climate earth
Carbon Accounting for the Whole Picture.

Enterprise Carbon Accounting:

The Key to Success in an Increasingly Carbon Constrained Economy

Why business must gain a whole view of their carbon footprint

This paper proposes that Enterprise Carbon Accounting (ECA) provides an information platform enabling business to be highly competitive and manage effectively in a low carbon economy. Further it proposes that broad adoption of ECA will place business at the forefront in the fight against climate change.

In a case study of Cisco Systems, the paper shows how, without ECA, Cisco has missed 80% of their enterprise carbon footprint originating largely from the core product operations of the company.

The paper covers how and why ECA evolved from process LCA (Life Cycle Analysis) and defines the requirements of a quality Enterprise Carbon Accounting (ECA) system. It concludes with how implementation of a quality ECA system enables any company to create and manage a robust climate strategy, gain competitive advantage, and effectively compete in the new economic environment.

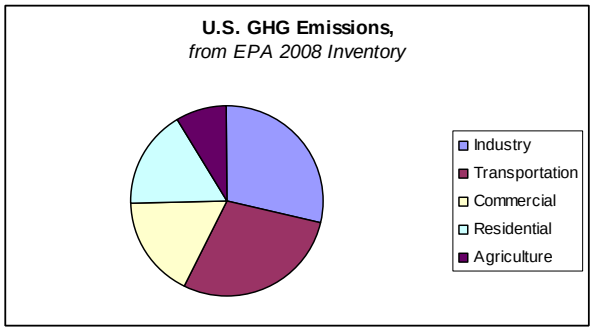
A Climate Earth Whitepaper by:
Chris Erickson, CEO and Co-Founder

Climate Change Demands New Strategic Approaches

Companies must gain a whole picture

Climate change is creating a new carbon constrained economy that changes everything about how businesses will compete and thrive in the future. Moreover, changing how business operates is a key to effectively fighting climate change.

Green house gas emissions from all business and agricultural sources comprise over 80% of the carbon footprint of the United States. Besides the clear economic benefits of taking immediate action, an unpredictable economic future, the potential for high social impact, and the certainty of regulation all provide added incentives for business to act sooner rather than delay their response to climate change.



The implications of climate change run deep, and the new skills, new thinking, new strategies and new products and services required to compete cannot be implemented quickly enough. The stakes are high, such that even the most skeptical organization should be taking prudent, if not aggressive action.

This paper proposes simply that what is not measured cannot be managed, and that a new and comprehensive approach for measuring and managing an enterprise's carbon footprint called Enterprise Carbon Accounting (ECA) provides the informational foundation for developing a competitive climate strategy and implementing effective change.

> *"Huge value is at stake. The winners will be companies that reposition themselves to seize the opportunities of a low-carbon future."*
> McKinsey Business Strategies for Climate Change *April 2008*

Carbon Accounting: Three Approaches and a New Imperative

Most companies who have undertaken to determine the carbon footprint of their operations have not examined the carbon footprint for their complete enterprise. Most have begun by using the first available greenhouse gas protocols which are also promoted by the reporting agencies such as the California Climate Action Registry and The Climate Registry and only address direct emissions from facilities, company owned vehicles and purchases of electricity and other power. Reporting 'toe prints' as 'whole prints', these businesses as yet have failed to address their complete corporate responsibility and miss capitalizing on emerging opportunities.

Process Life Cycle Assessment

The most common approach to assessing the carbon footprint of an operation or product is Process Life Cycle Assessment (LCA). Process LCA is generally used for discovering direct emissions, and carbon impact generated through the use of electricity (Scope 1 and 2 emissions respectively). This type of analysis is also occasionally used for emissions associated with a limited number of indirect processes.

Process LCA is labor intensive and is therefore has the disadvantages of both being costly and scaling very poorly across even a single supply chain, let alone across the large and complex supply chains typical of global firms.

While Process LCA falls short strategically, the method has one primary advantage over the Economic Input-Output Analysis, another common approach discussed below. The advantage of Process LCA is that it is considered to be more specific and accurate within the boundary set for an assessment. While setting boundary limits are necessary to this type of study, doing so introduces a systemic exclusion error. As supply chains become increasingly interwoven and complex, Process LCA becomes less feasible as an approach to fully capture all direct and indirect emissions.

Process LCA is an important tool for detailed assessments and can play a key role in the integrated hybrid approach discussed later. But cost, exclusion of indirect emissions, and the infeasibility of its scaling to address the enterprise level make Process LCA inadequate, on its own, for developing and managing an enterprise-wide climate strategy.

Economic Input-Output Life Cycle Analysis

In contrast to Process LCA, Economic Input-Output Life Cycle Analysis (EIOLCA) is a top down analytic approach that utilizes financial and environmental data to make a more comprehensive assessment. This approach creates a total enterprise carbon footprint that incorporates both the direct and indirect emissions of an enterprise and that of its supply chain(s).

EIOLCA is used broadly for economic analysis across a region, industry or nation and is based on economic data collection and environmental surveys of industry. The primary advantages of input-output analysis are that it:

- begins with a comprehensive top down picture,
- can be done relatively quickly and cost effectively, and
- can be easily utilized to analyze complex supply chains.

The primary criticism of EIOLCA is that its higher level of aggregation and more summarized classifications of data are less accurate than the results developed using the bottom up Process LCA.

However, the EIOLCA approach can be used for benchmarking, can be applied to capital goods, services, and overhead such as marketing, etc. which factors are generally ignored by Process LCA.

Hybrid Analysis

Process LCA has the advantage of being specific to the exact product or process being studied, but it has an inherent boundary problem. EIOLCA is able to capture the entirety of a supply-chain; however it lacks specificity because its organization and level of detail of data is dictated by available economic data. To address these issues, LCA researchers have put forth multiple hybrid approaches that combine these methodologies. The aim is an LCA that would be both comprehensive and supply the level of detail possible in a process LCA.

One early example describing the benefits of an integrated hybrid approach to supply chain carbon footprint assessment was proposed by Dr. Suh of University of Minnesota and others. This approach was published in the article "System Boundary Selection in Life-Cycle Inventories Using Hybrid Approaches" by Dr Sagwon Suh, Lenzen, et al. (*Environmental Science and Technology,* 2004). Dr. Suh's hybrid approach is strongly endorsed by other leading universities such as Carnegie Mellon, most recently in the August 2008 issue of "Environmental Science and Technology" [Matthews et al., 2008].

A New Imperative: Enterprise Carbon Accounting

Building on the hybrid approach suggested by leading researchers, and led by Dr. Suh a pioneer in this field, Enterprise Carbon Accounting (ECA) has been developed as a management tool to enable an enterprise to cost effectively measure, manage and track its total carbon emissions. ECA combines a hybrid approach for carbon footprinting and borrows heavily from financial accounting principles. The result is a method that overcomes the limits of both process LCA and EIO/LCA while adding the operational characteristics, flexibility, and familiarity of financial reporting systems.

With an extensible reference database, an ECA system provides business managers a viable platform from which to develop, implement and manage an enterprise wide climate strategy. Importantly, it also establishes a foundation for benchmarking individual products or product lines, for carbon labeling and, on a larger scale, for benchmarking industries.

Case Study: Cisco Systems

In a press release dated June 24, 2008 and titled "Cisco Aims to Reduce Greenhouse Gas Emissions 25% by 2012", the company reported a gross carbon footprint of 724,000 metric tons of CO2e. To arrive at this number, Cisco employed a Process LCA in analyzing their direct emissions, their direct electricity consumption and their business travel.

Not surprisingly, this approach missed a majority of Cisco's impact because the limited scope of the Process LCA *failed to account for 74-83% of the Company's total GHG impact* found primarily in their core product operations.

Using Climate Earth estimates and Carnegie Mellon University's estimates for average total industry emissions, Cisco's 724,000 metric tons reported comprise *only between 17% and 26%* of emissions attributable to Cisco's enterprise carbon footprint from all operations (including materials extraction, material processing, services, logistics, and manufacturing) throughout their value chain.

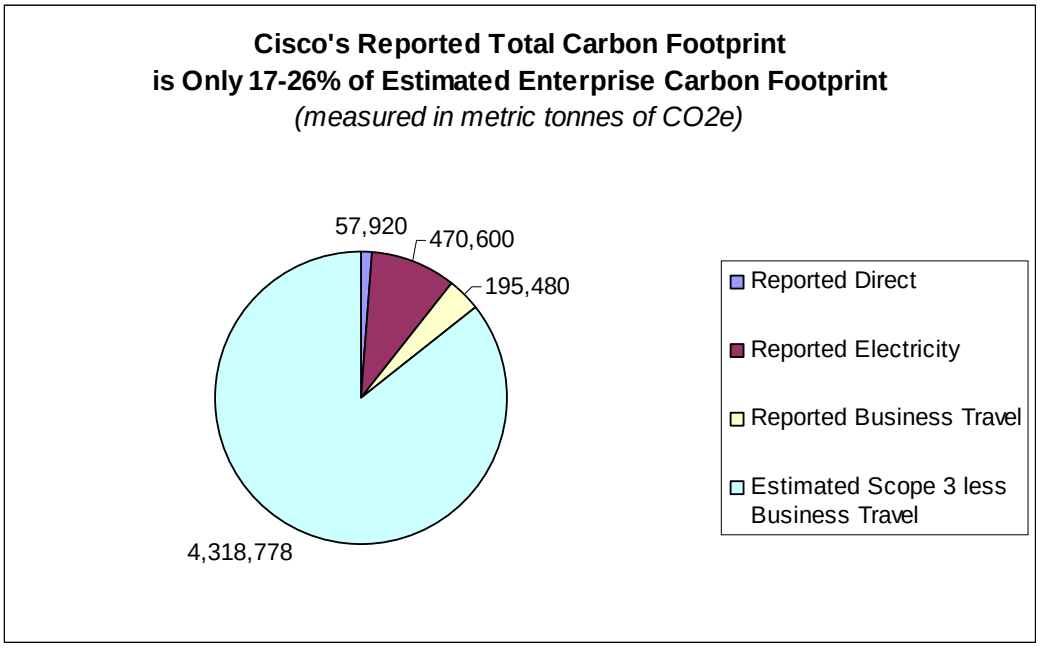


Figure 1: Cisco's Reported Total Carbon Footprint measured in metric tonnes.
Source: Cisco, Climate Earth and Carnegie Mellon University estimates of industry averages

The results of the limited Process LCA gave management a handle on a limited set of emissions leaving out the "levers and dials" which show the carbon impact of their core product operations invisible, and as a consequence, largely unattended.

Cisco's products are the strategic asset of the company, and an analysis that does not include the impact of the materials, manufacturing processes and transportation associated with the core line of business misses the very places where Cisco's impact is greatest and where they could most effectively focus innovation to remain a leader in a carbon constrained economy.

Requirements for Enterprise Carbon Accounting

Any company that wishes to establish a comprehensive climate strategy and measure progress at implementing that strategy must have relevant and reliable information reflecting the carbon usage throughout its business operations and supply chain.

Managers need complete and timely carbon usage information to:

- prioritize and manage potential investments for carbon reduction,
- assess the risks inherent in key contributors to the enterprise carbon footprint,
- assess the current and future carbon costs of working assets.

Enterprise Carbon Accounting (ECA) evolved from traditional LCA methods and leverages financial accounting principles along with hybrid LCA approaches to address the urgent need for a more comprehensive and scalable approach to carbon footprint assessment. ECA can be a rapid and cost effective process for businesses to collect, summarize, and report enterprise and supply chain GHG inventory.

Enterprise Carbon Accounting Supports Enterprise Climate Strategy

An Enterprise Carbon Accounting system provides the information base for planning, execution and monitoring progress of a firm's climate strategy. Whatever the specific strategy, the Enterprise Carbon Accounting system must provide visibility to ensure the strategy can be effectively managed.

A quality ECA system quantifies a firm's carbon usage ensuring that:

- **Targets are specific.** An ECA system enables clear objectives at every level. Objectives may be set at each organizational level to capture progress on tactics such as reducing the carbon footprint of the annual report to more strategic levels such as reducing the carbon footprint of raw material input by a specific amount.
- **Targets are negotiated and practical.** An ECA system provides a clear current status of the enterprise carbon footprint. Having an organization-wide measure enables study, feasibility assessment and negotiation of targets. Such a participatory process yielding quantified goals builds motivation and commitment among internal and external stakeholders.
- **Targets are feedback rich.** An ECA system enables regular periodic progress reporting, scenario planning, and ad-hoc reporting and feedback when needed. All are critical elements of any well executed initiative.
- **Targets enable periodic follow-up.** While rich feedback is important, periodic follow up is critical. Quarterly and annual reviews of financial progress are built into nearly every company culture. Goals that are not part of this periodic process usually move into the background and can often fade away from neglect. Because ECA is derived from the financial process, reports can be generated regularly and ensuring that attention to the firm's climate strategy becomes an integral part of the organization's periodic review process.

Key Characteristics of a Quality ECA System

To meet these business goals, an ECA system must demonstrate the following key characteristics:

- *Comprehensive* - Enterprise Carbon Accounting system must assess the full carbon impact of the enterprise. Service oriented firms make major strategic investments in capital assets, which investments are carefully evaluated from a financial perspective. Such investments must also be evaluated for their climate impact and carbon cost over time. Manufacturing companies manage every phase of their product life cycle and must now include the climate impact of design, manufacturing, marketing, use and reuse of the product portfolio. In sum, an Enterprise Carbon Accounting system must be comprehensive and enable measurement and management of all emissions, direct and indirect. Just as business manages the full financial cost of products and services, in a carbon constrained economy business must also manage the full carbon cost of products and services.

- *Periodic* - An ECA system must enable carbon footprint updates at regular intervals and comparisons across reporting periods. Periodic reporting enables status communication, and measurement of progress and course correction, and is ultimately the basis for rewarding success. Perhaps most important, in an era where computing systems provide real time financial results, carbon accounting should be held to a similar standard for reporting quality and timeliness.

- *Auditable* - An Enterprise Carbon Accounting system must allow for the traceability of transactions and enable independent review for compliance. Practically, because ECA must be applicable for small to large size concerns, auditability requires that the system utilize a data driven, automated approach that is not encumbered by the need for any significant manual intervention.

- *Flexible* - An ECA system must be flexible to allow for the incorporation of a growing base of relevant data. The system must be able to support iterative refinements to the footprint while maintaining the integrity of the audit trail.

- *Standards-Based* - An ECA system must accommodate generally accepted and emerging standards for both carbon accounting (e.g. ISO 14000 and WRI/WBCSD) and greenhouse gas data interchange (Extensible Business Reporting Language (XBRL)).
    - International Standards Organization (ISO) publishes standards for Environmental Management Systems under the ISO 14000 series. Updated standards are being developed. An ECA system must remain consistent with both present ISO standards and future extensions.
    - The World Resource Institute and the World Business Council on Sustainable Development (WRI/WBCSD) have worked together to define a global standard for Green House Gas accounting called the Greenhouse Gas Protocol, which establishes a strong framework for accounting for scope 1 and 2 emissions (http://www.ghgprotocol.org/). Work has now begun on a standard that incorporates product and supply chain GHG accounting and reporting (Scope 3

emissions). An ECA system must conform to this standard which will likely emerge before changes to ISO.

- An ECA system must effectively enable automated communication throughout the supply chain and to external agencies. A potential framework for this function is the open source Extensible Business Reporting Language (XBRL) being developed by a consortium of over 450 organizations (http://www.xbrl.org/Home/). The SEC has posted the text of a proposed rule requiring XBRL reporting of financial data and it is likely this standard may be extended to address carbon reporting.

- *Scalable* – An ECA system must accommodate rapidly changing business and supply chain operations. An enterprise carbon accounting system must easily scale to accommodate data from a complex of globally distributed, multi-sources supply arrangements. The ability of a company to capture carbon data from these complex supply chains is fundamental to being able to lower costs, reduce risks, and increase market share through carbon optimization throughout the supply chain.

- *Efficient* - To be effective, an Enterprise Carbon Accounting system must be efficient. Carbon accounting data must be delivered to key decision makers and throughout the supply chain as quickly and efficiently as is financial data. Carbon data must be available at least at the same times and in the same places as is financial data. Executives responsible for the ongoing viability of any enterprise should not be required to make carbon management a strategic imperative without the availability of easily understandable, timely and relevant data to manage the process.

Technology Required for Enterprise Carbon Accounting

Three fundamental technologies are required for a quality ECA.

- *Environmental Data Base* – The data on which an ECA system is built should be applicable to a broad spectrum of industries and geographic areas, and should be sufficiently scientifically validated. This includes databases such as the Comprehensive Environmental Data Archive (CEDA), which is a premier example of such peer-reviewed and vetted datasets.

- *Integrated Hybrid Approach to Life Cycle Analysis* – An ECA should engender a hybrid analysis approach to mitigate the faults of both the Process LCA and the EIO LCA approaches.

- *Mature Software Technology* – An ECA should take advantage of software technology to extract, transform and tag financial transactions. Such software approaches are mature and well established. The rapid growth of data warehousing and analytics in the 1990s has made these processes readily understood and easy to deploy. Data warehousing and analytics have also produced tools that simplify and commoditize data reporting and visualization.

Conclusions

In summary, in the same way that financial accounting enables financial planning, a quality ECA system enables managers to make informed strategic decisions, establish direction, monitor progress, and report to internal and external stakeholders the periodic results and the carbon performance of the firm. As a quality ECA system becomes an integral part of business management and reporting, its conscientious use enables businesses to compete and thrive in an increasingly carbon constrained economy.

Commercially Available ECA Alternatives

A quality Enterprise Carbon Accounting system is now available from Climate Earth (CE). Climate Earth's ECA system demonstrates all the characteristics of a quality ECA outlined above. The CE solution is based on the CEDA database and hybrid process as developed by Dr. Sangwon Suh who is Professor of Bioproducts/Biosystems Engineering at University of Minnesota and also Chief Scientist for Climate Earth. CE is led by Mr. Chris Erickson who, with more than 25 years of executive management experience, is best known for bringing game changing technology to the enterprise market. The Climate Earth team is balanced with equal emphasis on the executive management, technical and scientific expertise needed to help clients quickly and easily understand, integrate and efficiently deploy their ECA solution. Currently the Climate Earth ECA solution is available to any manufacturing or service enterprise.

Benefits of Implementation

The implementation of a quality ECA system provides many benefits such that companies that chose to deploy ECA immediately will have significant competitive and operational advantages. These companies will:

- Be market leaders in building, deploying and managing a well considered comprehensive climate strategy,
- Increase revenue, reduce cost and strengthen their brand in the consumer and commercial marketplaces,
- Develop critical expertise and the culture to compete effectively in an increasingly carbon constrained economy,
- Gain advantage by encouraging and promoting ECA standards,
- Be part of a great future for the planet and the economy.

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