Carbon Management: Voluntary Programs, Regulations, and Corporate Strategies

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***Abstract*-Most human activities including those associated with the production processes, transportation, and disposal services require use of energy. Accordingly, every product or service that humans consume directly or indirectly creates either CO_2 or other greenhouse gas (GHG) emissions that is commonly defined as "carbon footprints". The need and the urgency for designing voluntary and regulatory programs that can assist organizations with managing their carbon footprints have been proposed and approached to for decades. The implementation of such programs, however, has become even more evident and critical today as we are experiencing the change in the pattern of the local, regional, and global climate and resulting economic, environmental and social risks those impose. This paper reviews voluntary and regulatory carbon management programs, presents the results obtained from analysing a set of successful carbon management strategies while highlighting their commonalities and critical components, and proposes a proactive, step-by-step approach to manage organizations' carbon footprints. This is an attempt to assist organizations with designing strategies that could assist them with both discovering the opportunities and managing the risks climate change poses.**

Keywords- Carbon Management; Climate change ; Clean Air Act Regulations; GHG Management; Corporate Strategy

I. INTRODUCTION

Most economic development activities including, among others, manufacturing, production processes, storage, and transportation, require use of different forms of energy (from fossil fuel sources) and as such contribute to the emission of greenhouse gases (GHGs) including carbon dioxide (CO_2). Greenhouse gases are those gases that trap heat in the atmosphere. Some greenhouse gases such as carbon dioxide could occur by human activities or naturally. Others are created and emitted solely through human activities.

The principal greenhouse gases that enter the atmosphere because of human activities are: carbon dioxide (CO_2) from burning fossil fuels (oil, natural gas, coal, solid waste, trees and wood products, chemical reactions (e.g., manufacture of cement)); methane (CH_4) that can be emitted during the production and transportation of the coal, natural gas and oil, livestock, agricultural practices, or municipal solid waste landfills; nitrous oxides (NO2) that can be emitted during agricultural and industrial activities; and fluorinated gases (such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic), as powerful greenhouse gases that are emitted from a variety of industrial processes. These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases they are sometimes referred to as High Global Warming Potential gases ("High GWP gases").

Carbon management strategies, as presented in this paper, are those concerned with the assessment and management of organizations GHG emissions, in other word their "carbon footprint". The term "carbon footprint" describes the total amount of CO_2 and other GHG emissions (measured in CO_2 equivalent) for which an individual or organization is responsible for. The full footprint encompasses a wide range of emission sources from direct use of fuels to indirect emissions that can be attributed to an organization's disposition and practice. An accurate estimation of the carbon footprint, however, is not easy and requires development of a well-structured strategy that among others should include a detailed emission assessment methodology (i.e. effective data collection method, proper selection of boundaries and scope of emission management, use of proper data analysis methods and disclosure of the results) and reduction strategies.

To date most acceptable approaches to estimate and manage organizations' carbon footprints have been involved with design of strategies based on aggressive energy audit and energy management programs. While focusing on closed loop systems, efforts have been directed toward developing strategies that can meet organizations sustainable development goals and objectives, and as such, expanding operations and profitability while reducing GHG emissions from the direct and indirect sources. The challenge, however, has been how to maintain profitability and competitive advantage when implementing sustainability oriented strategies that include organizational policies and procedures that require reducing organizations carbon footprint and other environmental and social impacts resulting from economic development activities.

Improving competitiveness and profitability while meeting the core components of sustainability requires diagnosis of the needs and identification of profitable eco-efficiency projects that can also assist in identifying improved technical, economic and environmental performance. Among many approaches, the most significant steps toward sustainability have been identified to be quantification and reduction of GHG emissions and the resulting carbon footprint. As such, many organizations have attempted to, at a minimum, focus on the identification, quantification, reduction, and preparation of emission monitoring and management reports for validating their GHG emission reduction capabilities.

A. Research Goals and the Objectives

The study presented in this paper recognizes the strong environmental, social and business foundation for design of practical and effective GHG management strategies. The focus of the paper, therefore, has been to provide an overview of the governing principles of GHG management from voluntary and regulatory perspectives, review organizations efforts and strategic planning approaches to manage their GHG emissions and carbon footprints, and subsequently design a step-by-step approach (a roadmap) to assist organizations with their efforts toward design of GHG emissions management strategies that could result in lowering their emissions and reducing their carbon footprints in a sustainable manner.

The proposed roadmap was designed according to the results obtained from analysis of the best GHG management practices at selected leading organizations. Those practices are shown to be also responsible for improvements in operating efficiency, compliance with emerging regulatory requirements, and enhancement of the organization's reputation.

The main goals and the objectives of this paper, therefore, are to: (a) demonstrate similarities and differences among the existing GHG emission/carbon footprint management policies and programs, (b) compare organizations approaches to manage their GHG emissions and carbon footprints, and (c) suggest a step-by-step roadmap for sustainable management of the organizations GHG emissions and carbon footprints according to the lessons learned from best practices and the most applicable polices.

B. Methodology

The research methodology in this study consisted of: (a) reviewing a set of selected most prevalent, applicable, and widely practiced GHG management strategies at international and national organizations (both voluntary and regulatory, if applicable), (b) analysing, grouping, and scoring the most common elements of the practiced GHG management strategies at selected organizations, and (c) using the results and formulating a portfolio of actions for organizations' approach to manage their GHG emissions and carbon footprints in the most sustainable manner.

II. GLOBAL REPORTING INITIATIVES (GRI) AND KYOTO PROGRAM

The following sections provide an overview of the corporate sustainability framework "GRI" which focuses on the corporate information disclosure and reporting, and Kyoto program which aims at international GHG reduction. The review sections are followed by discussions of the most widely used carbon management initiatives in the United States.

A. Global Reporting Initiative (GRI) and Sustainability Reporting Guidelines (GRI Guidelines)

The GRI Guideline is an internationally accepted, voluntary reporting framework for economic, environmental, and social aspects of a company's performance. The GRI Guideline provides an overarching framework for sustainability reporting that allows for direct comparison of environmental performance to the efforts of other companies within the same industry and other industries [1].

Another well received strategy is the carbon disclosure project (CDP) which has been successfully used by institutional investors to urge firms to disclose extensive information about their climate change activities. Carbon disclosure represents a form of civil regulation and a mode of corporate governance in which civil society put pressure on businesses to comply with environmental and social norms [2].

B. The Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988 [3]. When not giving a management reporting guidelines, IPCC publishes internationally accepted inventory methodologies that serve as a basis for all greenhouse gas accountings. Such methodologies ensure that accounting procedures are both comparable and understandable. The 2006 IPCC methodological instructions were completed and accepted by the IPCC in May 2006 [4].

C. The Kyoto Protocol

The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), which is an international environmental treaty aimed at stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Industrialized countries which joined the Kyoto Protocol are required to reduce GHG emissions by a specified amount. The total emissions of the developed countries are to be reduced by at least 5 % over the period between 2008 and 2012 compared with 1990 levels [5]. The Kyoto Protocol, which entered into force in 2005, has established a market-based mechanism to allow developed countries with binding emissions targets to reduce greenhouse gas emissions. Market-based mechanisms, among others, included international cap and trade programs such as Clean Development Mechanism, Joint Implementation, Assigned Amount Units, and European Trading Systems [6].

D. ISO 14064

ISO 14064 is an international standard that addresses GHG inventory boundaries, quantifying and reporting of GHG emissions and verification of such information. It provides guidelines for private and public sectors to develop GHG inventories for organization as well as foundation for policy makers and program developers for initiatives to address the global environmental challenge of climate change [7].

III. US VOLUNTARY AND REGULATORY PROGRAMS

A. Climate Leader Program

In its Fiscal Year 2008 Consolidated Appropriations Act (H.R. 2764; Public Law 110–161), Congress directed EPA to publish a mandatory greenhouse gas reporting rule, using the Agency's existing authority under the Clean Air Act (CAA). Climate Leaders is an EPA industry government partnership that works with companies to develop comprehensive climate change strategies. Partner companies commit to reducing their impact on the global environment by setting aggressive greenhouse gas reduction goals and annually reporting their progress to EPA [8] The reporting requirements consist of three major components: an Inventory Management Plan, the Annual GHG Inventory Summary and Goal Tracking Form, and the review process.

The EPA Climate Leaders program provides a company-wide GHG reduction guideline which includes techniques to be used for source identification within sectors and company boundaries, strategies and techniques for emission inventory development, methods for inventory management, and elements of an effective reduction goal setting. Performance benchmarking has been used to rate energy efficiency efforts in products, buildings, and industrial facilities. The U.S. Environmental Protection Agency (EPA) has developed a sector-based benchmark methodology to use as a tool for projecting business-as-usual GHG intensity improvements and assessing corporate GHG reduction goals proposed to the EPA Climate Leaders Partnership. The program has identified three key components central to a robust GHG management strategy:

1. Inventory Corporate-wide Emissions of the six major GHGs from direct sources including stationary combustion, mobile combustion, and process and fugitive emissions, and from indirect sources such as electricity and steam purchases;

2. Develop an Inventory Management Plan that describes the process of competing and maintaining a high-quality, corporate-wide inventory;

3. Set a long-term, forward-looking GHG emissions reduction goal. Inventory Management Plan to ensure credibility and consistency in emissions data, both of which are essential to tracking progress towards meeting a GHG reduction goal [9].

Although successful, on September 30, 2011, the U.S. Environmental Protection Agency officially ended its Climate Leaders program and is now proceeding with a number of activities (i.e. Joint Recognition Programs for Climate Leadership, Supply Chain GHG Management, Strategic Partnerships and Engagements, GHG data analysis corresponding to the GHG Reporting Program, and Promotion of GHG management best practices and technologies in collaboration with other EPA programs and other organizations) [10].

In addition to the Climate Leader program, the U.S. Department of Energy (DOE) Federal Energy Management Program (FEMP) assists Federal agencies with managing their greenhouse gas (GHG) emissions. GHG management entails measuring emissions and understanding their sources, setting a goal for reducing emissions, developing a plan to meet this goal, and implementing the plan to achieve reductions in emissions.

B. US Cap and Trade and CAA Regulatory Programs

1) Cap and Trade:

U.S. Regional Greenhouse Gas Partnerships including the Regional Greenhouse Gas Initiative (RGGI) became effective in 2009 as the first mandatory Cap and Trade program in the United States. The cap and trade program is a quantity-based approach and market-based mechanism to control pollution emissions. President Clinton's Climate Change Action Plan (CCAP) which was released in October 1993, spawned many initiatives including Green Lights, Climate Wise, Motor Challenge, and Energy Star Buildings, among many others [11]. Under Cap and Trade, the regulatory authority determines a total quantity of pollution which is so called "cap". Regulated businesses need to hold enough emissions allowances to meet the "cap" and create demand for the allowances as well. Allowances can be traded, are valuable and lead to pricing GHGs. This price provides continuous incentive for companies to innovate and reduce emissions as much as they can since they can save money if they avoid buying allowances. In other words, if it is less costly to reduce emissions than to buy allowances, companies will reduce their own emissions and vice versa. Besides, if companies can reduce emissions below the requirements, they can bank their excess allowances for future use or sell them at the current market. Whether the firms can raise revenue by selling the excess allowances depends on whether they were allocated certain amount of allowances for free or they were auctioned [12].

To date, EPA's cap and trade programs have been primarily focused on the electricity generating sector. Due to the characteristics of long-range transport of GHG emissions, cap and trade programs can facilitate significant emission reductions

both interstate and over large geographic areas, benefiting human health and the environment [13].

2) CAA GHG Regulations:

The EPA currently regulates GHG emissions from large stationary sources (new sources and major modifications) under CAA's PSD Program, Tailoring Rule and NSPS Program [14].

The PSD Program applies to new plants or existing plants that plan to conduct "major" or "significant" modifications that emit 100 tons per year (tpy) (250 tpy in some cases) or more of any criteria pollutants [15]. As GHG emissions typically occur in much higher concentrations (up to hundreds of times of other air pollutants) [16] using the 100- and 250- tpy thresholds for GHG emissions is not plausible. Thus, the EPA issued the Tailoring Rule to target only the largest GHGs emitters to acquire PSD and Title V air quality permits.

The NSPS program could involve emission limits, efficiency standards, and reporting requirements. In contrast to PSD permitting requirements, NSPSs are uniform and applied nationwide. Standards may differ between categories, and States implementation plans to achieve performance standards, subject to the EPA approval [17].

3) CAA New Regulatory Rules for Power Plants:

On March 2012, the US EPA proposed the first-ever GHG Standard which set national limits for new fossil-fuel-fired power plants. The recently proposed NSPS is aimed at limiting CO2/GHGs emissions from new electricity generating units (EGUs) at power plants rather than plants currently operating or new permitted plants that begin construction within the next 12 months [18]. Fossil-fuel-fired energy generating units (EGUs) include fossil-fuel-fired boilers, integrated gasification combined cycle (IGCC) units and stationary combined cycle turbine units that generate electricity for sale and are larger than 25 megawatts (MW) [19]. Through the deployment of modern technologies, the EPA's new proposal (the proposed NSPS) will ensure the ongoing trend toward cleaner, safer power plants continues. In contrast to the Tailoring Rule, the proposed NSPS applies to new individual units rather than "sources".

The proposed NSPS is practical, flexible and achievable. It will prohibit affected units from emitting more than 1,000 pounds of CO_2 per megawatt hour (lbs. CO_2/MWh gross) [20].

According to the EPA, based on available data, power plants with new natural gas combined cycle (NGCC) units should be able to meet the standard without add on controls [21]. But new coal or petroleum coke power plants would employ new technology like CCS (carbon capture and storage) to achieve this standard, in which carbon dioxide emissions are collected and sequestered in the ground rather than released into the atmosphere [22]. In addition, the proposed NSPS gives new power plants that use CCS the flexibility to meet the standard [23].

Both the proposed NSPS and the PSD program could regulate GHG-emitting facilities regarding the GHG emission level of the facilities or the sources. Thresholds that trigger these regulations are important, such as 1,000 lbs. CO_2/MWh for the proposed NSPS, 100,000 tpy of GHGs (new sources) and additional net GHG emissions of 75,000 tpy (modifications) for the PSD program [24].

4) PSD Permitting Requirements:

PSD permits and installation of BACT for GHGs will be required for (1) new source construction with emissions of 100,000 tons CO_2 per year or more, and (2) major facility modifications resulting in GHG emission increases of 75,000 tons of CO_2 per year or more [25].

The EPA procedure for determining BACT is a "top-down" process [26] which has been used for over 30 years. This process involves five steps for involving in decision making process the technical feasibility, cost, and other economic, environmental and technical considerations (1) Identify all available control options, (2) Eliminate technically infeasible control options, (3) Evaluate and rank remaining options based on environmental effectiveness, e.g. pollutant reduction, (4) Evaluate cost effectiveness of controls and energy and other environmental impacts and (5) Eliminate options that fail energy, environmental, or economic criteria [27]. EPA stated that "it will apply BACT for GHGs using the same facility-specific five-step process that is currently used for other regulated pollutants and indicated that in most cases BACT will, at least initially, be limited to energy efficiency improvements."

5) CAA Regulatory Rules and Offset Programs:

An Offset is an environmental policy mechanism which allows an emitter to increase emissions or avoid required reductions by committing to reduce emissions made elsewhere. It implies that "the offsets may come from the same facility, a different facility under the same owner, or as a result of a contractual agreement between different emitters". Generally, offsets can enable industries to achieve equivalent environmental results at lower cost [28].

International GHG offsets have played a key role in GHG mitigation as they are capable of significantly reducing the cost of emission reductions. However, the regulatory programs under the CAA may not be legally compatible with international offsets which have been used in US environmental regulation for more than 30 years (1977 amendments to the CAA Climate Policy) [29].

The major barriers to combine the offset programs with those identified in the CAA regulations are the nature of NAAQS requirements. Under PSD (NAAQS, the CAA), the emission ERCs-CAA offsets can generally only be tradable within the same nonattainment area as they are created [30] rather than across the US or internationally. In principle, EPA could issue a "model rule" integrating International Offsets for states to implement in their SIPs while defining at which level the GHG NAAQS should be set [31]. The CAA at the federal level lacks a solid legal foundation for international offsets as well. Nonetheless, offsets play a key role in reducing the overall cost of complying with GHG regulations and achieving reductions in uncapped sectors. For instance, unregulated entities can voluntarily participate in the program and earn income by selling credits, which could "increase political support and spread the economic benefits of the program" [32].

6) Macro-level Comparison of the GHG Governing Rules:

Table I provides an overview of the presented GHG management guidelines both voluntary and regulatory. As shown, cap-and-trade and market mechanisms are the most common programs used at both national and international levels. In the US, however, while voluntary programs and use of guidelines suggested by the national and international organizations have been active since 2005, the first regulatory program has been activated in 2012 under CAA regulations. This regulation is focused on governing GHG emissions in fossil burning power plants only. EPA is, however, aiming to regulate the GHG emissions under CAA for other sectors in the near future.

TABLE I EXAMPLE GHG MANAGEMENT PROGRAMS

GHG Program	Voluntary		Regulatory	Focus
	International	US		
GRI G3 2006	X			Sustainability Benchmarking
IPCC 1988- 2006	X			Inventory Methodology
Kyoto Protocol 2005	X			Stabilization of GHG in Atmosphere Reduction over Emissions at Base year (1990)
ISO 14064 2006-2007	X			International Standards for Setting Emission Boundaries: Public and Private Organizations
GHG Off Sets (Kyoto-2005)	X	X		An Environmental Policy to Allow for GHG Reduction Elsewhere *
US Climate Leader 2008-2011		X	X (Mandatory Reporting)	GHG Reporting Rules; EPA Industry-Government Partnership Under CAA
Cap and Trade 2005**, 2009***	X	X	X	Quantity-based Approach and Market-Based Mechanism Specific to Electricity Sector (in US)
CAA GHG 2012		X	X	First-ever US GHG Standards for Fossil Fuel Fired Power-plants

*Clean Development Mechanism (CDM) and Joint Implementation (JI) programs,
** International Programs (2005), ***US program (2009)

IV. ANALYSIS OF THE ORGANIZATIONS GHG MANAGEMENT STRATEGIES

A. GHG Management Strategies

Literature indicates that most organizations' strategic planning for managing GHG emissions starts with designing, developing or enhancing corporate strategies that are capable of accounting for both the risks and the opportunities associated with GHG emissions reductions.

In order to understand the nature and the structure of the most commonly used strategies for addressing GHG emissions, we reviewed programs employed in leading organizations in six industrial sectors: electric utilities, chemical and mining industry, manufacturing industry, service industry, and food industry.

Data collection methodology involved, among others, intensive literature review, extraction and analysis of the information published in corporate reports (i.e. GRI reports) and/or other relevant publications discussing corporate GHG management strategies.

The performed analysis in this study indicated that all GHG management strategies more or less included eight different criteria: full management participation, development of organizations policies, design of voluntary and regulatory-based programs, design of internal programs that could be either non-technical and/or technical in nature, design of external nontechnical as well as technical programs.

For example, technical programs were those associated with the change/modification of the employed technology (ies), product design, energy use, or operational modes. Non-technical programs, however, were initiatives that focused on the

training, and/or involvement of employees and stakeholders in design of organizations approach to manage its GHG emissions. External non-technical and technical programs and initiatives were those associated with development of GHG management policies in collaboration with the government agencies, nongovernmental organizations (NGOs), and community leaders or those focused on development of technical research programs in collaboration with research labs, institutions or other industries, respectively.

B. Analysis and Scoring of the GHG Management Strategies

A qualitative approach was used in this study to score and rank GHG management strategies according to the eight criteria identified above. The scoring methodology involved assigning a value of "0" or "1" to each criteria, if it was included in the portfolio of actions defined by the industry's GHG management strategy. For example, a score of eight indicated that all eight criteria were considered in the portfolio, and score of five otherwise suggested that only five criteria were included in the design of industry GHG management strategy.

The "Effectiveness Score" was subsequently estimated for each industry from the ratio of the industry total GHG management score to eight (assumed maximum possible score for each strategy). For example, the effectiveness score for Wallmart's GHG management strategy was estimated to be 0.63 which is equivalent of 5:8. As shown, Wallmart mainly focuses on development of the voluntary internal and external non-technological programs that are supported by the upper management.

C. Results

Fig. 1 presents the types, scores and characteristics of the industrial GHG management strategies reviewed in this study. As shown: (a) all industries have adopted voluntary programs and have support and involvement of the top management, (b) Electric utilities and high-tech industry score the highest for the number of the external and internal programs they pursued, respectively, (c) chemical/mining industry GHG management portfolio includes the utmost number of criteria when compared to the others, and (d) food industry portfolio of actions is among those scored the lowest. It is also important to note that neither industry was subject to any regulatory-based program.

The "effectiveness scores" which indicated the significance of the GHG management portfolios were estimated from the number of criteria included in each GHG management program. As shown in Fig. 1 manufacturing and food processing industries had the highest and the lowest effectiveness scores respectively (0.73 vs. 0.56). This observation suggested that industries which historically have been regulated for their emissions have developed more complete GHG management portfolios than those who have not. It is important to note that the effectiveness scores were estimated and used only to facilitate comparative analysis of the employed programs, and as such, those scores were not used to examine programs for their real effects and/or significance of the final results.

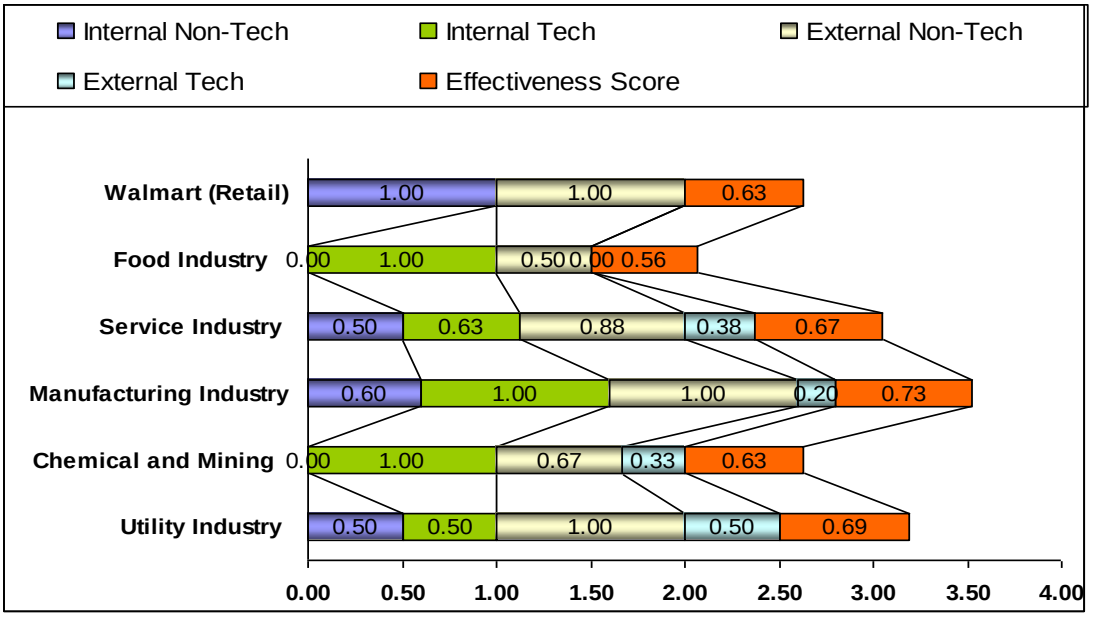

Fig.1 Reviewed GHG management criteria and estimated scores

V. DESIGN OF PORTFOLIO OF ACTIONS FOR MANAGING GHG EMISSIONS

An example framework is proposed for the design of a portfolio of actions for managing GHG emissions. The design of the framework mimics common findings of our study and those provided in Hoffman and Andrew, 2006 publications [33]. The

framework suggests three categories of actions: (1) Analysis of the GHG Emission Profiles, (2) Analysis of the Organization's Resources, and (3) Design of External Outreach Programs. Any strategy, accordingly, must be designed and supported by top management and include a set of common goals and objectives, analysis of the internal human and financial capital, and external outreach and collaborative programs (see Fig. 2). GHG management strategic planning, therefore, should start with developing GHG emission profiles and include initiatives and programs that are specific to managing carbon emissions while addressing climate change risks. Any proactive strategy must also involve assessing values at risk, establishing emission inventories, assessing internal options for emission reduction, examining external options and opportunities for collaboration on carbon management specific programs. Among others, this could include managing product line operations, and development of integrated environmental strategies using the provided information through the use of the framework.

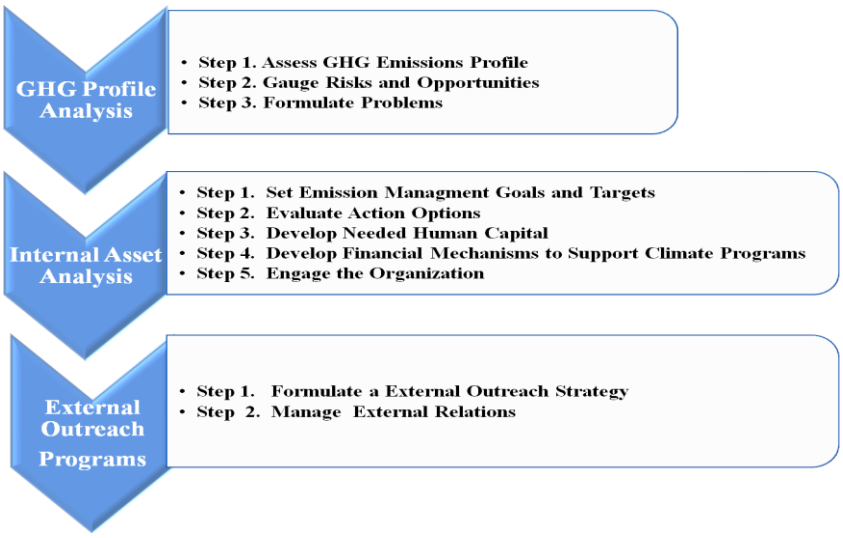

Fig. 2 A roadmap for design of GHG management strategies

More specifically, such strategies must involve characterization of the energy sources, reduction in the magnitude of energy consumption and related GHG emissions along the supply chain. Managing the risk of exposure to increased prices for carbon-intensive energy requires management of the energy use through the supply chain at both the upstream (input material, operation) and the downstream (resulting from product use, consumers use, and disposal).

GHG management programs and initiatives are also encouraged to take into the considerations mandatory and voluntary programs, namely government and industry regulations, corporate responsibility rules, voluntary registries and corporate polices. All of these require companies to both develop GHG emissions inventory via GHG accounting and reporting methodologies as explained in section II of this paper. Such initiatives could assist organizations with investment decision making and detailed evaluations of their corporate carbon risk management.

A sound sustainable strategy that is centred on GHG reduction, however, can be used to differentiate an organization among its competitors by enhancing its reputation, promoting its market position and strengthening its brand among environmentally conscious consumers [33].

Successful climate change adaptation over the long term requires proactive action options which can recognize and act on threats from an early stage rather than reactive actions which have been used by many companies to deal with the impacts that have already occurred. Proactive actions could be more difficult to identify and evaluate as they challenge companies' embedded routines.

VI. CONCLUSIONS

The need and urgency for designing voluntary and regulatory programs that can assist organizations with managing their GHG emissions and thus their carbon footprints have been proposed and utilized for decades. The implementation of such programs, however, has become even more evident and critical today as we are experiencing the change in the pattern of the local, regional, and global climate and resulting economic, environmental and social risks. This paper provided a condensed review of voluntary and regulatory carbon management programs, presented the results obtained from analyses of a set of successful carbon management strategies and highlighted their commonalities, criteria used in design of their portfolio of actions according to industries type and focus.

From the lessons learned, we proposed a simple framework and a stepwise approach to design GHG management strategies that could reduce organizations' carbon footprints in a sustainable manner. This paper also attempts to assist organizations with designing strategies that could assist them with both discovering the opportunities and managing the risks climate change poses.

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