



# **12 steps to a greener, more sustainable electronics supply chain.**

*Global Electronics Industry*

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**Defining a green supply chain strategy**

Universal awareness of global warming has electronics companies thinking about how they can minimize the impact of their operations on the environment. It's not just about altruism. Like consumers in general, electronics customers are rewarding companies that can provide high-quality products with proven green credentials. Plus, emerging regulatory and tax environments, such as the European cap-and-trade program, have encouraged heavy trading in carbon as a commodity. As the price goes up and the number of carbon permits declines, it's changing the way that companies view their operations and supply chains and how customers feel about using their products.

Based on its own experience, research and work with clients, IBM has reached the conclusion that a greener supply chain is, fundamentally, a leaner supply chain. This executive brief highlights 12 different actions IBM is helping companies take to simplify the process of defining and implementing their green supply chain strategies.

**Carbon reduction: the new variable in supply chain decision making**

IBM defines green supply chain management as the art and the science of designing a supply chain that accounts for and optimizes the carbon footprint as a variable in operational decisions. This means that you can approach the challenge of achieving a green supply chain much as you would inventory or cost reduction—that is, with two principles in mind:

- *View carbon reduction as simply another decision variable in your supply chain.*
- *Identify the sources of carbon and reduce or eliminate them.*

Consider the typical electronics supply chain. It has five tiers—raw materials suppliers, component manufacturers, assembly operations, distribution companies and retailers serving end customers. Reducing the overall carbon footprint requires looking at each of these tiers, identifying the entities within them, assessing the carbon they are generating and determining what actions are required to help take carbon out of the network.

*Five out of six CEOs no longer agree with the late Nobel Prize-winning economist Milton Friedman's view that the sole purpose of business is to increase profits. IBM's annual CEO surveys found that corporate social responsibility is climbing higher on corporate agendas, with an increasing focus on such external forces as environmental issues, socioeconomic factors and people skills. In fact, the percentage of CEOs citing environmental issues as an external force affecting their organizations doubled between 2004 and 2008.<sup>1</sup>*

*BMW Group is one of the pioneers in developing a recycling norm—a set of guidelines for the R&D department to use in creating products that are easier to recycle. Using advanced tools such as software that allows virtual dismantling analysis during the development phase, the company designs its cars to ensure optimal recovery of key components for recycling and reuse.*

Regardless of how many tiers a supply chain has, the basic steps are transformation and transportation. At each step, there is carbon generation. Figuring out ways to make plants and distribution sites more energy efficient and to decrease distance in your transportation network can help you achieve two goals—a leaner, more cost-effective supply chain and a reduced carbon footprint.

### **Step 1: Redesign the product**

One of the first things your company might want to consider is redesigning the product itself to have a smaller impact on the environment and consume less energy in manufacturing, distribution or use. Simple changes can have big implications. For example, what kinds of components go into the product? Where do they come from? How toxic are they? How long does the battery last? Can used products be disassembled without destroying components—allowing those components to be recycled or reused?

Every conceivable change is an opportunity—from reducing the weight of the product to making it easier to take apart. In some cases, innovation or new technologies may make it possible for you to eliminate components or subcomponents entirely, thereby eliminating a portion of the supply chain.

### **Step 2: Reconfigure manufacturing**

There are many ways to reduce carbon in your manufacturing plant. A closer look at the power source is an excellent start. For example, two plants that consume the same amount of energy may have completely different carbon footprints. That's because one uses hydro-generated electricity while the other operates with coal-generated electricity.

As early as 2000, IBM initiated an intensive water and energy savings program at its Burlington, Vermont, semiconductor facility. In the seven years since the program began, IBM has reduced fuel consumption 21 percent and electricity consumption 14 percent despite increasing output. The company has also managed to reduce fresh water consumption by 27 percent, further saving energy and reducing the plant's environmental impact.

Looking beyond the source of energy, there are ample opportunities to reduce consumption. How is water consumed as a resource throughout the production stages? How efficient are your plant layout and production plans? How much inventory is produced in excess of what's needed? Streamlining production steps and reducing toxic materials and harmful emissions can each have a significant impact on how green your supply chain is.

### Step 3: Shift to green suppliers

Moving beyond the four walls of the plant, you can take a fresh look at your supplier base to begin reducing the overall supply chain footprint. Are there suppliers that use more energy-efficient processes and less toxic material? Although they may have higher manufacturing costs, suppliers with greener practices can help reduce the environmental impact of bringing products to market. An analysis of suppliers may uncover potential benefits that justify making a change.

For example, figure 1 presents findings of the Intergovernmental Panel on Climate Change (IPCC) on the tradeoffs of different sourcing strategies for steel.<sup>2</sup> Based on the overall carbon footprint for each of the three sourcing options shown, it is clear that North America is the best choice.

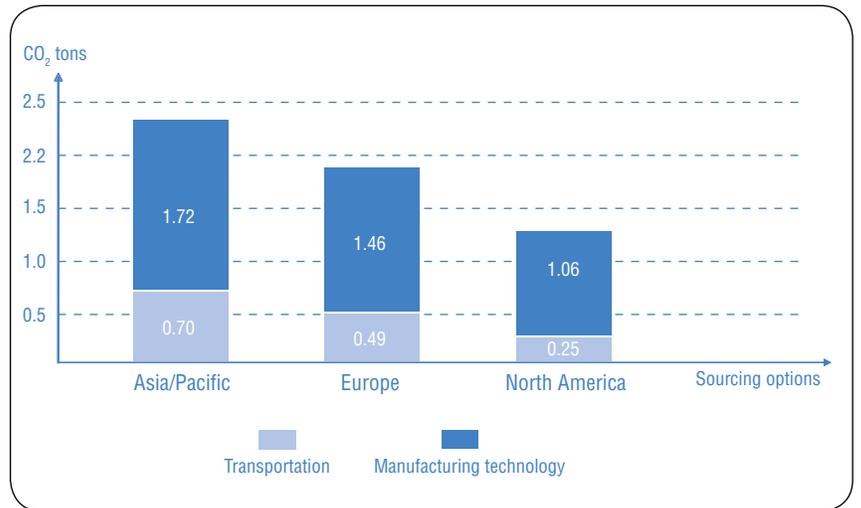


Figure 1: In the above illustrative scenario, the number of tons of carbon dioxide emitted per ton of the same processed steel varies by provider.

Analysis of suppliers should include logistics providers. For example, IBM is a member of the U.S. Environmental Protection Agency (EPA) SmartWay program, which encourages companies to allocate a certain percentage of their transportation requirements to environmentally responsible carriers that use trucks that run on biofuels. By shifting some transport to SmartWay-certified carriers, IBM was able to realize an immediate reduction in its supply chain carbon footprint.

**Step 4: Shorten distances**

Electronics supply chains have grown globally over decades. Many companies have evolved highly complex, extended distribution networks—sourcing components from distant countries and delivering end products to customers around the world.

Now, with the price of oil going up, some products are becoming more expensive to import than to build locally. The cost of transporting finished goods from overseas manufacturing sites may offset the savings realized from outsourcing. In addition, the carbon emissions associated with production in countries that are not as environmentally conscious will probably be factored into the importer cost basis as well as eventually affecting the air we all breathe. So not only can reevaluating your sourcing strategies reduce costs, but it's also the right thing to do.

*“As OECD countries impose large and growing economic costs on their own carbon emitters, their tolerance for those economies who impose no costs on their own emissions will quickly fade. Imports from countries that do not play by the same carbon standards will be subject to a carbon tariff that will countervail the implicit trade subsidy that they derive from what goes up their smokestacks. . . . And for many energy-intensive industries that joined the exodus to the cheap labour markets of East Asia, imposing a carbon tariff means coming home.”<sup>3</sup>*

—Jeffrey Rubin, chief economist,  
CIBC World Markets

Where once companies looked for the least production cost despite the transportation cost, the new, green value equation for evaluating sourcing options is actual cost (production + transportation) + corresponding carbon cost.

By rationalizing sourcing, assembly and delivery channels in relation to markets, you can reduce the distances that products must travel. How many transportation lanes do you have? Where do your products travel from and to? There are many ways to reconfigure your network to reduce the distances traveled to fulfill demand while maintaining the required service levels. For some products, simply locating or developing local suppliers can significantly reduce energy use.

#### **Step 5: Alter service level agreements**

Service level agreements (SLAs) that force suppliers to make small, expedited deliveries waste energy. When such SLAs aren't driven by valid business needs, you have opportunities to save.

Not infrequently, companies create SLAs that reflect lack of confidence in their suppliers' ability to deliver shipments on time. As a result, they end up with agreements that are unreasonably stringent and often require excessive dependence on air freight. Transporting products by air is much more harmful to the environment than land- and sea-based alternatives, especially when shipments are fragmented and expedited.

By revisiting your SLAs, you can uncover ways to consolidate shipments. And it may be possible to reduce the use of air freight by better leveraging ships, rail cars or trucks.

*In 2006, a North American retail giant began a global initiative to measure suppliers on the elimination of unnecessary packaging to reduce waste and improve logistics efficiency. The goal is to prevent hundreds of thousands of metric tons of carbon from entering the atmosphere and save billions of dollars within 5 years.<sup>4</sup>*

**Step 6: Shrink packaging**

Large packages take more energy to produce. And the larger the package, the less shipment consolidation is possible.

Fortunately, new packaging materials and designs make smaller package volumes possible while providing the same level of strength and product protection. By reengineering packages to reduce their size and weight, you're able to load additional products into shipping containers or trucks and deliver more in a single trip. Improved package designs can also help reduce the burden of recycling or eliminating packaging materials at the end of the chain.

**Step 7: Plan for reverse supply chain activity**

Product recalls, upgrades and refurbishments require some kind of reverse supply chain. In addition, when products are at the end of their useful life, it makes business sense to recover them for disassembly and component reuse. It also makes sense from an environmental perspective because electronics products, in many cases, include toxic materials that must be disposed of properly. Planning for these events up front can help you eliminate or reduce unacceptably high energy costs and environmental impact later. How products are designed, assembled, labeled and packaged can have a profound effect on the efficiency of any reverse supply chain.

Reverse logistics is an area where IBM's history and legacy can be of particular benefit to clients. For most of this history, companies didn't buy mainframes from IBM. They leased time on the mainframe or leased the computer itself. Eventually, all equipment came back to IBM. As a result of its leading-edge experience in this area, IBM has a deep understanding of how to effectively design products for reuse and recycling.

**Step 8: Consolidate shipments**

Reviewing past shipment history can reveal areas where lack of coordination, both internally and with suppliers, has resulted in fragmentation. What started out as a few expedited deliveries may have evolved into inefficient, point-to-point shipments.

With a holistic view of the supply chain and proper planning, it's possible to replace multiple, smaller shipments with fewer, larger shipments. By consolidating loads, you reduce the number of vehicles needed to transport the same quantity of goods. This simple idea requires careful analysis to determine which suppliers to use, where to locate facilities and what inventory levels to maintain.

**Step 9: Plan shorter routes**

As a corollary to consolidating shipments, you can also plan shorter routes. There's an art to planning distribution routes and choosing the right transportation modes. Relying on intuition seldom leads to optimal solutions, and over time tradition and inertia can allow routes to settle into patterns that are inefficient and wasteful. Factoring in the true costs and carbon implications can lead to more rational choices.

For example, if you have numerous trucks coming from various suppliers, you can look for ways to reduce the total distance traveled to source the components you use in production and assembly. Perhaps the most extreme example is UPS figuring out which turn—right or left—requires less gasoline and less waiting time in traffic. But most companies with a good supply chain optimization and logistics system can actually find ways to significantly shorten their logistics routes.

*A Fortune 50 manufacturing company requested help from IBM to model and provide reduction scenarios for the carbon footprint of one of its manufacturing divisions, given the very large number of components that were coming in for assembly. By leveraging advanced analytics from a proprietary IBM solution, the company was able to incorporate carbon emissions calculations into planning its logistics operations, uncovering ways to reduce its transportation carbon footprint by up to 25 percent.*

### **Step 10: Coordinate with partners**

Although you can make initial progress on your own, you soon will need to integrate your efforts with suppliers and distributors. Virtually every electronics supply chain today is a multiechelon supply chain. To the extent that you can coordinate with your partners to have centralized points of consolidation, shared logistics activities and shared manufacturing and supply-based locations, you can significantly reduce the total carbon footprint of your manufacturing and distribution processes. You must be prepared to share your goals and plans with these allies and incorporate their plans and priorities into your solutions.

Unlike inventory management, where companies can push inventory upstream to improve their numbers, effective management of carbon emissions allows no such tradeoff. If suppliers are pushed into producing extra inventory to help sustain production at a certain level, there is no reduction in the carbon footprint of the supply chain. And if the suppliers are unable or unwilling to adopt green practices, the result may even be greater environmental degradation. Therefore, you need to coordinate with partners to make sure that the supply chain is as lean as possible—producing the least amount of inventory required to meet demand.

### **Step 11: Take a lifecycle view**

Just as you are thinking about the carbon cost of manufacturing your products, your company should also be educating customers about carbon consumption over the lifecycle of those products. Energy used while a product is in service can be significant, as can the costs to recycle, reuse or refurbish it.

In fact, the carbon consumed in the lifecycle of an electronics product may be far greater than the carbon consumed in manufacturing and getting it to market, including all of the logistics involved. We're used to thinking about how much carbon is used in transformation and transportation. But once a product gets into the hands of customers, it may often consume many times that amount of carbon in electricity or batteries, accessories, service calls, training manuals and other support. It's important to think about the entire product lifecycle and educate customers about greener products that may have a higher up-front cost, but a substantially lower long-term cost.

The IBM supply chain management (SCM) Carbon Distribution Modeler helps organizations take the total product lifecycle view in analyzing the carbon footprint (see figure 2). The objective is to lower the environmental impact at all five stages of the cycle—design and sourcing, inbound logistics, internal operations, outbound logistics, and service and use.

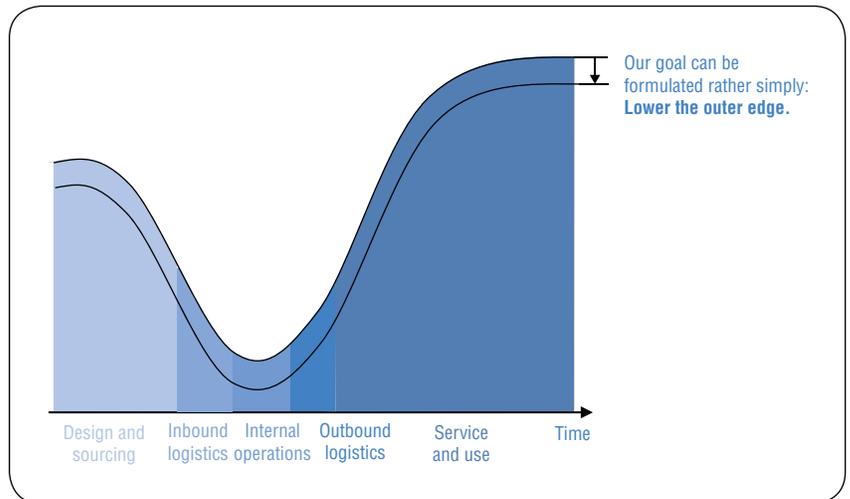


Figure 2: The objective of the IBM SCM Carbon Distribution Modeler is to lower the carbon footprint across the total product lifecycle.

For example, assuming a car travels an average of 12,000 miles per year for three years, at 30-miles-per-gallon efficiency, it can emit between three and four tons of carbon annually. When added to the nearly 19 tons of carbon emitted as part of the supply chain process, that means the car has a carbon footprint of close to 23 tons, which does not even take into consideration the environmental cost of recovery and recycling or disposal.

## **12. Start now**

Finally, it's important to start now on defining and implementing your green supply chain strategy. Although the ideas presented in this paper for reducing your carbon footprint are fairly straightforward, implementing them takes time. In the electronics industry, it can take up to three years to redesign products and qualify new suppliers. With the price of energy expected to rise substantially, along with the level of regulatory requirements aimed at reducing carbon footprints, two to three years from now may be too late to make these transformations. Or it may be much more expensive. The cost of making rapid adjustments in the future may be much higher than the cost of making simple adjustments today.

### **Easing the transformation**

As demonstrated by the number of ideas presented in this brief, there's no one answer for defining an effective green supply chain strategy. By leveraging innovations from its research division and proven best practices from its internal supply chain group, IBM is well positioned to help you with the transformation.

IBM has invested heavily in the research, methodologies, tools and technologies required for building a greener supply chain. It has consolidated these assets into an approach that takes an inside-out view of how the supply chain functions and where there opportunities exist to optimize processes with a reduced carbon footprint in mind.

This approach starts within the four walls of the plant—looking for ways to make your processes more efficient and less carbon-intensive. IBM has designed and validated a tool internally called the IBM Green Sigma Dashboard, which uses the principles of Six Sigma business management strategy—but from a different perspective. That perspective is the voice of the environment—instead of the voice of the customer. Using the Green Sigma Dashboard, companies can more easily monitor and control energy consumption and take corrective action when performance falls outside defined parameters.



Moving outward from the plant, the focus turns to what's coming in and what's going out. The Carbon Tradeoff Modeler from IBM can help you identify and analyze the inflows and outflows of particular sites to uncover opportunities for consolidating shipments, changing transportation lanes and taking other steps to reduce overall distances traveled.

Finally, the IBM approach moves to analysis of the entire network. IBM Supply-chain Network Optimization Workbench and IBM Warehouse Site Planner software can help companies reconfigure their distribution network for a smaller carbon footprint.

These are just a few examples of the kinds of resources IBM has available to assist you in defining a green supply chain strategy that sustains the desired level of customer service at reduced cost to your company and to the environment. The IBM approach helps you decide which opportunities deserve investment now and which can wait—initially focusing on the opportunities you control and then looking outward to opportunities you can share with your partners upstream and down.

#### **For more information**

To learn about how IBM can help you define a green supply chain strategy, visit:

[ibm.com/electronics/green](http://ibm.com/electronics/green)

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1 IBM CEO Study 2008.

2 Modified based on a graphic included in an Intergovernmental Panel on Climate Change report, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

3 CIBC World Markets, Inc., "Coming Home," Jeffrey Rubin, *StrategEcon*, March 27, 2008.

4 Mindy Fetterman, "Wal-Mart grows 'green' strategies," *USA Today*, September 25, 2006.