MANAGEMENT ACCOUNTING GUIDELINES
MAG - IV

TOOLS AND TECHNIQUES OF ENVIRONMENTAL ACCOUNTING FOR BUSINESS

The Institute of Cost and Works Accountants of India
(Statutory Body under an Act of Parliament)

Management Accounting Guidelines

MAG - IV

TOOLS AND TECHNIQUES OF ENVIRONMENTAL ACCOUNTING FOR BUSINESS

Issued by
The Institute of Cost & Works Accountants of India
(Statutory Body under an Act of Parliament)
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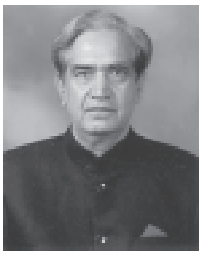

10 Sept. 2008

MESSAGE

Peter Drucker's Activity Based Costing (ABC) is very apt in the context of implementing environmental strategies by corporate and non corporate enterprises. Akin to the framework of cost of quality - the environment management related costs can also be bifurcated as costs of failing to protect the environment and those related to preventive care of environmental damage.

Again the environmental costs can be regulatory, incurred upfront or voluntary by raising the level of integration of business strategy with environment. The costs level of the corporate enterprise in the above category is largely a function of what level of maturity they are which has been effectively brought out by ICWAI in another guidelines relating to implementing corporate environmental strategies. A commendable interfacing of assessing the costs with reference to the strategy has been attempted in this management accounting guidelines by ICWAI.

Reckoning with the environmental related costs be it be financial accounting or cost accounting cannot be the outcome of the conventional wisdom. These aspects have been discussed in depth in the management accounting guidelines brought out by the Institute of Cost and Works Accountants of India (ICWAI).

The Indian corporate sector which is fond of always picking up the best practices on manufacturing from Japan should pick up the aspect of reporting on environmental costs by their Japanese counterpart. The Indian reporting on environment costs if adopted can be based on these guidelines issued by ICWAI and to that extent it will be a real spin on the concept contributed by India to the global community. I look forward to the collaboration between ICWAI and Indian corporate sector in introducing cost reporting on environment based on the guidelines.

FOREWORD

For long-term success, organizations today need a corporate environmental strategy that integrates environmental consideration into management decisions. To support these decisions, companies need effective ways to measure and manage environmental costs and related opportunities.

However, these costs are often misallocated or hidden in overheads accounts; as a result, costing and pricing are distorted across the business and poor investment and strategic decisions can be made. These guidelines describe the methods available to isolate, measure, report and manage current and future environmental costs and opportunities and focuses on three management decision-making processes: cost analysis, investment analysis and performance evaluation. The guidelines complement material in implementing Corporate Environmental Strategies, and understanding and implementing ISO 14000 and will be useful to all organizations regardless of size, location or existing environmental systems.

I would like to place on record efforts put in by Mr. B.M. Sharma, Central Council Member and Chairman, P.D. Committee of Institute and Mr. Veerraghavan Iyengar in bring out these guidelines by the Institute.

I, on behalf of the Institute, acknowledge CMA, Canada for allowing the Institute to publish Management Accounting guidelines on "Tools and Techniques of Environmental Accounting for Business". These guidelines have been adopted by the Institute through P.D. Committee of the Institute. The guidelines contained in the book would be very useful for the Management Accountants, Regulatory bodies, Industries and other professionals.

Chandra Wadhwa
President

PREFACE

The guideline brought out by Professional Development Committee of ICWAI on Tools and techniques of environmental accounting. Environmental protection and economic growth are becoming more closely aligned. The tools and techniques of environmental accounting for business decisions that are described in this guideline can be used by the business organisations in each of the three stages. Just as companies can include the boundaries of these stages, they often use these tools and techniques in more than one stage.

In this guideline, environmental accounting is the identification, measurement and allocation of environmental costs, the integration of these environmental costs into business decisions, and the subsequent communication of the information to a company's stakeholders.

To successfully implement a corporate environmental strategy, decision-makers require precise information about the environmental costs of the company's products, processes and activities. Determining whether a cost is environmental is not critical; the goal is to ensure that relevant costs receive appropriate attention.

This guideline focuses on three management decision-making processes such as costing analysis, investment analysis, and performance evaluation.

The risk are already high, and are rising daily, not only in the legal context but in terms of becoming a good corporate citizen ,more energy-efficient and cost-effective operation, and identifying short- and long-term business advantages.

We are of the opinion that the tools and techniques

suggested in this guideline are meant to improve corporate environmental management practices to minimize corporate environmental negative impacts and also to improve corporate financial performance.

I would like to place on record efforts put in by Mr. A. N. Raman Central Council Member of the Institute, Mr. Veer Raghavan Iyengar member of the Institute, Mr. P. Thiruvengadam member of the Institute and Ms. Nalinee Jagtap student of ICWAI in bringing out these guidelines by the Institute. We are also thankful to CMA Canada for extending their helping hand in reproducing the publication.

We are grateful to Mr. Chandra Wadhwa President of ICWAI, Mr. Kunal Banerjee vice-president of ICWAI, the members of Central council and the members of the Professional Development Committee in particular who have given their valuable Guidance and support in bringing out this publication.

Brijmohan Sharma
Chairman
(Professional Development Committee)

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ENVIRONMENTAL ACCOUNTING IN BUSINESS DECISIONS

CURTAIN RAISER BY CONFEDERATION OF INDIAN INDUSTRY (CII)

Background

Environmental protection and economic growth are becoming more closely aligned. Governments, corporations, non-Governmental voluntary organizations and individuals are recognizing the benefits of environmental sensitivity and environmental progress. Consumers are more responsive to concerns in their purchasing, use, and recycling decisions in respect of the products from an environmental perspective.

Issues and scope

Indian Business organizations are just beginning to understand what is meant by proper response to environmental concerns and the changes that are needed due to the environmental agenda being practiced by Government, other interest groups and other organizations. The environmental monitoring and control is divided between the central and state Governments and the agencies/Government Departments which are doing the work are governed by a comprehensive legislation or guidelines.

Indian Business Organisations processing towards proper response to environmental accounting in business decisions.

Every organization is trying to understand the values, systems and practices that have to be focused to translate to environmental strategy for each of the organizations. The objectives of an environmental strategy would be:

- To recognize environmental trends and implement appropriate measures
- To increase stakeholders' confidence in management of environment issues proactively
- To ensure long term corporate profitability on a clean environmental basis
- To minimize risks arising from product liabilities and changes in the environmental norms
- To assesses risks and mitigate the risks by proper planning

Role of Management Accountant

The Management Accountant's roles in this issue vary with the type of job and enterprise. Management accountants should work closely with other multidisciplinary groups, like production, maintenance, utilities, waste water management, marketing and materials management in areas pertinent to their individual enterprise's business lines.

For example, the management accountant may :

- Identify cost areas that directly relate to environmental objectives, such as waste treatment, resource recovery, disposal, or site maintenance;

- Help resolve conflicts between environmental management and traditional financial management systems, such as those that occur in capital investment appraisal and capital budgeting;
- Contribute to life-cycle assessment of product/ processes;
- Assess potential liabilities of past practices;
- Assess the need for new or modified management information and financial systems;
- Consider the financial costs and risks associated with an investment that will likely cause or increase pollution; and
- Make environment-related costs more visible

The code and guideline requirements

In the Indian context as indicated earlier the Legislations, enforcement and the practice in relation to environmental issues is in its early developmental stages. Going by the experience of other countries this is not likely to remain so. Hence an excellent opportunity exists, to introduce and manage environmental accounting and implementation issues voluntarily and in a planned manner.

The areas that need attention are:

- Building up a standard list of regulatory requirements
- Planning and listing of all possible risks

- Preparing the organization for building in systems and responsiveness in respect of compliance required as above
- Integrating the requirements into all aspects of the business of environmental accounting programme
- Developing management information from this angle for cost identification, accumulation and analysis for environmental management information through the management accounting system.
- Internal training and management development of people and setting up an Environmental Audit programme would also be next stage of evolution.

All the required environmental information has to be integrated in the management decisions. So the typical corporate organization should have:

- An environmental policy
- Safety & Healthy environment principles and values
- Environmental information system
- Guidelines for environmental accounting

The guidelines for Environmental Accounting cover:

- A detailed cost analysis
- Allocation of environmental costs
- Investments required and cost management of those investments
- Performance evaluation and reporting

TOOLS AND TECHNIQUES OF ENVIRONMENTAL ACCOUNTING FOR BUSINESS DECISIONS

Successful business strategies depend on the quality and comprehensiveness of information available to decision-makers. The practice of generating management information such as cost of sales is well established, and the systems employed to produce conventional management reports generally ensure timely availability of high-quality data to management.

However, competitive advantage is gained by generating and capitalizing on business information not generally investigated by one's competitors. Comprehensive management information, including information on environmental costs and opportunities, can yield competitive advantage. Typically, environmental costs and associated opportunities are buried in various overhead accounts. By distorting costing and pricing across the business, this practice can result in poor investment and strategic decisions. Methods are now available to measure, report and manage current and future environmental costs and opportunities. These management tools and techniques can help management isolate the sources and magnitude of previously hidden and misallocated environmental costs and facilitate better business decisions. This guideline follows and relies on the material discussed in an earlier publication titled *Implementing Corporate Environmental Strategies*, which provided a

framework for companies to begin implementing a corporate environmental strategy. This guideline assumes that users have read Implementing Corporate Environmental Strategies and have a basic understanding of the need for and benefits of a proactive corporate environmental strategy and overall guidelines for implementation.

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THREE STAGES OF IMPLEMENTING A CORPORATE ENVIRONMENTAL STRATEGY

Environmental concerns play a significant role in the formulation of corporate strategy. Implementing Corporate Environmental Strategies describes three stages of corporate involvement in the development and implementation of a corporate environmental strategy. These stages are:

- Stage 1 Managing Regulatory Compliance;
- Stage 2 Achieving Competitive Advantage; and
- Stage 3 Completing Environmental Integration.

In Stage 1, organizations develop environmental management programs in response to increases in both external pressure and internal awareness. Stage 1 organizations are motivated by concerns about the potential liability exposure they may face. They realize the possible risks, such as litigation and cleanup costs, associated with current practices; and they develop systems for identifying and monitoring physical risks and hazards relative to regulatory requirements.

Beyond a commitment to compliance with legal requirements, Stage 2 organizations realise that using resources more efficiently can gain them a competitive advantage. Minimizing environmental risk and liability exposure is the hallmark of Stage 1 organisations; Stage 2 companies focus on cost management.

In Stage 3, organizations have fully integrated environmental considerations into corporate life. They recognize that environmental performance is not just a legal requirement, moral imperative or cost of doing business but a part of surviving in a competitive world economy. Environmental issues, large and small, are part of everyone's day-to-day decision-making. Stage 3 companies recognize that long-term economic growth must be environmentally sustainable.

The tools and techniques of environmental accounting for business decisions that are described in this guideline can be used by companies in each of the three stages. Just as companies can straddle the boundaries of these stages, they often use these tools and techniques in more than one stage.

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DEFINING ENVIRONMENTAL ACCOUNTING

The term “environmental accounting” is open to interpretation. In this guideline, environmental accounting is the identification, measurement and allocation of environmental costs, the integration of these environmental costs into business decisions, and the subsequent communication of the information to a company’s stakeholders.

Identification includes a broad examination of the impact of corporate products, services and activities on all corporate stakeholders.

After companies identify the impacts on stakeholders1 as far as they can, they measure those impacts (costs and benefits) as precisely as possible in order to permit informed management decision-making. Measurements might be quantified in physical units or monetized equivalents.

After their environmental impacts are identified and measured, companies develop reporting systems to inform internal and external decision-makers. The amount and type of information needed for management decisions will differ substantially from that required for external financial disclosures and for annual environmental reports.

Organizations use environmental accounting for several reasons, including the following:

- to help managers make decisions that will reduce or eliminate their environmental costs;

- to better track environmental costs that may have been previously obscured in overhead accounts or otherwise overlooked;
- to better understand the environmental costs and performance of processes and products for more accurate costing and pricing of products;
- to broaden and improve the investment analysis and appraisal process to include potential environmental impacts; and
- to support the development and operation of an overall environmental management system.

■

DEFINING ENVIRONMENTAL COSTS

To successfully implement a corporate environmental strategy, decision-makers require precise information about the environmental costs of the company's products, processes and activities.

How organizations define environmental costs typically depends on how they intend to use the information and the scale and scope of the exercise. Whether or not a cost is environmental may not always be apparent. However, determining whether a cost is environmental is not critical; the goal is to ensure that relevant costs receive appropriate attention.

Union Carbide Corp. (UCC), for instance, has specific guidelines regarding environmental costs, which are distinguished from capital expenditures. Environmental expenses "cover all non-capitalized environmental costs charged to operations for the year". UCC includes a measure of the benefits in determining the "net total cost" for the environmental expense.

The U.S. Environmental Protection Agency (EPA) Pollution Prevention Benefits Manual and the Global Environmental Management Initiative (GEMI) Environmental Cost Primer provide frameworks for identifying environmental costs. Exhibit 1 illustrates examples of these costs, labelled as conventional company, potentially hidden, contingent and image/relationship.

According to the U.S. EPA, conventional company costs include costs typically recognised in investment analysis and appraisal such as capital equipment and raw materials. Potentially hidden costs result from activities undertaken to 1) comply with environmental law (i.e., regulatory costs); or 2) go beyond compliance (i.e., voluntary costs). Contingent costs are costs that may or may not be incurred in the future, such as the cost of remedying and compensating for future accidental pollution. Because pollution prevention projects aim to reduce or eliminate pollution, the savings from lower contingent costs could produce significant benefits that might otherwise be ignored. Image and relationship costs are costs incurred to affect the subjective (albeit measurable) perception of stakeholders, such as the costs of annual environmental reports and community relations activities.2 (Definitions for other cost categories shown in Exhibit 1 are provided in the glossary.)

Involuntary failure costs, such as environmental fines, are paid for directly by corporations and internalized. Other costs, such as environmental damage, may not be always completely identified. These external costs are costs to society and the environment. External environmental costs include such potential liabilities as the risk of cleanup and damage to natural resources or damage to people and property.

Exhibit 2 provides a graphical representation of the important difference between internal and external environmental costs. For many companies, current environmental accounting practices typically encompass only

Box A conventional company costs, including such items as:

- off-site waste disposal;
- purchase and maintenance of air emissions control systems;
- utilities costs; and
- perhaps costs associated with permitted air or wastewater discharges

Exhibit 1: Environmental Costs Incurred by Firms
Potentially Hidden Costs

Regulatory	**Upfront**	**Voluntary**
• Notification	• Site studies	• Community relations/ outreach
• Reporting	• Site preparation	• Monitoring/testing
• Monitoring/testing	• Permitting	• Training
• Studies/modelling	• R&D	• Audits
• Remediation	• Engineering and procurement	• Qualifying suppliers
• Record keeping	• Installation	• Reports (e.g.,annual environmental reports)
• Plans		
• Training	**Conventional Company Costs**	• Insurance
• Inspections	• Capital equipment	• Planning
• Manifesting	• Materials	• Feasibility studies
• Labelling	• Labor	• Remediation
• Preparedness	• Supplies	• Recycling
• Protective equipment	• Utilities	• Environmental studies

- Medical surveillance
- Environmental insurance
- Financial assurance
- Pollution control
- Spill response
- Stormwater management
- Waste management
- Taxes/fees
- Structures
- Salvage value
- Landscaping

Back-End

- Closure/ decommissioning
- Disposal of inventory
- Post-closure care
- Site survey
- R&D
- Habitat and wetland protection
- Other environmental projects
- Financial support to environmental groups and/ or researchers

Contingent Costs

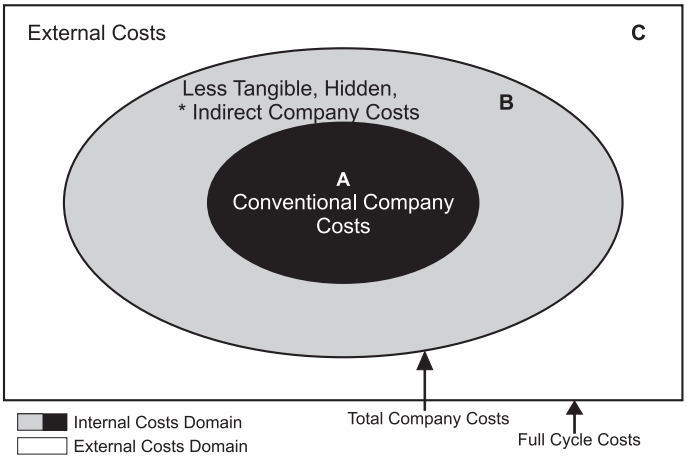
- Future compliance costs
- Penalties/fines
- Response to future releases
- Remediation
- Property damage
- Personal injury damage
- Legal expenses
- Natural resource damages
- Economic loss damages

Image and Relationship Costs

- Corporate image
- Relationship with customers
- Relationship with investors
- Relationship with insurers
- Relationship with professional staff
- Relationship with workers
- Relationship with suppliers
- Relationship with lenders
- Relationship with host communities
- Relationship with regulators

Source: EPA. An Introduction to Environmental Accounting as a Business Management Tool: Key Concepts and Terms.1995.

Exhibit 2: Internal and External Environmental Costs



Beyond this conventional cost domain is Box B, which encompasses a wide range of less tangible, hidden indirect company costs (and savings and revenue streams) including:

- liability;
- future regulatory compliance;
- enhanced position in "green" product markets; and
- the economic consequences of changes in corporate image linked to environmental performance.

Boxes A and B collectively make up the internal cost domain, which contains costs that affect the firm's bottom line under current and foreseeable regulatory and market conditions.

Box C comprises external costs, or externalities. These are costs for which firms are not accountable or that have no material economic consequences to firms under current and foreseeable regulatory and market conditions. For example, Box C may include:

- environmental damage due to acid rain deposits from combustion of fossil fuels;
- adverse health effects due to noise pollution from airports or highways; and
- Ozone depletion caused by aerosol cans containing CFCs.

As regulation and penalties proliferate, many of these external costs eventually become internal costs. When it evaluates the long-term profitability of a product line, a firm must consider that its total costs will likely include expenditures for short-term, external costs. To do otherwise can lead to undercosted products, poor management decisions and reduced corporate profitability.

■

THE ROLE OF THE MANAGEMENT ACCOUNTANT

Given ever-changing environmental laws and the complexities of environmental management, proactive businesses recognize the need to integrate environmental considerations into decisions made throughout the organisation.

Incorporating environmental considerations into decision-making throughout the organization requires the combined skills of multiple disciplines, including environmental managers, economists, engineers, operations managers, planners, scientists, lawyers and management accountants.

The management accountant has an important role to play on the corporate environmental team. The management accountant may help develop and implement better environmental analysis tools and techniques in several ways, such as:

- helping assess the need for new or modified management information and financial systems;
- developing or seeking capital investment and appraisal tools that more effectively incorporate environmental costs and benefits;
- isolating and computing individual environmental costs;
- helping resolve conflicts between environmental

management and traditional financial management systems, such as those that occur in capital investment appraisal;

- considering the financial costs and risks associated with an investment or product/ process design choice that will likely cause or increase pollution;
- helping improve methods for reallocating internal environmental costs to specific products and activities;
- training line personnel in environmental accounting reports and concepts, and in performing new procedures (e.g., coding) to implement environmental accounting processes and systems;
- working with other professionals in the organization to assess the potential costs of failing to undertake environmental initiatives; and
- offering expertise in the financial evaluation of environmental litigation and settlement options

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TOOLS AND TECHNIQUES OF ENVIRONMENTAL ACCOUNTING

Companies use a variety of tools and techniques in order to integrate environmental impacts into management decisions. This guideline focuses on three such management decision-making processes: costing analysis, investment analysis, and performance evaluation.

Costing Analysis

Effective corporate environmental management is impossible without an adequate system to identify and measure environmental costs. Some of the tools and techniques that can help companies define the activities, processes and products that cause environmental costs are:

- allocation of environmental costs;
- life-cycle assessment;
- hierarchical cost analysis;
- activity-based costing; and
- quantification and monetization of externalities and full environmental cost accounting.

Allocation of Environmental Costs

It is generally agreed that, decades ago, the lack of understanding of the eventual environmental impacts of products and services and their related legal liabilities3 caused

companies to ignore those impacts in their calculation of product costs. Remediation costs related to Superfund4 were caused decades ago, but are being incurred today. Thus, the products that caused those costs were undercosted and probably underpriced. Companies must ensure that current costs include an estimate of total product costs, so that future generations of managers and products are not encumbered by those costs when they occur.

Many companies are investigating and implementing systems that better accumulate and measure their past, present and future environmental costs related to product costing. Companies generally distinguish among three categories of environmental costs. These are costs incurred to respond to:

- past pollution not related to ongoing operations;
- current pollution related to ongoing operations; and
- future environmental costs related to ongoing operations.

Past pollution not related to ongoing operations. Some companies are paying a significant portion of their total environmental cost to clean up pollution caused decades ago. For example, remediation costs related to Superfund are only being incurred today but pertain to pollution of decades ago. Because these corporate environmental expenditures are often substantial, including them in product costs often dramatically affects the profitability of products, facilities and

divisions. But many companies include current operating costs pertaining to past environmental liabilities in their current product costs.

Some companies justify this inclusion as follows: earlier (maybe decades ago), other expenses that created future benefits were charged to product costs or corporate overhead, including product development, research and development, and advertising expenses. Thus, current products benefit from those prior expenditures. The product must now bear the costs related to prior production, just as it reaps the benefits.

Current products are often improvements over their predecessors. Even when the company no longer makes those predecessor products, often a particular facility still bears the costs. Many managers believe

that loading these costs onto product costs fails to accurately measure the profitability of the product, facility or division. More important, this practice damages performance evaluation and compensation.

For many companies, it is more appropriate to include these costs in corporate overhead or general and administrative expense accounts rather than in product costs. Other companies place them in overhead accounts and then spread them to products through an allocation system that less directly affects a particular product. But even after allocating past costs, the performance evaluation of managers includes costs incurred possibly decades earlier.

According to traditional concepts of responsibility accounting, managers should not be held accountable for costs beyond their control. In order to effectively measure the performance of products, facilities, divisions and division managers, many companies believe that placing current costs for past environmental liabilities into current product costs is inappropriate.

Many organizations argue that, as the company must bear past costs, these costs should be assigned to facilities and products on some basis. If not, the business units might show a profit even as the corporation itself shows a loss. This case also highlights the extensive costs incurred through a lack of effective planning for future impacts and a failure to consider full life-cycle costs.

Current pollution related to ongoing operations. No such controversy is raised by including current operating costs that relate to current production in product costs. These costs vary widely. But as they pertain to the current environmental impacts of producing current corporate products and services, most organisations agree that they should be included in current product costs.

Many companies, however, do not adequately separate or track their environmental costs so they are unable to determine their product costs accurately. Most companies arbitrarily assign environmental costs, continuing the practice of undercosting some products and overcosting others. Analysis and cost reduction are difficult because these

companies do not know which products cause the environmental costs.

Future environmental costs related to ongoing operations. For many companies, estimated costs that might be incurred in the future from today's processes and products are typically excluded from current product costs and prices. Past experience with environmental law shows that today's processes and products might be subject retroactively to regulations not yet written. It is difficult enough to estimate and book costs accurately when the business context is well understood, let alone when the focus shifts between today and tomorrow. But such estimation is important for managerial decision-making.

Although identifying and measuring future impacts depends on many factors that are unclear today, the process of broadly identifying impacts by examining all relevant stakeholders is certainly beneficial – and will increasingly be expected by shareholders, other investors and purchasers of corporate assets. Investors and others will gravitate toward investments when they are confident that the potential environmental risks and liabilities of current operations have been adequately assessed and incorporated into business strategy.

Life-Cycle Assessment

The momentum toward responsible management of global energy and environmental resources is unmistakable and irreversible. Customers are demanding products that are

functional, energy-efficient and environmentally responsible. For example, new German washing machines contain computer microchips that sense the weight of a load and dispense soap and water accordingly. Both Germany and Japan are on the cutting edge in developing zero-polluting electric and hydrogen vehicles in response to increasingly stringent environmental legislation.

By integrating environmental considerations into their products and processes now, companies are strategically positioning themselves for the next century, when aggressive environmental management will be an imperative for business survival. These organisations focus not only on complying with government regulations but on reducing their corporate environmental impacts. Sophisticated companies are applying various methods and techniques that encourage a comprehensive evaluation of all "upstream" and "downstream" effects of their activities or products.

For example, some companies use Life-Cycle Assessment (LCA) to help them evaluate the cradle-to-grave environmental burdens and opportunities associated with their products, processes or activities. They use LCA to help bridge the gap between improved accounting for existing internal environmental costs and recognition of external environmental impacts.

By looking beyond the corporation's facility and outside the boundaries of traditional environmental strategies, the LCA process helps companies to identify and assess environmental

impacts that they may not presently capture. This process evaluates the environmental effect of a product or activity holistically, by analyzing its entire life cycle. This includes identifying and quantifying energy and materials used and wastes released to the environment, assessing the environmental impact, and evaluating opportunities for improvement. LCA addresses environmental impacts in ecological health, human health and resource depletion. It does not address social effects. (SETAC)

To illustrate how LCA differs from traditional approaches, consider product disposal costs. Previously, few manufacturers were concerned with the ultimate disposal of their products or post-consumer waste. It was up to the consumer to figure out how to safely dispose of the product. Today's take-back6 principle shifts this burden for disposal of products and raw material components back to the manufacturer. The company must determine, allocate and formally account for costs in order to ensure that products can be properly disposed of after their useful life.

For most organizations, the primary objectives of carrying out an LCA are:

- to provide as complete a picture as possible of the interactions of activities with the environment;

- to contribute to understanding the overall and interdependent nature of the environmental consequences of human activities; and

- to provide decision-makers with information that defines the environmental effects of these activities and identifies opportunities for environmental improvements.

LCA consists of four inter-related activities: *goal-setting, inventory analysis, impact assessment and improvement assessment.* Depending upon the purpose of the assessment, one or more stages might be included.[7]

i) **Goal-setting (scoping).** The first stage of LCA identifies which issues are pertinent to the particular study product in each of its life-cycle stages, and identifies specific environmental vulnerabilities. Goal-setting identifies the"big picture" issues without the detailed research necessary for a full-blown inventory analysis.

ii) **Inventory analysis (data collection).** The second stage of LCA quantifies energy and raw material inputs, and air, water and waste outputs associated with each phase in the product life cycle from raw materials acquisition to disposal, as illustrated in Exhibit 3.

Inventory analysis is a fairly complex, in-depth process. It is usually completed by consultants or by several internal teams with knowledge and experience in each stage of the life cycle.

If the necessary information is already available in various formats, it can be compiled to complete the

inventory analysis. For example, a company might already have gathered information about air emissions, water pollutants and even habitat destruction in order to apply for government permits and comply with regulations.

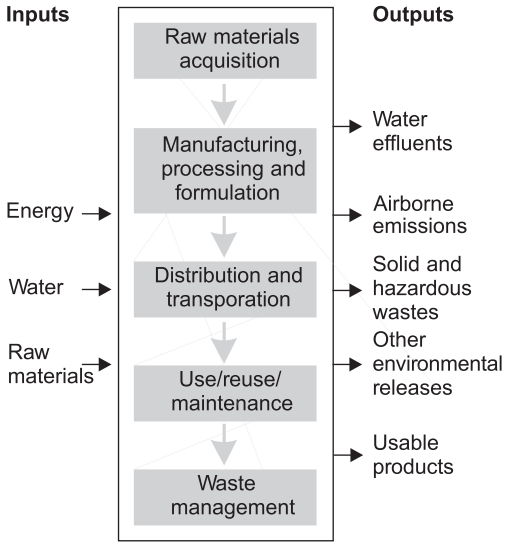
iii) **Impact assessment (environment evaluation).** This stage of LCA characterises the effects (e.g., ecological, health, economic, esthetic) and significance of the pollutants identified in an inventory analysis. It is usually accomplished by completing an assessment matrix in which relevant impacts are qualified. A hypothetical matrix of the relationship between specific impact categories and the various areas of protection is illustrated in Exhibit 4.

An organization can usually improve its impact assessment by including a cost comparison of either competing products or competing materials and manufacturing processes (including such costs as raw materials, manufacturing, R&D and process redesign). Both internal and external environmental costs should be included in LCA.

iv) **Improvement assessment (company response).** The final stage of LCA strategically evaluates the options for reducing the environmental impact of the product or process, considering the product's environmental vulnerabilities and strengths.

Opportunities for impact reduction include: minimizing energy and raw material consumption; introducing closed-loop systems for chemicals; minimizing activities that destroy habitat; and minimizing releases.

Exhibit 3: LCA Inventory Analysis



Source: SETAC 1991.

The four stages of LCA are interdependent. Knowing the impact of the production process, for example, should determine what factors are included in the inventory analysis. Because LCA is a time-consuming activity, the most environmentally malign products should be tackled first.

LCA is not a static exercise but an iterative, dynamic one that develops along with understanding the impacts of

activities. Improvements will likely be incremental, with each LCA building on the next (Gray *et al* 1993).

Ciba-Geigy, Dow Chemical, and Church & Dwight have already adopted elements of LCA. Ciba-Geigy, a Switzerland-based company with interests in health care, pharmaceuticals, agricultural products and chemicals, uses LCA in project selection and product design. It uses LCA to choose product packaging and to compare energy requirements for producing various materials. Dow Chemical has completed pilot LCA projects in its chemical and plastics business, and Church & Dwight conducted an LCA study on its Arm and Hammer7 baking soda.

Exhibit 4: LCA Impact Assessment Matrix

SPECIFIC IMPACT GENERAL AREAS FOR PROTECTION	**CATEGORIES (Examples)**		
	Resources	Human	Health
Ecol.health			
Resource depletion			
- Depletion of abiotic resources	+		
- Depletion of biotic resources	+		
Pollution			
- Global warming		(+)	+
- Ozone depletion		(+)	(+)

- Human toxicity		+	
- Ecotoxicity		(+)	+
- Photochemical oxidant formation		+	+
- Acidification			+
- Eutrophication			+
Degradation of ecosystems and landscape - Land use			+
+ A direct potential impact (+) An indirect potential impact			

The lack of standardized LCA tools and lack of standardized data sets can make widespread, consistent, and cost-effective use of LCA difficult sometimes. However, LCA is a relatively new and evolving technology that is rapidly being developed in order to overcome these barriers.

For example, Canadian businesses will soon be able to obtain environmental information on raw materials for their products and packaging systems through a Canadian Raw Material Database. The database will address the need for more standardized LCA tools and data sets, and is being developed by Environment Canada, in partnership with the Canadian Standards Association (CSA) and a number of Canadian raw material producers.[8]

Hierarchical Cost Analysis

In Stage 1 of implementing a corporate environmental strategy, companies are seeking the least costly option for complying with environmental standards. As Stage 1companies typically believe pollution concerns have minimal importance or value to their success, their investments for environmental projects usually focus on pollution control. These pollution control projects focus on “end of pipe” techniques and aim to control and reduce the release of pollutants.

In contrast, Stage 2 companies generally focus on more comprehensive pollution prevention methods that target the root cause of pollution.9 Stage 2 corporate environmental strategies typically include designing products/processes that take environmental impacts into account.

When cost inventory and cost allocation practices fail to provide a level playing field for all investments, organizations may lack the information they need to make optimal use of limited resources, especially for environmental projects with strong pollution prevention content.

To remedy this situation, the U.S. EPA has supported several studies to demonstrate how economic assessments and accounting systems can be modified to improve the analysis of prevention-oriented investments for pollution prevention initiatives.

In one such study, the EPA developed a hierarchical costing method to identify, track and monitor environmental

costs for companies.[10] This technique for pollution prevention contains a four-tier hierarchy of costs including:

- *Tier 0, Usual Costs* - are directly linked with a project, products or process. They typically include the following:

  - capital expenditures/depreciation: buildings, equipment, utility connections, equipment installation, and project engineering;
  - operating and maintenance expenses: materials, labour, waste management, and utilities.

- *Tier 1, Hidden Costs* - refer to regulatory compliance on other costs that are "hidden" or lumped into a general account. These are hidden costs because they are obscurred in overhead accounts, making it impossible for managers to manage them effectively. Examples of hidden costs are:

  - compliance reporting;
  - legal support;
  - waste management;
  - sampling and testing; and
  - monitoring.

These costs could be significant, and an effective pollution prevention project could possibly reduce them.

- *Tier 2, Liability Costs* - are costs associated with contingent liabilities that may result from waste and materials management. Just as the regulatory costs of *Tier 1* are hidden, so too are many of the contingent liability costs.

- *Tier 3, Less Tangible Costs* - are benefits that derive from improved corporate image, customer acceptance and community goodwill. A company may realize savings in less tangible costs as a result of reducing or eliminating pollution. These cost savings are increased revenues or decreased expenses due to improved customer acceptance, employee relations and corporate image. Although it is difficult to predict with certainty the extent of these benefits, it is reasonable to assume that they may be significant.

The EPA hierarchy of costs reduces the effort needed to reveal the economic benefit of a pollution prevention investment. Companies can begin by analyzing *Tier 1* costs; if this analysis does not reveal an economic benefit, then they may want to analyse *Tier 2* costs; and so forth. By analysing pollution prevention investments in this way, a company will not have to analyse costs in all the tiers in order to prove the economic viability of every pollution prevention investment. In the process, the company saves time and money.

The analysis suggested in each of the tiers is as follows:

- *Tier 0, Usual Costs*

- Identify pollution prevention alternatives.
- Estimate usual costs of current and alternative practices.

 Tier 1, Hidden Costs

- Establish facility_s regulatory status.
- Estimate hidden capital expenditures.
- Estimate hidden expenses.

 Tier 2, Liability Costs

- Identify regulatory programs under which penalties and/or fines could be incurred.
- Estimate expected annual penalties and fines associated with each program and requirement.
- Identify waste-management issues with which liabilities can be associated.
- Estimate total expected liabilities.
- Estimate expected years of liability incurrence.
- Estimate the firm's share of total future liabilities.

 Tier 3, Less Tangible Costs

- Identify qualitatively less tangible costs and benefits of pollution prevention.
- Quantify less tangible costs and benefits of pollution prevention.

After completing all steps within all tiers, organizations conduct a financial analysis of all current and proposed alternative practices. They compile and analyse the calculated costs to yield estimates of three financial indicators that underpin a ranking of practices. The three recommended financial indicators are total annualised savings (TAS), NPV and IRR.

Hierarchical cost analysis helps firms consider the full range of environmental costs and thereby encourages improved quantitative analysis. As some of the equations involve long algorithms, organisations might have difficulty using these equations without any software. Many software tools exist that can help users identify and/or quantify some of their environmental costs.[11]

Activity-Based Costing

When organizations incur environmental costs, not all processes and products are equally responsible for cost generation. Even in modest-sized manufacturing firms with two or three production lines, environmental costs are not driven equally by each production line. Various lines may contain more hazardous materials, generate more emissions per unit of output, require more frequent intensive inspection and monitoring, and generate greater quantities of waste requiring off-site disposal.

Similarly, particular processes or products may cause a disproportionate share of costs associated with training and reporting to government agencies, or lead to risks that may

increase insurance costs. Given the current costs associated with environmental concerns and the expected increases in these costs, companies should know the principal factors that determine the environmental costs incurred. Companies should also assign environmental costs to products properly.

Traditional accounting systems usually fail to provide accurate environmental cost information, for two main reasons: they often allocate environmental costs to overhead costs; and they often combine environmental costs into cost pools with non-environmental costs.

For example, many companies assign environmental compliance costs (costs directly imposed by regulations, including pollution-control equipment costs, disposal fees, etc.) and oversight costs (costs that arise indirectly from satisfying various compliance requirements) to general overhead rather than trace them to particular products or manufacturing processes.

Although some firms subsequently allocate these environmental costs to products or processes, the basis for these allocations is often ill-conceived. When costs are improperly allocated, managers receive distorted signals regarding the true costs and benefits of retaining or changing processes or products. Moreover, misallocation of environmental costs prevents effective performance monitoring, product pricing, incentive and reward systems, and other activities essential to maintaining a competitive enterprise.

In order to get more accurate and useful information about their costs, and given the shortcomings of traditional cost accounting systems, some firms implement activity-based costing (ABC) for specific processes or systems that contain a large portion of the environmental risks and liabilities. ABC is especially relevant to environmental costs because of the diffuse, long-term and less tangible nature of so many environmental costs. These attributes make allocations particularly challenging from an accounting perspective.

While traditional cost accounting assumes that costs arise out of making products and providing services, ABC attributes costs to the associated activities involved in making products and providing services.

ABC provides two approaches for tracking the costs of activities. One approach is to establish sub-accounts in the general ledger, which allocates costs to various activities in the appropriate proportions. This approach resembles traditional accounting systems but permits the organization to emphasize environmental costs.

The other approach is to mirror more closely the actual flow of costs through the organization. This method emphasizes the relationships among activities and different cost drivers. Following this approach, costs move from incurrence to cost objects in a series of steps, all based on a cause-and-effect relationship.

Exhibit 5 illustrates how environmental compliance costs can be classified according to cost drivers. This hypothetical

example shows that the cost of "hazardous waste transportation and disposal fees" varies with the volume of hazardous waste (HW) produced.

Cost driver analysis also reveals opportunities for improvement. For example, incorporating sensitivity to environmental costs into its ABC approach has enabled AT&T to better identify its true product costs. Cost driver analysis prompted AT&T to conduct process improvements and re-engineering, unlike its traditional cost accounting system, which had failed to highlight environmental costs.[12]

Using ABC to identify cost-bearing activities effectively and to allocate costs to individual products can help rationalize managerial decisions. Armed with information on how environmental costs affect current product costs, organizations can make better strategic decisions about continuing or abandoning products. Knowing the full costs of current production and processes also allows managers to focus on opportunities to minimise compliance costs, reduce operating costs, and fully mesh the organisation's environmental and financial goals.

Exhibit 5 - Environmental Compliance Costs Classified By Cost Drivers

Cost Driver	Compliance Requirement	Expected Relationship of Compliance Cost to Cost Driver(s)
Hazardous substances (HS) used	- Permit preparation and fees	- per HS per plant
	- Inspection and monitoring	- per HS per plant
	- Worker right-to-know training	- per HS per plant - per new worker per process
	- Filing and recordkeeping	- per HS per plant - per new worker per process
	- Regular (periodic) training	- per number of workers per plant
	- Process safety equipment	- per process
	- Process emission controls	- per process
	- Emergency response planning	- per HS-generating process per plant
Hazardous wastes (HW) produced	- Permit preparation and fees	- volume-related step function per HW
	- Inspection and monitoring	- per HW per plant
	- RCRA reporting costs	- volume-related step function per HW
	- Filing and recordkeeping	- volume-related step function per HW
	- Worker training requirements	- per worker
	- Pre-disposal storage costs	- volume-related step function per HW
	- Hazardous waste transportation and disposal fees	- per volume of HW
	- Minimization planning	- per HW-generating process
	- Emergency response planning	- per HW-generating process

However, implementing ABC to rationalise environmental managerial decisions carries its own cost. Organizations must always weigh the value of disaggregating cost information against the attendant costs of setting up and maintaining the accounting infrastructure to collect, analyze and digest its outputs.[13]

Quantification and Monetization of Externalities and Full Environmental Cost Accounting

Despite much progress, corporate costing systems fail to produce a true picture of environmental costs. For instance, no company has fully implemented a system to integrate all

present and future external and internal environmental costs into its product costing system. For external costs, it is difficult to measure the cost to society of such factors as the degradation of quality of life caused by air pollution.

In Stage 3, organizations expand their systems to include a broader inventory of environmental costs. One such system is full environmental cost accounting. Although definitions vary, the vision is consistent. Full environmental cost accounting includes the current and likely future costs, including externalities related to the environmental impacts of a company's products, services and activities.[14] It takes into consideration the future costs imposed by a product and allocates them to the product itself.

Ontario Hydro has made a corporate commitment to using full environmental cost accounting in its decision-making. For the utility, full environmental cost accounting is a tool that can help integrate environmental considerations into business decisions.[15]

Ontario Hydro's approach to full environmental cost accounting incorporates environmental and other internal costs with data on the external impacts and costs/benefits of the utility's activities on the environment and on human health. When the company cannot monetise these external impacts, it uses qualitative evaluations.

An approach used by Ontario Hydro that considers internal and external costs, including present and future costs, is the damage function approach. The damage function

approach attempts, where possible, to place a dollar value on "actual" environmental impacts. It does so by considering site-specific environmental and health data, using environmental modelling techniques to translate activities (e.g., air emissions, water emissions, land use, etc.) into damages on the ground, and applying economic valuation techniques to translate physical impacts into monetary terms.

Four specific methods suggested by Ontario Hydro to monetize these environmental impacts are:

i) *Market-price method.* Using information on market prices of, for example, crops that have been damaged or lost due to toxic emissions;

ii) *Hedonic-pricing method*. Using differences in real-estate values or wage rates, assuming that such differences are attributable to relative environmental quality (also known as the property-value approach);

iii) *Travel-cost method*. Using the economic value of "time" as the central indicator of willingness to pay for improvements in environmental quality. This approach evolved to measure the value of public recreation locations and activities and is most often used to monetize recreational activities such as sport fishing, etc.

iv) *Contingent-valuation method*. Contingent valuation (CV) is a survey technique used to estimate individuals' willingness to pay (WTP) for

improvements to environmental quality, or willingness to accept (WTA) a loss in environmental quality. For example, the CV method was used to assist in estimating the economic value of environmental damages caused by the Exxon Valdez disaster.

Full environmental cost accounting is not a precise science. It can be constrained by data limitations. Such limitations primarily affect the quantification of hidden regulatory costs, contingent liability costs and less tangible costs. Monetary estimates of externalities are also generally uncertain. Organizations must determine whether the benefits of collecting environmental data outweigh the costs of doing so.

Allied Signal Aerospace Corp. in Kansas City uses legacy costing as an alternative approach to full environmental cost accounting.

The broad definition of legacy costing includes an analysis of all corporate environmental impacts:

Legacy costs include costs incurred to minimize environmental impact (prevention costs), to assess environmental impact (assessment costs), and to remediate damage caused by the failure to avoid environmental insult (failure costs). Failure costs may be further classified as either voluntary failure costs or involuntary failure costs.

(Lawrence and Butler 1995)

Voluntary failure costs include costs that the company might avoid by redesigning products (including the use of less toxic materials) or processes. They also include legal and environmental, health and safety (EH&S) costs. Involuntary failure costs include fines levied for environmental damage caused by accidental spills.

Legacy costing attempts to help companies avoid regulatory surprises and to encourage engineers and others to cooperate in solving problems detected through the legacy costing process and process waste assessments.

Like LCA and full environmental cost accounting, legacy costing attempts to identify and better measure environmental costs and benefits of corporate activities. By identifying and measuring impacts, organisations can better identify and evaluate alternatives and make decisions that yield the greatest environmental improvement for the resources invested.

Investment Analysis and Appraisal

In many organizations, traditional investment analysis and appraisal approaches overlook pollution prevention projects. Pollution prevention projects usually fare poorly because a systemic bias in traditional investment analysis places them at a competitive disadvantage. For example, managers accustomed to using traditional accounting methods are unable to pinpoint other quantified (internal) environmental costs.

Another bias is the mere fact that many environmental

costs are uncertain: managers do not know what they are, their ultimate magnitude, and when they will occur. This uncertainty reflects the inherent complexity of use, movement and exposure to hazardous substances. Rapidly changing regulations and judicial decisions also cause uncertainty.

Another bias is the tendency of traditional investment appraisal techniques - typically, discounted cash flow (DCF) and payback-to narrow the range of issues considered and to favour short-term, less risky options. For example, DCF tends to discourage large projects that are expected to last more than about 10 years. Most important in an environmental context, DCF inevitably places less emphasis on events later in the project's life.

For instance, a conventional DCF calculation typically fails to account for a plant's reduced efficiency toward the end of its life (and the attendant potential increases in emissions and spills) and thus discounts abandonment and decommissioning costs or any other environmental problems (e.g., land contamination) that might then arise. Because of these systemic biases, companies may not recognize financially attractive investments in pollution prevention and cleanup technology.

Organizations, in stages 2 or 3, that are concerned with achieving a competitive advantage and/or completing environmental integration use several frameworks and measurement techniques to effectively incorporate environmental risks and uncertainties into their capital decision

processes. Although not without their limitations, these approaches offer significant improvements for environmental management. They include:

- total cost assessment;
- multi-criteria assessment; and
- risk and uncertainty analysis

Total Cost Assessment

Company investment projects must usually pass a so-called “hurdle rate,” or an acceptable profitability threshold. Environmental projects must compete with other investment alternatives, environmental or otherwise. A critical dimension of this capital allocation process is to examine how a firm defines and estimates project costs and benefits.

When examining proposed environmentally related projects, organizations usually account for all direct costs. However, project estimators usually omit indirect costs, as they do not directly affect a project’s financial profile.

As disposal costs rise, some environmental projects become more competitive. In order for these projects to reach corporate hurdle rates, organizations need to include indirect or less tangible, hidden regulatory and liability costs associated with their current production processes. Likewise, they need to use a longer time frame and account for any indirect benefits of alternative production processes.

Total cost assessment (TCA) improves the decision-making process for investment analysis and appraisal by ensuring that the data gathered include environmental costs - both direct and indirect - and environmental risks. TCA helps organizations analyse the long-term costs and savings of pollution prevention projects. It considers a broader range of costs than does traditional investment analysis, including certain probabilistic costs and savings. TCA utilises full environmental cost accounting techniques to properly assign environmental costs and savings to all competing projects, products or processes.

In research studies for the EPA's Office of Pollution Prevention and Toxics, the Tellus Institute17 proposed four key elements for TCA: *cost inventory, cost allocation, time horizon and financial indicators*.

i) *Cost Inventory.* Includes all benefits and costs of a proposed capital investment, including direct and indirect costs, future liability costs, less tangible benefits and non-environmental costs.

ii) *Cost allocation.* Requires an understanding of the manufacturing process so that organizations can apply all costs to a specific product or process. These allocations can become difficult, for example, when the waste costs from various products and processes are accumulated for disposal.

iii) *Time horizon.* Is important in examining how long it will take for a project to become profitable. For

pollution prevention projects, companies should consider avoidance of future liability from personal injury, property damage or environmental regulation fines. Future, harder-to-quantify benefits that organizations should consider might include higher revenues from better product quality, improved corporate and/or product image, and lower health maintenance costs. These benefits are better captured in financial indicators that allow for a longer time horizon.

iv) *Financial indicators.* Typically, discounted cash flow methods such as NPV, IRR, and Profitability Index (PI)18 are used for this analysis.

Without these considerations, it will be impossible to level the playing field to enable environmental projects to compete. This does not mean that, with TCA, all or most environmentally oriented projects will be able to compete on purely economic terms. It does mean, however, that firms will discover a wider variety of benefits over a longer time frame than they normally would utilizing traditional investment analysis. It also means that the cost of existing environmental practices will not be excluded from the calculation.

Multi-Criteria Assessment

Another technique that offers improvements to traditional investment analysis and appraisal is multi-criteria assessment (MCA).20 MCA is designed to help companies systematically evaluate options according to multiple criteria that are

sometimes measured on different and/or non-commensurable scales. This evaluation tool enables organizations to consider and trade off all relevant criteria in decision-making.

The main objectives of MCA are to:

- display trade-offs among different objectives (i.e., cost, social, environmental, reliability, risk, etc.); and
- " help participants in the decision-making process decide what trade-offs they are willing to accept, determine which alternatives they prefer, and document the results.

MCA can be used to compare and evaluate "unlike" environmental and social impact information when the company lacks a full range of monetized impact data. For instance, Ontario Hydro has used MCA to make trade-offs among environmental measures to identify key indicators of environmental impact/damage for inclusion and evaluation within its corporate planning process.

Companies can also use MCA to compare and make trade-offs of environmental and other attributes (e.g., private costs, internal environmental costs, reliability, flexibility, etc.) that must be considered in the investment decision-making processes.

The methodology of MCA can be divided into three steps: 1) structuring the decision problem, 2) formulating a preference model, and 3) evaluating and comparing alternatives. Structuring the decision problem includes the specification of

objectives and attributes, the generation of alternatives, and the assessment of consequences of each alternative in terms of multiple criteria. A formal preference model is developed to represent the decision-maker's values and to elicit relevant information about the decision-maker's preferences. Finally, evaluating and comparing alternatives provides the ordering of decision alternatives required in a problem.

Ontario Hydro has also recently used MCA to assess the relative performance of planning horizon portfolios, according to criteria reflecting objectives of option costs (private costs), environmental performance (including external impacts and costs) and resource use efficiency, social and economic benefits, and financial and operational viability.

Environmental Risk Assessment and Uncertainty Analysis

Although the terms uncertainty and risk are often used interchangeably, they are distinctly different. Uncertainty relates to a situation in which the probability distribution of an event is unknown; risk relates to a situation in which such a distribution is known. To assess risk in environmental situations, it is often suggested that the company make adjustments to the cost and benefit profiles rather than to the discount rate. A better approach to this problem is to test the sensitivity of the outcome of project evaluations to variations in the key parameters (Kula 1992).

Environmental decisions are considered complex and risky, and can cause enormous financial impact. Remediation

costs for environmental spills and other accidents, fines, penalties, legal costs, damages and

bad decisions have increased dramatically in recent decades. Traditional financial analysis of uncertain future events as best-and worst-case scenarios is inadequate as it ignores risk components. New techniques for risk assessment have recently been developed, and existing techniques have been applied more frequently to environmental issues.

Numerous frameworks and measurement techniques are available to effectively incorporate environmental risks and uncertainties into the investment analysis and appraisal process. For example, many companies actively use such techniques as:

- option assessment, option screening, and scenario forecasting; and
- Monte Carlo simulation and decision trees.

Option assessment, option screening and scenario forecasting. Option assessments and option screenings are designed to provide all of the available alternative options to decision-makers. They help decision-makers assess, and act on, the relative attractiveness of options to reduce the environmental impact of substance chains.

(Winsemius and Hahn 1992)

Organizations can use a three-phase methodology to help them select among alternative options. The first phase is to generate options. It is based on cost-effectiveness,

relevance for decision-makers and environmental impact. This selection phase includes four steps:

i) drawing a flow diagram;

ii) identifying the major environmental issues;

iii) defining the options; and

iv) selecting the most likely options for future evaluation.

The second phase prioritizes the options by determining an economic and environmental profile of the effects. These effects are quantified in monetary terms, and typically include the net changes in operating and capital costs. The options are then positioned on an “option map” based on the relative weight and importance of the costs and the benefits of each option.

The last phase requires the establishment of targets, resources and responsibilities.

Niagara Mohawk Power uses option screening to compare potential environmental scenarios and associated costs of environmental considerations. It implemented a system to identify and measure the options related to both the demand and supply side of electric power usage. The company uses option screening to determine the optimum mix of demand and supply strategies that provides electrical energy services at the lowest cost, within a set of various constraints. It used focus groups to determine the appropriate options and assign probabilities to the most likely scenarios.

Some companies use scenario forecasting techniques to help them examine the likely impacts on their total environmental costs of changing regulations, changing technologies and changing technology costs. For companies facing high levels of uncertainty, imminent change, and a diversity of opinions, scenario forecasting can help clearly identify various choices for decision-makers. Some companies suggest that scenario forecasting aids in assessing and managing risk, broadens corporate thinking, and makes managers focus on the long-term impact of their decisions.

Option assessment, option screening and scenario forecasting help business unit managers to be proactive rather than wait for regulatory or technology changes to affect their businesses. These techniques also provide information, albeit imprecise, that is useful in improving business and environmental planning.

Monte Carlo simulation and decision trees

Monte Carlo is a simulation technique that permits the calculation of probability distributions of outcomes for complex decision trees. The technique employs a computer to repeatedly and rapidly simulate the outcome of a series of probable events.

A decision tree visually portrays the structure of a decision problem, thus displaying the alternative courses of action, all possible outcomes and the probability values of each decision.

Companies have applied Monte Carlo simulation to the problem of comparing the possible costs of alternative environmental remediation options. Using Monte Carlo random sampling from an option's cost probability distribution, the probability that one option will cost more than another can be estimated and the most likely costs of each operation can be compared. Probabilities (i.e., confidence levels) can be assigned to a range of possible costs, leading to more credible and defensible comparisons.

Monte Carlo simulation assigns a probability distribution to environmental risk. That risk can increase or decrease depending on changes to environmental legislation. Once probability distributions are established for all inputs required for an NPV analysis, the Monte Carlo simulation begins. A computer program implementing the algebraic formula for NPV is written. When the simulation calls for the dollar value of future liabilities or interest rates, these amounts are replaced by random numbers drawn from the appropriate probability distributions.

The computer works through the decision tree, drawing a sample from the relevant probability distributions at each point where an event occurs and then applying simple logic to determine how to proceed through the tree. When alternative technologies are available, the computer model will determine the probability distributions of the possible costs of the technologies and then choose the least costly option. If different possible events exist in the decision tree, the computer will model each event and the possible outcomes. This process

is repeated until meaningful probability distributions can be established.

Performance Evaluation

In Stage 3, companies are committed to fully integrating environmental considerations into corporate life and recognize the importance of integrating environmental measurements into their performance evaluation systems. This ensures that statements of environmental responsibility articulated by the CEO and in corporate mission statements are properly implemented.

If environmental performance is truly important, evaluations and rewards should highlight that component. If a company sincerely wants to establish and maintain environmental leadership, then the environmental performance of individuals, facilities and divisions must become an integral part of the performance evaluation.

In the long run, environmental performance and financial performance are interrelated. Companies cannot continue to strive for environmental excellence while evaluating and rewarding performance based strictly on short-term financial indicators.

Environmental performance evaluation techniques include:

- corporate, strategic business units and facilities evaluations;
- individual incentives;

- environmental multipliers;
- internal waste and environmental taxes; and
- balanced scorecard measures.

Corporate, Strategic Business Units and Facilities Evaluations

Numerous organizations have developed environmental performance indices to help them gauge the performance of strategic business units and company facilities. This development is sometimes prompted by external evaluators and sometimes as part of a comprehensive performance evaluation system that is used partly to encourage better environmental performance.

Niagara Mohawk Power began developing a comprehensive self-assessment program as part of its 1989 settlement with the New York State Public Service Commission. This assessment concluded, in part, that sustaining long-term improvement necessitated a change in corporate culture. In order to implement this change, the Measured Equity Return Incentive Term (MERIT) was developed. The organization identified three performance areas that affect value creation for various stakeholders and developed measures in all three areas:

i) responsiveness to customer needs;

ii) efficiency through cost management, improved operations, employee empowerment and safety; and

iii) aggressive, responsible leadership in addressing environmental issues.

Success in these three goals determines how large a financial award is available for distribution to company employees. The organization developed an Environmental Performance Index (EPI) and established targets to focus on consistent, measurable improvements from a base-line of environmental performance. Establishing solid benchmarks against which to measure environmental performance encourages management and staff to improve compliance with environmental regulation and can reduce costly non-compliance issues and corrective actions.

Three categories of performance were measured: emissions/waste, compliance and environmental enhancements. For two of the categories, weights were assigned and benchmarks established for continuous improvement. For example, weights were assigned in the compliance category based on their relative importance, including the number of notices of violation and the number of environmental audits performed.

In the emissions/waste category, the weights were "subjectively assigned to reflect the relative environmental externalities costs based on currently available information." For example, weights and benchmarks for sulfur-dioxide and nitrogen oxides have been established for use in the scoring system. (Miakisz 1992)

The environmental enhancement category is scored based on the number of dollars invested in the enhancement.

For every $200,000 invested, an additional point is scored. The scores for these three categories are totalled in order to determine a composite index score used for yearly comparisons. If the organization fails to achieve at least half of the category point total, no MERIT award is earned for that category.

Driving this system down to individual performance indicators and individual compensation might be desirable. However, explicitly identifying corporate goals and setting explicit targets likely improves corporate environmental performance and focuses attention on areas of concern and priority. Niagara Mohawk managers believe that applying MERIT and the EPI has improved the company's environmental performance.

Although this system affects the amount of money that the company sets aside for bonuses, an explicit system that directly affects individual pay often provides stronger individual incentives and has a more powerful impact on corporate culture.

Individual Incentives

The traditional accounting system in most organizations acts as a negative incentive (disincentive) to report potential hazards or violations of environmental laws, corporate goals and corporate practices. Employees are sometimes reluctant to notify a manager about a potential hazard, as they believe that eliminating the hazard might cause the business unit to suffer a short-term financial loss. This expenditure typically is

viewed as an expense rather than an asset and often reduces a manager's overall rewards.

To confront this concern, many companies encourage excellence in environmental performance by establishing individual environmental goals and tracking progress toward those goals. Often, specific environmental attributes are listed on a performance evaluation form. Comparing performance with goals in this way ensures that both the employee and the evaluator consider environmental impacts in the performance evaluation process.

Although poor environmental performance should affect pay, there is no evidence of such an influence in most companies. Only a fully integrated explicit system can do that. Some companies have intentionally opted for an implicit system that gives managers discretion to make trade-offs between environmental performance and financial performance. If a company views environmental performance as a core value and wants to change its corporate culture, an explicit performance evaluation system will probably produce more powerful results.

One way to improve environmental performance is to involve employees throughout the organization in seeking out violations and quickly reporting them, or, in some cases, to empower them to repair the problem. Some companies develop extensive training programs that sensitize employees to the environmental and financial impacts of various projects and products. These programs demonstrate to employees what

they can do to help themselves, the corporation and the environment.

Going a step further, some companies move much of the internal environmental audit work from the central internal environmental audit staff to local employees at the manufacturing facilities. These employees conduct self-audits and report or repair the problems. This also drives home to employees the importance of environmental compliance to the corporation, their individual welfare and their jobs.

If developed properly, the system can affect the pay of the factory workers, their supervisors and senior managers through divisional performance evaluations that include an environmental component besides the standard profit component. The system also can:

- substantially reduce fines for violations of environmental laws;
- increase efficiency through better monitoring of process performance; and
- reduce the amount of work that the central environmental audit staff must perform.

When the system is pushed down to local staff levels, suggested process improvements are more noticeable, waste is often reduced and profits often increase. Employees can even receive small monetary rewards for discovering and reporting potential or existing hazards.

Environmental Multipliers

Among the most advanced and explicit integrations of environmental performance into performance evaluation systems is that of Browning-Ferris Industries (BFI). With 30,000 employees, BFI is one of the largest solid waste handlers in North America. In the late 1980s, BFI decided that it needed to change its corporate direction. Hired as CEO, former EPA administrator William Ruckelshaus recognised that the company needed to view changing societal requirements for corporate environmental responsibility as new opportunities rather than regulations to be opposed. Altering the view of its societal role and attempting to reposition itself for future growth, the company decided in 1990 that it needed to make a fundamental change in its corporate culture.

Among its first steps, the company developed Awareness Compliance Tools (ACT) to guide the training needed to meet its new corporate environmental objectives. The objectives used to measure environmental performance are very specific. They include both core corporate objectives and district objectives that apply both to specific business needs and community needs. The company developed a different set of ACT tools for each of its three major lines of business: landfill operations, solid waste and medical waste. A detailed training manual more than 200 pages long describes the objectives, explains the problems and the roles of all employees in achieving corporate environmental compliance and responsibility, and provides training videos and extensive detailed tools to help all employees meet the performance objectives.

Senior corporate officers recognized that in order to effectively implement this change in strategy, the company needed to change its incentives and tie environmental performance directly to employee pay. Under the new system implemented in fiscal 1991, one-third of total compensation became at-risk pay, and the company integrated an environmental compliance component into its bonus calculations.

Exhibit 6 illustrates the multiplier scale used in the performance evaluation system. The scale converts the total points earned on the environmental compliance goals to the environmental multiplier. Thus, an employee who scores 70 points receives only 25 per cent of the incentive pay related to financial and revenue objectives, as described below. A score of less than 70 produces a multiplier of 0. This system is obviously a powerful performance motivator for a company that considers environmental performance as critical to corporate financial success and that wishes to become more environmentally sensitive.

The advantage of a compound incentive plan like this is clear. Under an additive system with multiple performance measures, employees could focus on one or two goals at the expense of others without incurring a severe penalty. Under a compound plan, the multiplicative effect encourages employees to consider all company objectives and goals, rather than ignore some performance measures and still receive a bonus. The company might use weights on each performance measure if it wishes to focus attention on one or two goals.

Exhibit 6 - BFI Multiplier Scale

PointsEarned	District EnvironmentalMultiplier
95-100	1.00
90-94	0.90
85-89	0.80
80-84	0.75
75-79	0.50
70-74	0.25
below 70	0.00

Source:Epstein 1995.

BFI believes this emphasis on environmental compliance boosts the company's public image and, ultimately, its financial performance. This system works partly because all employees understand that environmental compliance is non-negotiable and is a critical success variable for both their own and the company's performance. This incentive pay system does not apply to employees below the level of district manager. But district managers themselves use incentives to encourage their subordinates to be environmentally responsible in order to achieve bonuses.

Internal Waste Taxes

Another way that companies can motivate behavior is by using a waste tax. In Dow Chemical's Michigan division, for example, one waste landfill was built to last until 2007. Recently, the company has charged each plant a fee based on the amount of waste that it brings to the landfill. It became more economical for plants to introduce process

improvements to reduce their waste quantities. This internal waste tax has reduced the amount of solid waste by half, and the Michigan landfill is now expected to last until 2034. Integrating environmental impacts into product costs and then driving those costs into the performance evaluation system can be a powerful motivator of individual behavior.

An Ontario Hydro study recommended establishing a "liability fund", which would consist of monies collected from customers for asset removal, decommissioning, irradiated fuel disposal and radioactive waste disposal. In addition, a provision for the amounts collected in prior years, including interest, would be fully funded.

Some companies believe a waste tax might work better in highly centralized organizations than in less centralized counterparts. In decentralized organizations, a single tax imposed on business units would conflict with corporate culture and would generate resistance. Managers make their own trade-offs of business and environmental improvements rather than obtain penalties or extra funds through internal taxes and redistribute those funds. But such waste taxes have given business units information on the costs of environmental pollution and they often motivate managers to reduce waste.

Balanced Scorecard Measures

Companies seldom connect various financial performance measures with non-financial measures of corporate performance in such areas as productivity and environmental management.

The corporate scorecard developed by Kaplan and Norton is based on a recognition that managers need both financial and operational measures to effectively manage an enterprise and that a choice between the two is unnecessary. They write that "the balanced scorecard is like the dials in an airplane cockpit: it gives managers complex information at a glance". It also forces managers to recognize how implementing one corporate policy affects the performance of several variables simultaneously and to consider whether "improvement in one area may have been achieved at the expense of another." (Kaplan and Norton 1992)

This is exactly what is required of today's managers. They need to institutionalize environmental considerations into all levels of managerial decisions. They need to link environmental information systems with the management accounting, management control and financial reporting systems already in place in organizations. They need to integrate them with existing cost management and capital investment decision systems.

The balanced scorecard forces managers to turn their goals and organizational strategy into action by specifying the measurements to be used in evaluating the implementation of the strategy. Incorporating environmental management into the balanced scorecard format thus forces the managers to develop specific measures that can be used to measure success. Thus, a company needs to do far more than just establish a goal of being environmentally sensitive. It must specify the measurable goals. It must develop goals and

performance measures for the corporation, its business units and facilities, and its teams, managers and staff.

Kaplan and Norton include four perspectives in their balanced scorecard:

i) financial;

ii) customer;

iii) internal; and

iv) learning and improvement.

These all relate to the core values of the company. A company that develops a corporate environmental strategy within its overall corporate strategy must develop measures of success. As increased environmental sensitivity becomes a core corporate value, it should become an overlay onto the balanced scorecard and should be an additional goal within each of the four scorecard perspectives. Environmental sensitivity must be seen as relating to:

i) increased financial profitability;

ii) increased customer satisfaction;

iii) increased operating effectiveness; and

iv) increased innovation and learning.

Alternatively, environmental responsibility and performance could be viewed as a fifth perspective rather than as a core corporate value. In either case, goals and

performance measures must be developed and specified. The balanced scorecard model suits the three stages of implementing a corporate environmental strategy framework used in this guideline. It examines the importance of the performance measures in the implementation of strategy. By integrating environment as a core corporate value, the balanced scorecard can become an important component of the overall implementation of a corporate environmental strategy.

■

ORGANIZATIONAL AND MANAGEMENT ACCOUNTING CHALLENGES

Managers need information to make decisions on product costing, product pricing, capital investments and performance evaluations for the corporation, its business units and its employees. In order to make better decisions and minimize environmental impacts and their related costs, managers need to co-ordinate employees from accounting, finance, legal, engineering, operations and EH&S departments in gathering information and providing inputs. The management accountant can play a critical role by applying the appropriate tools and techniques, yielding better information for better decisions.

In helping organizations implement more effective tools and techniques of environmental accounting, management accountants will face challenges in the following areas:

- Long-term planning and forecasting systems are needed that incorporate environmental improvement targets and their financial implications. Management accountants must assess the need for new and/or modified information and financial systems.

- New costing and capital appraisal systems may need to be developed. Whether these systems are based on standard or unconventional accounting information systems, they must give decision-makers adequate information about environmental costs and risks.

- Implementing new cost accounting systems is an organization-wide effort and requires the support of senior management as well as a formal implementation plan. An implementation plan should anticipate requirements such as employee training, assignment of responsibility for providing input into the system, and the likely effects of the new information on current operations.

- Conversion of any cost accounting system must be shown to be cost-effective, as with any other investment.

- Environmental costs are often lumped into overhead accounts. These costs must be removed and applied to appropriate accounts in order to help the company better understand its environmental costs and their causes.

- Management accountants need to find ways to account for quantifiable and tangible environmental factors in investment decisions. Otherwise, some proposals that are economically and environmentally sound in the long term may be rejected; alternatively, omission of significant environmental costs might cause the company to accept environmentally unsound proposals.

- Companies must adopt long-term accounting goals for producing environmental accounts that reflect the full cost of production -even when monetary values cannot be assigned.

CONCLUSION

Few would dispute the argument that the emerging "green" debate in boardrooms represents a pressing issue for the 1990s. The stakes are already high, and are rising daily, not only in the legal context but in terms of becoming a good corporate citizen, running a leaner, more energy-efficient and cost-effective operation, and identifying short- and long-term business advantages.

The tools and techniques suggested in this guideline are meant to improve corporate environmental management practices to minimize corporate environmental negative impacts and also to improve corporate financial performance. The development and implementation of a corporate environmental strategy that integrates environmental impacts into all relevant management decisions is essential for all progressive companies.

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APPENDIX A: CARBON CREDIT

Carbon credit and how you can make money from it

Carbon dioxide, the most important greenhouse gas produced by combustion of fuels, has become a cause of global panic as its concentration in the Earth's atmosphere has been rising alarmingly.

This devil, however, is now turning into a product that helps people, countries, consultants, traders, corporations and even farmers earn billions of rupees. This was an unimaginable trading opportunity not more than a decade ago.

Carbon credits are a part of international emission trading norms. They incentivise companies or countries that emit less carbon. The total annual emissions are capped and the market allocates a monetary value to any shortfall through trading. Businesses can exchange, buy or sell carbon credits in international markets at the prevailing market price.

India and China are likely to emerge as the biggest sellers and Europe is going to be the biggest buyers of carbon credits.

Last year global carbon credit trading was estimated at $5 billion, with India's contribution at around $1 billion. India is one of the countries that have 'credits' for emitting less carbon. India and China have surplus credit to offer to countries that have a deficit.

India has generated some 30 million carbon credits and has roughly another 140 million to push into the world market.

Waste disposal units, plantation companies, chemical plants and municipal corporations can sell the carbon credits and make money.

Carbon, like any other commodity, has begun to be traded on India's Multi Commodity Exchange since last the fortnight. MCX has become first exchange in Asia to trade carbon credits.

So how do you trade in carbon credits? Who can trade in them, and at what price? Joseph Massey, Deputy Managing Director, MCX, spoke to Managing Editor Sheela Bhatt to explain the futures trading in carbon, and related issues.

What is carbon credit?

As nations have progressed we have been emitting carbon, or gases which result in warming of the globe. Some decades ago a debate started on how to reduce the emission of harmful gases that contributes to the greenhouse effect that causes global warming. So, countries came together and signed an agreement named the Kyoto Protocol.

The Kyoto Protocol has created a mechanism under which countries that have been emitting more carbon and other gases (greenhouse gases include ozone, carbon dioxide, methane, nitrous oxide and even water vapour) have voluntarily decided that they will bring down the level of carbon they are emitting to the levels of early 1990s.

Developed countries, mostly European, had said that they will bring down the level in the period from 2008 to 2012.

In 2008, these developed countries have decided on different norms to bring down the level of emission fixed for their companies and factories.

A company has two ways to reduce emissions. One, it can reduce the GHG (greenhouse gases) by adopting new technology or improving upon the existing technology to attain the new norms for emission of gases. Or it can tie up with developing nations and help them set up new technology that is eco-friendly, thereby helping developing country or its companies 'earn' credits. India, China and some other Asian countries have the advantage because they are developing countries. Any company, factories or farm owner in India can get linked to United Nations Framework Convention on Climate Change and know the 'standard' level of carbon emission allowed for its outfit or activity. The extent to which I am emitting less carbon (as per standard fixed by UNFCCC) I get credited in a developing country. This is called carbon credit.

These credits are bought over by the companies of developed countries — mostly Europeans — because the United States has not signed the Kyoto Protocol.

How does it work in real life?

Assume that British Petroleum is running a plant in the United Kingdom. Say, that it is emitting more gases than the accepted norms of the UNFCCC. It can tie up with its own subsidiary in, say, India or China under the Clean Development Mechanism. It can buy the 'carbon credit' by making Indian or Chinese plant more eco-savvy with the help of technology

transfer. It can tie up with any other company like Indian Oil [Get Quote], or anybody else, in the open market.

In December 2008, an audit will be done of their efforts to reduce gases and their actual level of emission. China and India are ensuring that new technologies for energy savings are adopted so that they become entitled for more carbon credits. They are selling their credits to their counterparts in Europe. This is how a market for carbon credit is created.

Every year European companies are required to meet certain norms, beginning 2008. By 2012, they will achieve the required standard of carbon emission. So, in the coming five years there will be a lot of carbon credit deals.

What is Clean Development Mechanism?

Under the CDM you can cut the deal for carbon credit. Under the UNFCCC, charter any company from the developed world can tie up with a company in the developing country that is a signatory to the Kyoto Protocol. These companies in developing countries must adopt newer technologies, emitting lesser gases, and save energy.

Only a portion of the total earnings of carbon credits of the company can be transferred to the company of the developed countries under CDM. There is a fixed quota on buying of credit by companies in Europe.

How does MCX trade carbon credits?

This entire process was not understood well by many.

Those who knew about the possibility of earning profits, adopted new technologies, saved credits and sold it to improve their bottom line.

Many companies did not apply to get credit even though they had new technologies. Some companies used management consultancies to make their plan greener to emit less GHG. These management consultancies then scouted for buyers to sell carbon credits. It was a bilateral deal.

However, the price to sell carbon credits at was not available on a public platform. The price range people were getting used to was about Euro 15 or maybe less per tonne of carbon. Today, one tonne of carbon credit fetches around Euro 22. It is traded on the European Climate Exchange. Therefore, you emit one tonne less and you get Euro 22. Emit less and increase/add to your profit.

We at the MCX decided to trade carbon credits because we are in to futures trading. Let people judge if they want to hold on to their accumulated carbon credits or sell them now.

MCX is the futures exchange. People here are getting price signals for the carbon for the delivery in next five years. Our exchange is only for Indians and Indian companies. Every year, in the month of December, the contract expires and at that time people who have bought or sold carbon will have to give or take delivery. They can fulfill the deal prior to December too, but most people will wait until December because that is the time to meet the norms in Europe.

Say, if the Indian buyer thinks that the current price is low for him he will wait before selling his credits. The Indian government has not fixed any norms nor has it made it compulsory to reduce carbon emissions to a certain level. So, people who are coming to buy from Indians are actually financial investors. They are thinking that if the Europeans are unable to meet their target of reducing the emission levels by 2009 or 2010 or 2012, then the demand for the carbon will increase and then they may make more money.

So investors are willing to buy now to sell later. There is a huge requirement of carbon credits in Europe before 2012. Only those Indian companies that meet the UNFCCC norms and take up new technologies will be entitled to sell carbon credits.

There are parameters set and detailed audit is done before you get the entitlement to sell the credit. In India, already 300 to 400 companies have carbon credits after meeting UNFCCC norms. Till MCX came along, these companies were not getting best-suited price. Some were getting Euro 15 and some were getting Euro 18 through bilateral agreements. When the contract expires in December, it is expected that prices will be firm up then.

On MCX we already have power, energy and metal companies who are trading. These companies are high-energy consuming companies. They need better technology to emit less carbon.

Is this market also good for the small investors?

These carbon credits are with the large manufacturing companies who are adopting UNFCCC norms. Retail investors can come in the market and buy the contract if they think the market of carbon is going to firm up. Like any other asset they can buy these too. It is kept in the form of an electronic certificate.

We are keeping the registry and the ownership will travel from the original owner to the next buyer. In the short-term, large investors are likely to come and later we expect banks to get into the market too. This business is a function of money, and someone will have to hold on to these big transactions to sell at the appropriate time.

Isn't it bit dubious to allow polluters in Europe to buy carbon credit and get away with it?

It is incorrect to say that because under UNFCCC the polluters cannot buy 100 per cent of the carbon credits they are required to reduce. Say, out of 100 per cent they have to induce 75 per cent locally by various means in their own country. They can buy only 25 per cent of carbon credits from developing countries.

Tell us what's the flip side of your business?

Like in the case of any other asset, its price is determined by a function of demand and supply. Now, norms are known and on that basis European companies will meet the target between December 2008 and 2012. People are wondering

how much credit will be available in market at that time. To what extent would norms be met by European companies. . .

As December gets closer, it is possible that some government might tinker with these norms a little if the targets could not be met. If these norms are changed, prices can go through a correction. But, as of now, there is a very transparent mechanism in which the norms for the next five years have been fixed.

Governments have become signatories to the Kyoto Protocol and they have set the norms to reduce the level of carbon emission. Already companies are on way to meeting their target.

Other than this, it's a question of having correct information. How much will be the demand for carbon credit some years from now? How much will the supply be? It is a safe market because it is a matter of having more information on the extent of demand and supply of carbon credit market.

- Joseph Massey, Deputy Managing Director, MCX. February 05,2008

India Inc takes to carbon trading

More than 112 Indian companies, including Hindustan Lever Ltd [Get Quote] and Tata Steel [Get Quote], are set to trade in carbon credits.

These companies are ready with clean technologies to bring down the emission levels of greenhouse gases and sell certified emission reductions (CERs) to developed countries.

This is the largest portfolio for any country signatory to the United Nations Framework of Climate Change Convention (UNFCCC). The UN body certifies countries and companies that can trade in carbon credits under the Kyoto Protocol.

According to World Bank estimates, India is expected to rake in $100 million annually by trading in carbon credits and Indian companies are expected to corner at least 10 per cent of the global market in the initial years.

Globally, greenhouse gas emissions are expected to come down by 2.5 billion tonne by 2012. According to industry estimates, Indian companies are expected to generate at least $8.5 billion at the going rate of $10 per tonne of CER.

By 2007, when actual trading will start, the cost of a tonne of CER was estimated to rise to $45, said officials in the ministry of environment and forests.

Under the Kyoto Protocol, between 2008 and 2012, developed countries have to reduce emissions of greenhouse gases to an average of 5.2 percent below the 1990 level.

They can also buy CERs from developing countries, which do not have any reduction obligations, in case their industries are not in a position to lower the emission levels themselves.

One tonne of carbon dioxide reduced through the Clean Development Mechanism (CDM) project, when certified by a designated entity, becomes a tradable CER.

"It is cheaper for developing countries to reduce emissions than developed countries. As a result, buyers are coming to Indian shores," said Teri Associate Fellow Vivek Kumar. Brazil and China are emerging two of India's strong competitors.

According to industry estimates, some Indian companies have entered into forward contracts with buyers from the European Union. These contracts are estimated at $325 million.

The World Bank has also purchased CERs from 10 companies. Tata Steel, HLL, Jindal Vijaynagar Steel, Essar Power and Gujarat Flurochemicals Ltd have specially designed projects to take advantage of the opportunity. Bharat Heavy Electricals Ltd [Get Quote] is the only public sector firm which is planning to approach the ministry for approval.

The projects range from cement, steel, biomass power, bagasse co-generation and municipal solid waste to energy, municipal water pumping and natural gas power.

While the ministry has given the host-country clearance, the CDM projects will have to be approved by the executive board of the UNFCCC. Of the 15 projects approved by the UNFCCC so far, four are Indian.

These four are: Gujarat Flurochemicals, Kalpataru Power Transmission Ltd, the Clarion power project in Rajasthan and the Dehar power project in Himachal Pradesh.

India is the world's sixth largest emitter of carbon dioxide with its present share in global emissions estimated at 6 per cent.

Are we ready for Carbon trading?

Carbon credits are a tradable permit scheme. They provide a way to reduce greenhouse gas emissions by giving them a monetary value. A credit gives the owner the right to emit one tonne of carbon dioxide.

International treaties such as the Kyoto Protocol set quotas on the amount of greenhouse gases countries can produce. Countries, in turn, set quotas on the emissions of businesses. Businesses that are over their quotas must buy carbon credits for their excess emissions, while businesses that are below their quotas can sell their remaining credits. By allowing credits to be bought and sold, a business for which reducing its emissions would be expensive or prohibitive can pay another business to make the reduction for it. This minimizes the quota's impact on the business, while still reaching the quota.

Credits can be exchanged between businesses or bought and sold in international markets at the prevailing market price. There are currently two exchanges for carbon credits: the Chicago Climate Exchange and the European Climate Exchange.

In addition to the burning of fossil fuels, major industry sources of greenhouse gas emissions are cement, steel,

textile, and fertilizer manufacturers. The main gases emitted by these industries are methane, nitrous oxide, hydro-fluro-carbons, etc, which increase the atmosphere's ability to trap infrared energy.

The concept of carbon credits came into existence as a result of increasing awareness of the need for pollution control. It was formalized in the Kyoto Protocol, an international agreement between 169 countries. Carbon credits are certificates awarded to countries that are successful in reducing emissions of greenhouse gases.

For trading purposes, one credit is considered equivalent to one tonne of CO2 emissions. Such a credit can be sold in the international market at the prevailing market price.

How buying carbon credits attempts to reduce emissions?

Carbon credits create a market for reducing greenhouse emissions by giving a monetary value to the cost of polluting the air. This means that carbon becomes a cost of business and is seen like other inputs such as raw materials or labor.

By way of example, assume a factory produces 100,000 tonnes of greenhouse emissions in a year. The government then enacts a law that limits the maximum emissions a business can have. So the factory is given a quota of say 80,000 tonnes. The factory either reduces its emissions to 80,000 tonnes or is required to purchase carbon credits to offset the excess.

A business would buy the carbon credits on an open market from organisations that have been approved as being able to sell legitimate carbon credits. One seller might be a company that will plant so many trees for every carbon credit you buy from them. So, for this factory it might pollute a tonne, but is essentially now paying another group to go out and plant trees, which will, say, draw a tonne of carbon dioxide from the atmosphere.

As emission levels are predicted to keep rising over time, it is envisioned that the number of companies wanting to buy more credits will increase, which will push the market price up and encourage more groups to undertake environmentally friendly activities that create for them carbon credits to sell. Another model is that companies that use below their quota can sell their excess as 'carbon credits.'

The possibilities are endless; hence making it an open market.

The Kyoto Protocol provides for three mechanisms that enable developed countries with quantified emission limitation and reduction commitments to acquire greenhouse gas reduction credits. These mechanisms are Joint Implementation (JI), Clean Development Mechanism and International Emission Trading.

Under JI, a developed country with relatively high costs of domestic greenhouse reduction would set up a project in another developed country that has a relatively low cost. Under

CDM, a developed country can take up a greenhouse gas reduction project activity in a developing country where the cost of greenhouse gas reduction project activities is usually much lower. The developed country would be given credits for meeting its emission reduction targets, while the developing country would receive the capital and clean technology to implement the project. Under IET, countries can trade in the international carbon credit market.

There are currently several trading systems in place with the largest being the European Union's. The carbon market makes up the bulk of these and is growing in popularity. Many businesses have welcomed emissions trading as the best way to mitigate climate change. Enforcement of the caps is a problem, but unlike traditional regulation, emissions trading markets can be easier to enforce because the government overseeing the market does not need to regulate specific practices of each pollution source. However, monitoring (or estimating) and verifying of actual emissions is still required, which can be costly.

Critics doubt whether these trading schemes can work as there may be too many credits given by the government, such as in the first phase of the European Union's scheme. Once a large surplus was discovered the price for credits bottomed out and effectively collapsed, with no noticeable reduction of emissions.

Perhaps the most successful emission trading system to date is the SO2 trading system under the framework of the

Acid Rain Program of the 1990 Clean Air Act in the United States. Under the program, which are essentially cap-and-trade emissions trading system, SO2 emissions are expected to be reduced by 50% from 1980 to 2010.

The European Union Emission Trading Scheme is the largest multi-national, greenhouse gas emissions trading scheme in the world and was created in conjunction with the Kyoto Protocol. It commenced operation in January 2005 with all 27-member states of the European Union participating in it. It contains the world's only mandatory carbon trading program. The program caps the amount of carbon dioxide that can be emitted from large installations, such as power plants and carbon intensive factories and covers almost half of the EU's Carbon Dioxide emissions.

Critics argue that emissions trading does little to solve pollution problems overall, as groups that do not pollute sell their conservation to the highest bidder. Overall reductions would need to come from a sufficient and challenging reduction of allowances available in the system.

Critics of carbon trading, such as Carbon Trade Watch argue that it places disproportionate emphasis on individual lifestyles and carbon footprints, distracting attention from the wider, systemic changes and collective political action that needs to be taken to tackle climate change.

- Srinivasan Venkataraghavan is Chief Executive Officer, Altos Advisory Services

Source - www.rediff.com/money/2008/feb/05inter1.htm

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