b>														

**4.6. Pollution Based EA/ER:** It is clear that climate change challenges companies with financial, social and environmental risks from litigation and/or regulation of greenhouse gases (GHG). According to a released report by Ceres and Calvert Standard & Poor’s S&P 500 the 500 largest US publicly traded companies are doing a poor job of disclosing climate change risks to their investors. Mindy S. Lubber, president of Ceres, said that all companies should disclose their risks using the three most common disclosure mechanisms: US Securities and Exchange Commission (SEC) filings, the CDP, and sustainability reports using GRI Guidelines. A study Produced by the Association of Chartered Certified Accountants (ACCA) and the FTSE Group of 42 UK companies recognized as leaders in environmental reporting indicates that even the “good guys” have considerable room for improvement when it comes to coverage of climate change issues. All companies should provide stakeholders with more analysis and disclosure on climate risks and their strategies for managing or mitigating those risks. The proposed filing of an annual comprehensive environmental report will make companies more transparent and

accountable with regard to their gas emissions and will improve their adapted strategies to reduce gas emissions and pollution over time.

**4.7. EA/ER Assurance and Evaluation:** Based on the ER filing presented by the company before its initiation and along its operation, its activities will be judged according to the baseline of its ER filing accepted by the government during its early phase of initiation. Table (5) below is an example of such evaluation sheet.

Table (5) Assurance, evaluation and control of company activity with respect to its ER baseline				
Evaluation criteria	ER* company evaluation on scale 0:6	EP** company evaluation on scale 0:6	Company Decision	Remarks
<b>(A1) Company structure and management systems</b>				
1. Existence of a department for pollution control and/or management positions.				
2. Existence of an environmental and/or a public issues committee in the board.				
3. Existence of terms/conditions applicable to suppliers/customers regarding environment practices.				
4. Stakeholder involvement in setting corporate environmental policies.				
5. Implementation of ISO14001.				
6. Executive compensation is linked to environmental performance.				
<b>(A2) Credibility</b>				
1. Adoption of sustainability reporting guidelines.				
2. Independent verification/assurance about environmental information.				
3. Periodic independent verifications/audits on environmental performance.				
4. Certification of environmental programs by independent agencies.				
5. Product Certification with respect to environmental impact (0-1				
6. External environmental performance awards and/or inclusion in sustainability index.				
7. Stakeholder involvement in the environmental disclosure process.				
8. Participation in voluntary environmental initiatives endorsed by EPA/Energy bodies.				
9. Participation in associations/initiatives to improve environmental practices.				
<b>(A3) Environmental performance indicators (EPI) (max score is 60)</b>				
1. ER/EP on energy use/efficiency.				
2. ER/EP on exergy use/efficiency.				
3. ER/EP on water use/efficiency.				
4. ER/EP on green house gas emissions.				
5. ER/EP on other air emissions.				
6. ER/EP on land/water/air.				
7. ER/EP on other discharges, releases and/or spills.				
8. ER/EP on waste generation/recycling/re-use/reducing/treatment/disposal.				
9. ER/EP on land and resources use/biodiversity/conservation.				
10. ER/EP on environmental impacts of products/services.				
<b>(A4) Environmental spending (max score is 3)</b>				
1. Summary of savings arising from environment initiatives.				
2. Amount spent on technologies, R& D and/or innovations to enhance environmental performance/efficiency.				
3. Amount spent on fines related to environmental issues.				
*ER: environmental reporting, ** EP: environmental performance. Based on Clarkson et.al (2008)				

## **5. Limitations to the research and suggestions for future researches**

We would like to point out certain limitations of the research and welcome comments and criticism. It is our hope that the study will spur follow up research and an open discussion of the issues. The research proposal was limited firstly by the lack of hypothetical comprehensive example to visualize the feasibility of the application. As a result, there is a consequent need to develop models in order to further investigate the rationality of the stated characteristics and assumptions. The research also didn't investigate the extent of applicability of the proposed filing system, the way governments will control and audit the submitted filings, the expected costs for new businesses to adhere to such regulation, and whether the perceived benefits from the regulation will exceed the expected business costs of filing. We fully acknowledge that this is only one way of looking at mandatory environmental reporting, and would recommend that further research be undertaken using different views, with hypothetical application within and across industries and professional sectors.

**Appendix A. Acronyms**

<b><i>AAA</i></b>	Annual Accounts Act.
<b><i>AICPA</i></b>	American Institute of Certified Public Accountants.
<b><i>ASB</i></b>	Accounting Standards Board.
<b><i>CERES</i></b>	Coalition for Environmentally Responsible Economies.
<b><i>CICA</i></b>	Canadian Institute of Chartered Accountants.
<b><i>EA</i></b>	Environmental Accounting.
<b><i>EC</i></b>	European Commission.
<b><i>EMAS</i></b>	Eco-Management and Audit Scheme.
<b><i>EMS</i></b>	Environmental Management System.
<b><i>EPA</i></b>	Environmental Protection Agency.
<b><i>ER</i></b>	Environmental Reporting.
<b><i>EU</i></b>	European Union.
<b><i>FASB</i></b>	Financial Accounting Standards Board.
<b><i>GDP</i></b>	Gross Domestic Product.
<b><i>GHG</i></b>	Greenhouse Gas.
<b><i>GRI</i></b>	Global Reporting Initiative.
<b><i>HSE</i></b>	Health, Safety, and Environmental.
<b><i>ICAEW</i></b>	Institute of Chartered Accountants in England and Wales.
<b><i>ISO</i></b>	International Organization for Standardization.
<b><i>OECD</i></b>	Organization for Economic Co-operation and Development.
<b><i>OFR</i></b>	Operating and Financial Review.
<b><i>PRP</i></b>	Potentially Responsible Party.
<b><i>PRTR</i></b>	Pollution Release and Transfer Register.
<b><i>SAB</i></b>	Staff Accounting Bulletin.
<b><i>SEC</i></b>	Securities and Exchange Commission.
<b><i>SOP</i></b>	Statement of Position.
<b><i>TBL</i></b>	Triple Bottom Line.
<b><i>TRI</i></b>	Toxic Release Inventory.



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