THE SUPPLY CHAIN DIGEST LETTER

This Month: The Green Supply Chain

inside

Green Supply Chain – Opportunities & Challenges

The "Green Supply Chain" and Sustainability have clearly become powerful and permanent forces driving overall business and supply chain decisions.

Carbon emissions reporting… executive-level positions in charge of Sustainability…myriad strategies to reduce energy use and costs…previously mundane areas such as product packaging suddenly getting significant attention.

However, we are very early in the game. The reality is that to this point there really has been a lot more talk than action. A recent McKinsey study, for example, found just 23 percent of companies said they always or frequently took climate change into consideration when making procurement and supply chain decisions. *(See graphic on page 4).*

Clearly a lot of the fervor was driven as much by cost as it was Sustainability principles per se, as oil prices soared for several years; some interest clearly waned as oil and energy prices swooned with a recession that left little room for experiments or risks. Now, oil appears to be heading back up – and with it likely Green interest.

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Understanding Cap & Trade and Carbon Taxes

On almost a daily basis, we hear reference to the potential for "cap and trade" legislation with regard to carbon emissions. Less prominent but also common is the topic of a "carbon tax."

Most of us understand either of these regulatory changes would have a profound impact on energy policy and consumption, and dramatically impact the economics of current and future supply chain decisions.

But does anyone well understand what these two largely competing approaches to carbon emissions really mean, and how they will likely work?

In this print version of the *SCDigest Letter*, we only have room for a relatively brief summary of these two approaches to climate change legislation and what they might

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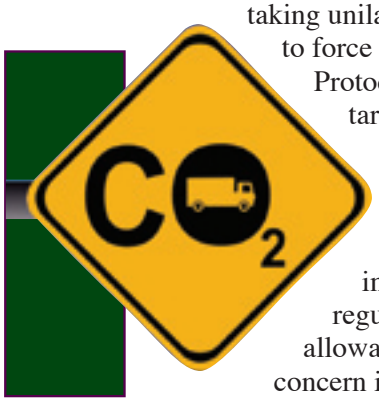
Green Supply Chain Thought Leaders Discussion - The Impact of Sustainability on Supply Chain Network Design

Supply Chain Digest's Dan Gilmore recently spoke with Dr. David Simchi-Levi of MIT and an IBM Contractor, to discuss the impact of Sustainability on supply chain network design.

Gilmore: How big an impact do you think carbon emissions concerns will ultimately have on supply chain network design?

Simchi-Levi: The focus on Green logistics is driven by three factors. First, sustainability has moved to the heart of business with green logistics playing an important role. Second, governments are increasingly taking unilateral legislative steps to force compliance. The Kyoto Protocol has set loose national targets but the European Union's Emissions Trading Scheme – EU ETS – has taken the lead, mostly in Europe, in strongly regulating emissions allowances. Finally, consumer concern is starting to translate into a real need for new products and services. This stakeholder pressure is not just being felt from consumers, but also employees, partners and governments who are demanding that business take tangible steps towards becoming more "Green." Such pressures are pushing the issue of carbon footprint up the business agenda.



However, logistics is a large and growing emitter of carbon dioxide. It contributes about 5.5 percent of the total greenhouse gas emissions generated by human activities, with transportation being responsible for 89 percent and the rest attributed to warehouses and distribution facilities. Within the transportation sector, road freight is responsible for more than half of the carbon dioxide emitted by the transportation sector, ocean is responsible for 20 percent, with rail and air for the rest. Of course, different modes of transportation have different emission efficiency. For example, truck carriage generates about six times the carbon emissions of rail to move the same level of freight.

Given this data, it is not surprising that significant opportunities exist to reduce carbon footprint across the entire supply chain, from raw materials through manufacturing all the way to distribution and home delivery. These opportunities involve changing the structure of the logistics network; more efficient recycling strategies; and government regulations and incentives. So in short, reducing carbon emission will require significant changes to the structure of the logistics network.

Gilmore: Are you seeing it now, even before cap and trade or a carbon tax?

Simchi-Levi: Yes! In particular, in Europe, where the Kyoto agreement provides financial incentives (through cap and trade) to companies to reduce carbon footprint. But this is not only the case in EU; we have customers which have applied IBM ILOG LogicNet Plus (our network design tool) to find the right trade-off between cost, service and carbon emission both in the US and globally. For example, Fonterra, a large Australian dairy cooperative, has made carbon emissions an important part of its supply chain network design.

Gilmore: What happens when we get either of the above? Does it matter which one we get?

Simchi-Levi: There is a big difference between the two and it does matter which one is implemented. The advantage of cap and trade is that it measures carbon at the aggregate level and it does not care which company reduced carbon emission as long as the total (aggregate level) achieves the desired impact.

The disadvantage of cap and trade is that carbon permit price is determined by the market and so decision makers face significant levels of uncertainty when they make decisions on whether to reduce carbon footprint below the cap and trade in the market or whether to violate the cap and purchase permits. The second problem with cap and trade is that implementation is difficult. For example, the government needs to decide how to initially allocate the permits and it may generate (unintentionally) an incentive to some companies with an initial allocation of permits to trade their permits and realize significant profit. They can do this without producing anything, benefiting from market price, rather than productive activities.

These problems do not exist when a carbon tax is implemented. This is true since tax rates will be known in advance and there is nothing that companies can sell in the market to generate windfall profit.

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Unfortunately a carbon tax does not look at the aggregate level of emissions and hence does not take advantage of situations when some companies reduce carbon footprint significantly and hence perhaps others do not need to do the same.

Gilmore: How will network design tools such as that offered by IBM really factor this into the optimization models?

Simchi-Levi: The idea is straight forward. We incorporate information on carbon emission associated with every supply chain activity and take carbon footprint into account either as a constraint, or as part of the objective function. In short it allows the optimizer to identify the trade-off between cost, service and carbon footprint, and look at various scenarios in terms of different network options.

Gilmore: Isn't accurately measuring/estimating carbon emissions going to be a real challenge? What can be done?

Simchi-Levi: This is true. In the EU, where the Kyoto agreement has been implemented, companies reducing carbon footprint go through an audit to verify their claims. At IBM, we have developed a substantial carbon emissions database that provides information on carbon emission by such areas as carbon emissions by fuel type, average fuel efficiency values, carbon-freight factors for waterborne and rail, and electricity emissions factors by US state, and country. This is important since carbon emission per kilowatt hour is different from state to state due to different power generation technology such as grid electricity, natural gas, diesel, petrol, coal, etc.

Also, we include electricity consumption by building characteristics including building size, geographic region, number of workers, principal activity, year constructed, etc.

Gilmore: Do you have any sense yet as to how big a change this will make in the optimal networks for some companies? Would it possibly promote nearshoring, for example, or more production outsourcing? More or fewer DCs?

Simchi-Levi: This can make a big impact, much like the impact that high oil price has on the network. The tighter the cap on carbon emission, (1) the more DCs you need (to reduce outbound transportation costs); (2) the more emphasis on efficient packaging to reduce transportation; (3) the more move from air to sea and from truck to rail (since these two modes are more efficient from a carbon footprint point of view). SCD

IBM ILOG Transportation Analyst is a strategic transportation routing solution that lets you quickly analyze many different strategies so you can promptly determine the best way to deliver products and utilize your transportation assets; manage your vehicle shipment assignments; determine your company's pickup and delivery sequencing, and minimize costs while adhering to business constraints – and now can consider carbon emissions and other Green supply chain issues in its network optimization models.

Key Customers:

This application is commonly used by supply chain planning analysts at CPG and Retail companies; 3rd Party Logistics planners; and Logistics Consultants.

Web Site and Contact Information:

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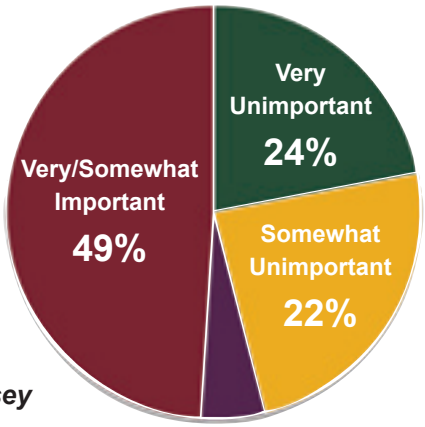
Featured Collateral

- Case Study: Combining Transportation Planning with Network Design to Reduce Transportation Costs
- Transportation Analyst Solution Overview
- Inventory Analyst Solution Overview
- LogicNet Plus XE Solution Overview

Available at the IBM ILOG corporate web site or www.thegreensupplychain.com

Green Supply Chain still Modest Influence in Supply Chain Decisions

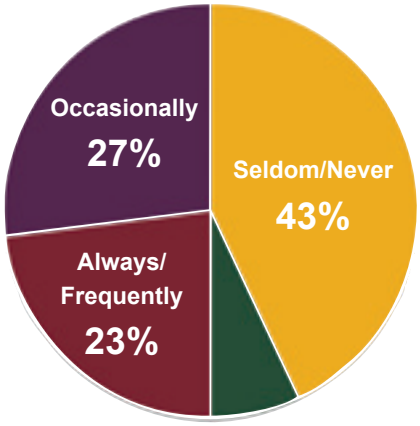
How Important is it for You to Consider Climate Change Issues in Purchasing & Supply Chain?



5% Don't know

Source: McKinsey Study of 2000+ Executives, 2008

How Often does your Company Currently Consider Climate Change Issues in Purchasing & Supply Chain Decisions?



7% Don't know

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Whether or not the Green Supply Chain becomes an overwhelming force that becomes central to virtually all supply chain management processes, it is clear that the world has changed, and that Sustainability will be another important factor in the myriad trade-offs companies need to manage in their supply chain decisions. It will also add interesting new wrinkles in the concept of "continuous improvement."

Impact on Supply Chain

Already, Green thinking is having a substantial impact across many supply chains – and that is before, at least in the US, there is any formal cost for CO2 emissions, as would be the case under either a "cap and trade" or carbon tax program. *(See Understanding Cap and Trade, Carbon Taxes, page 1).*

As noted above, the concept of the Green Supply Chain is tightly wrapped up with rising energy costs – fortunately making most Green Supply Chain efforts that also impact fuel and energy usage a "win-win" for the environment and the bottom line.

Below, we look at the many areas in which supply chain will be impacted by the growing Green movement, also summarized in the table on pages 6-7.

Supply Chain Network Design: We explore this issue in detail in our Thought Leaders interview with Dr. David-Simchi Levi of MIT/IBM on page 2, but at a high level the issues should be obvious. Rising fuel costs and volatility were already key factors in many network design projects. Kimberly-Clark, for example, was able to take out millions of truck miles per year as a result of its recent "supply chain network of the future" program. Many companies now perform network scenario planning across a wide range of potential future fuel costs. Increasingly, carbon emissions will also now factor into those calculations. Even before a formal cap and trade or carbon tax regime, companies need to plan today based on what is likely to happen down the road – adding a whole new variable that needs to be modeled in network design analyses.

Building/Facility Design: Factories and distribution centers are increasingly being developed with sustainability in mind. Again, part of this is simply common sense energy efficiency that provides a solid ROI whether there are Green considerations or not. But again, given the potential for cap and trade type legislation, the benefit from designing Green buildings today may be even greater down the road.

Though it has critics who argue that the requirements should be even tougher, the Leadership in Energy and Environmental Design (LEED) building standards and certifications are becoming increasingly prominent "must haves" in building design.

Meanwhile, in Europe, Procter & Gamble built a distribution center powered totally by alternative energy. Expect to see a lot more of that type of approach to facility construction.

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Customer Requirements: "Channel masters" are increasingly demanding Greener products. Here, of course, Wal-Mart led the way, with a massive program to reduce energy costs and increased Sustainability from its own supply chain, dragging its supply base along with it. That includes developing Green scorecards for its thousands of suppliers.

Food manufacturer Nestle is one of those suppliers that saw the added benefit of helping meet Wal-Mart's goals when it implemented new technology to help it achieve greater density utilization of its trailers, noting both reduced transportation costs and a more eco-friendly logistics initiative.

HP recently began reporting on the CO2 emissions of its supply base, and many other companies are as well, using such tools as those available from the Carbon Disclosure Project. While these are largely "voluntary" efforts for now, it is likely that they will be more prescriptive down the road.

Consumer Preference: Will consumers really choose the Green product over a less Green one? Especially if the Green product costs more? So far, the evidence is decidedly mixed, just as various "Buy American" programs languished when consumers voted with their wallets not their nationalism.

Still, Green may yet be an important driving force in consumer spend, with retailers such as Wal-Mart and Home Depot already featuring and clearly identifying "Green" products on their shelves.

Packaging: Suddenly, packaging is a hot topic, and packaging engineers are increasingly in demand. It is clear that there has been a tremendous amount of "waste" in much product packaging designs; now, the goal is "de-materialization."

Part of the benefits from those efforts is to reduce packaging materials and related direct packaging costs themselves, as well as the resulting waste stream.

Often, an even more important driver is transportation efficiency. Much more of the same base product packaged in a smaller or different footprint might be loaded into a given trailer for delivery, reducing the total amount of transport needed.

For example, a new, rectangular milk carton is in use at retailers such as Costco and Sam's Club. By enabling milk cartons to be palletized for the first time, twice as many gallon cartons can now be loaded onto trailers than was true with the traditional package design. The retailers are using some of this efficiency to reduce the price of milk in those cartons by as much as 20 cents, creating a win-win-win for producers, retailers and consumers.

There are also clear trends towards more "concentrated" products (e.g., laundry detergent) and a greater utilization of re-useable containers to move product.

Reverse Logistics: Long an area many supply chain pundits thought was deserving of greater attention, Green supply chain thinking is now finally bringing reverse logistics to the forefront.

In some cases, the driver is regulatory, as companies operating in Europe already understand with the rules there strictly regulating electronic product recycling (e.g., RoHS and WEEE). These laws are already being emulated in some ways by a handful of states in the US, and we can expect many other such state or federal requirements here soon.

The drivers of Green thinking in reverse logistics will be many: regulatory requirements, waste stream reduction, revenue capture from waste through recycling, reduction in carbon emissions and energy use through eliminating need for some reverse logistics transport and handling requirements, and mitigation of risk from environmental

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"It is clear that there has been a tremendous amount of "waste" in much product packaging designs; now, the goal is "de-materialization."

(Continued from Page 5): Green... Opportunities and Challenges

Green Can Dramatically Impact

Supply Chain Area	Impact or Opportunity	Comments
Supply Chain Network Design	Energy prices/planning already a key factor for many; now CO2 emissions may be another variable that needs to be modeled	If cap and trade and/or carbon taxes become law, these costs absolutely must be included in network optimization studies
Building Design	From overall energy consumption to use of solar panels and other alternative energy sources, design of manufacturing and distribution facilities will increasingly be developed with Sustainability in mind	Leadership in Energy and Environmental Design (LEED) certification becoming increasingly common (though LEED is not without its critics); Procter & Gamble builds distribution center powered totally by alternative energy
Customer Requirements	Sustainability an increasing factor in preference/requirements of many B2B customers	Wal-Mart, others developing Green Supplier Scorecards; HP and others collecting supplier CO2 emissions data
Customer Preference	Jury still out, but some believe consumers will increasingly choose more environmentally-friendly products	Wal-Mart, Home Depot among retailers featuring and identifying Green products on their shelves
Packaging	Packaging improvements/reduction turn out to be key opportunities for virtually every product	New rectangular milk cartons double trailer capacity; laundry detergent gets concentrated; "De-Materializing," re-usable containers, etc.
Reverse Logistics	Finally more attention on this often discussed, but still under-emphasized set of processes	Removing physical waste from the supply chain; recycling for profit; European style regulations for electronics (RoHS) end of life likely in U.S. soon
Transportation Management	Saving miles also saves CO2; Green has and will be a boon for transportation management technology	Kimberly Clark saves millions of miles with new network design; TMS, "telematics," trailer utilization and more technology tools

Virtually Every Area of the Supply Chain

Supply Chain Area	Impact or Opportunity	Comments
Collaboration	Reducing deadhead miles through load linking, multi-party loads	Maybe Green will drive collaboration where cost savings and capacity crunches have not succeeded well in the past
Sourcing	"Sustainability" now added to socially responsible sourcing practices; tough decisions between cost and Green-ness	Potential for "Carbon Tariff" on imported goods would dramatically change sourcing landscape
Technology	"Green" becomes additional ROI driver for TMS, routing and scheduling, telematics, etc.; Need for "carbon calculator" tools	Tracking carbon emissions will become increasingly important, and many new tools coming to market to address the issue; accounting systems will need to change
Laws and Regulations	Beyond cap and trade/carbon taxes, many other areas also likely to be impacted	We may see federal policies that favor rail transport; possible changes to permit heavy trailers and/or more "doubles"; Austria now mandates much freight move cross country in rail only, no trucks
Company Valuation	Will real/perceived Sustainability practices impact stock price/ shareholder value?	Carbon Disclosure Project in part uses pressure from investment bankers to drive corp. participation; new financial tool calculates company's stock "beta" based on its fossil fuel price exposure
Organizational	Where does the role of Sustainability fit within the organization chart?	An increasing number of companies have formal positions for managing Sustainability - sometimes at the executive level. Is this role one that belongs in the supply chain? If not, how will Sustainability and supply chain goals be harmonized?

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problems that might arise from product end-of-life management.

Transportation Management: Transportation is in a real sense the "epicenter" of the Green supply chain. When fuel prices rose dramatically in 2007-08, they delivered a tremendous hit to the bottom lines of many companies. As a result, it's no surprise companies are now looking to improve transportation processes and technology to reduce miles driven and trucks required by themselves or their carriers.

In addition to direct cost factors related to fuel, direct or indirect transportation operations will likely be the biggest single source of greenhouse gas emissions for many companies.

Some U.S. politicians have called for a "carbon tariff" - a duty on imports based in some way on an offshore supplier's carbon efficiency and/or the product carbon content.

Transportation Management was already moving much higher up the corporate food chain in recent years due to a better understanding of its role in overall supply chain excellence and then the rising cost of transport; add to that carbon emissions, and it's clear Green and transportation management are permanently joined at the hip.

Collaboration: The vision of collaborative transportation has been around for nearly two decades. Most estimates place the number of "deadhead miles" in the US trucking system at about 20 percent – offering a truly rare "win-win" opportunity for shippers and carriers.

Nevertheless, the basic value proposition for more collaborative transportation has to date not been enough to really drive high levels of such activity, which would include "load linking" and ultimately even multiple companies, including competitors, sharing delivery on the same truck. Why, some ask, should five different beer distributors all make delivery stops to the same restaurant, when one truck could deliver the products for each of them?

Will Green supply chain imperatives finally serve as the catalyst to get transportation collaboration off the ground this time? Just maybe, as there are a growing number of informal collaborative relationships being formed, (e.g., companies with complementary shipping lanes), the numbers of which could dramatically expand under cap and trade or other scenarios.

Sourcing: Green factors will be increasingly important in sourcing decisions, as companies such as Wal-Mart are already demonstrating. In a sense, we expect to see much of the same issues and policies that many companies have gone through with other areas of "social responsibility" (e.g., working conditions, child labor, etc.) now applied to Green sourcing.

This may be especially true in sourcing from low cost countries that may be further behind the Sustainability curve than Western nations. China, for example, is often saying the "right things" with regard to Sustainability, but whether there is real action yet is still unclear.

Some US politicians have called for a "carbon tariff" – a duty on imports based in some way on an offshore supplier's carbon efficiency and/or the product carbon content. While many say this is really just protectionist policy in another guise, if some form of legislation were to pass, it could have a dramatic impact on sourcing decisions.

Technology: If energy usage and carbon emissions are important supply chain issues, then surely technology will need to play a key role in helping companies manage and improve processes related to Green supply chain strategies and programs.

As discussed above, this may most prominently play out in the area of Transportation Management Systems (TMS), where soaring fuel costs were the key factor in boom times for most TMS providers over the past few years. Add a concern over better managing carbon emissions, and many TMS initiatives that just couldn't get over the approval process hump before may find that the funding now becomes available.

A host of other transportation-related technologies (e.g., routing and scheduling, GPS and "telematics," trailer load optimization, and more) will likely see increased interest as well.

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Green is Smart Business – Get Suppliers on Board

Kevin Harris, Director of Marketing
Compliance Networks

Green initiatives aren't just good for the environment and customer relations. Business, in particular the supply chain and logistics industry, has learned that green initiatives also contribute to efficiency and profitability. As it turns out, what is good for the environment is often good for business. Green initiatives promote lean operations, earn the admiration and loyalty of customers, and improve profitability.

According to Dr. Bruce Piasecki, founder and CEO of AHC Group and author of World Inc., "the 300 largest corporations on Earth are now exploring this new world order, a new social frontier, if you will. In order for them to survive and prosper further, they need to develop and further refine the business art of innovation for social needs -- they need to find a new and socially responsible way to fill the hole our depleting oil supply is leaving."

Today, many companies give green issues great consideration and weight when devising their business strategies. According to a July 2007 eyefortransport survey of 271 supply chain and logistics professionals (in transportation and logistics, hi-tech and electronics, food, retail and consumer packaged goods, automotive, chemical, and healthcare/pharmaceutical sectors) over half (59%) of respondents reported that green issues are either important or very important to their companies' overall strategy, 20% reported green issues as fairly important, 15% as somewhat important, and only 6% designated green issues as not important.

According to the eyefortransport study there is a direct correlation between a company's prioritization of green issues and their revenues and business success. In fact, key drivers for green initiatives include government compliance, improved customer and public relations, a decreased fuel bill and financial ROI.

Further, increasing supply chain efficiency, improving investor relations, decreasing risk and a larger Corporate Responsibility agenda were also important factors in the strategic decision to go green.

Most, if not all, green initiatives in the supply chain and logistics sector are directly facilitated by Vendor Compliance Optimization. A best-in-class Vendor Compliance Optimization program (also known as Supplier Performance Management) can enable retailers and manufacturers to decrease costs, increase revenues, and mitigate risk. It will enable them to measure supply chain performance and align their vendor community with the organization's strategic goals.

Supply chain performance has been shown to improve in as little as 120 days.

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In addition, it may become increasingly important – perhaps even required – that companies consistently and accurately measure their carbon emissions. Right now, current accounting and ERP systems are not designed for such an effort. A growing array of software and service providers are jumping into the fray (see *CO2 Emissions Tracking and Monitoring*, page 14).

Laws and Regulations: Government laws and regulations may have a dramatic impact on Green Supply Chain requirements and urgency. Of course, the most powerful and dramatic effect would come from cap and trade and/or carbon tax legislation, but there are many other potential action areas as well.

For instance, some believe transportation policy and government investment may increasingly favor rail transport as a mode, which would clearly impact shippers. As an extreme example, today in Austria, much cargo going across the country to other parts of Europe must be transported via rail – no truck carriage is permitted.

Other legislation may be more in shippers' favor – for example, Maine already allows trucks weighing more than most state and federal laws permit to operate on certain highways. Legislation is also being introduced that reopens the potential for double and triple trailers (even as proposed the "SHIPA" legislation goes the other way, and is the more likely to pass).

Regardless, keeping up with legislation that will impact Green supply chain strategies will be an increasingly important task for logistics managers.

Company Valuation: If the Sustainability trend continues in a powerful way, will it ultimately have an impact on a company's stock price and shareholder value?

Certainly could be. First, under a cap and trade or carbon tax program, a company's ability to reduce fuel/energy use and/or carbon emissions would have a direct impact on its bottom line and hence its stock price. Second, interestingly, the UK's Carbon Disclosure project solicited support for company self-reporting by getting a number of leading investment banking companies, whose analysts often influence stock prices, to support the idea of corporate reporting.

Even more interesting, professor Anant Sundaram of Dartmouth's Tuck School of Business has developed a new "Fossil-Fuel beta" (FFB) for a company's stock price that in effect measures how linked a corporation's bottom line is to dynamic fuel prices. In theory, a company with a high FFB would have a lower stock price for the same level of earnings as a company with a lower FFB. So, a company such as FedEx, which would have a high FFB, could increase its stock price just by reducing its dependence on fossil fuels even if its earnings did not improve, if the FFB gains currency among investors.

Supply Chain Organization: Someone needs to own all or various parts of a company's Green supply chain and Sustainability efforts and investments. Many companies have formally created such positions, sometimes at the executive level, (e.g., Gene Kahn, Vice President of Sustainability at General Mills).

That of course brings up other questions. Should this role be within the supply chain? If so, when? If it is outside the supply chain, is there still the need for a formal Sustainability role within the supply chain organization, with perhaps a dotted line relationship to the executive? If the executive is outside the supply chain, who owns what in terms of supply chain decisions and trade-offs?

A complicated set of issues, for sure, that few companies have yet really tackled.

Decisions will be More Complicated

Right now, few companies have moved deep enough into Green supply chain strategies to know where really tough decisions need to be made. In fact, a growing number of companies seem to be now publicly saying that going Green for Green's sake isn't enough – such decisions have to also be good for shareholders.

SCDigest has used the theoretic example in the past of industrial adhesives to illustrate the potential issues. What if the most environmentally friendly adhesive product costs more than the traditional product? What if the products are priced the same, but the buyer's production line needs to be run a tad slower for the Green product?

These and many more similar types of questions bring up a host of issues:

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- Who will be empowered to make these types of decisions? Procurement managers? The Sustainability executive? Someone else?
- Will companies develop clear guidelines and decision frameworks for managers to use in the analysis and decision?
- How will the explicit costs/benefits of a more Green alternative be calculated under a cap and trade environment?

However, Tom Dadmun, Supply Chain Vice President at high tech company Adtran tells *SCDigest* that "I think we are a long way from whether or not we will pay more for a Green product in some consumer markets. We are just scratching the surface in plain logistically efficient process improvements that can be called Green. In some industries, we have a long way to go before we hit the line where Greening will be an additional cost."

He added: "In the meantime our Greening improvements can and should make the cost saving cup runneth over for quite awhile!"

Summing it Up

What is perhaps most amazing about the Green supply chain is that it touches virtually every aspect of supply chain planning and execution, from supply chain organization and network design to the lowest level package and dispatching processes.

The great news is that for now, as Tom Dadmun notes above, going Green and saving "green" appear to be consistently aligned. Last year, for example, an executive at DHL observed at the CSCMP conference that "Reducing carbon emissions always results in lower operating costs in manufacturing and logistics" - a very provocative principle if true.

What is also clear is that the Green supply chain world for all of us will change dramatically if some form of cap and trade and/or carbon taxes is enacted. The reality is that such efforts have so far not appeared to have had much impact in Europe in reducing carbon emissions, but some argue it simply takes several iterations to get it right.

As a result of all this, Green-related roles are increasingly being created within companies and their supply chains.

According to Dave MacEachern, head of the supply chain practice at executive recruiters Spencer Stuart, "This is definitely picking up steam in the marketplace. My sense is that people are moving resources (people) into these roles versus hiring from the outside. I think there is a high comfort level with companies knowing who they are hiring into the role and not getting someone who will try and change everything to Green immediately."

However, he expects over time more companies will begin to look outside for proven expertise and results.

In that sense, there is still probably more talk about Green than action, especially if one separates out the largely cost-driven improvements companies have made in transportation. Each year, however, that changes a bit more. When we enter a world of cap and trade or carbon tax, the real challenge will begin.

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mean for the supply chain. On our new Green Supply Chain web site, you'll find more detailed video and text articles covering this topic, including a head to head comparison between the two (www.thegreensupplychain.com).

Two Paths on Carbon Emissions

While there is still much debate on the real dangers of global warming and the role of fossil fuel consumption in potential climate change, there is certainly a strong likelihood that the US and maybe other countries will join Europe in its regulatory efforts to reduce carbon emissions (which to date have met with at best mixed results in Europe).

Below, we summarize two main approaches being proposed:

Cap and Trade

This is the system currently in place in the European Union, and one just passed by the US House, though not as of yet at the time of publication in the Senate.

With a cap and trade system, the government sets a cap on carbon emissions that will be released into the atmosphere over a certain period (e.g., annually).

That "cap" is then divided into individual permits to release a specified amount of CO2 - which, of course, is where the challenges start.

However the permits are distributed, because the total CO2 emissions are capped they begin to take on financial value. That's where the "trade" part comes in.

Permits can be freely given away to affected participants (e.g., utilities, manufacturers, transportation companies), auctioned off, or some combination of the two.

However the permits are distributed, because the total CO2 emissions are capped they begin to take on financial value. That's where the "trade" part comes in. After the permits have been created, companies can sell excess credits if they will not need all of the emission permits they own, while other companies which will exceed the threshold need to buy credits from those willing to sell. So, the market quite directly sets a price for the right to emit a ton of CO2 into the environment, and companies can weigh the costs of permits versus the cost of internal CO2 abatement.

The theory goes that over time, the emissions cap will be tightened, requiring companies to further reduce emissions.

A cap and trade program could tremendously benefit companies that can significantly reduce their carbon emissions, as the excess permits could be sold and the proceeds in effect driven straight to the bottom line. In fact, some critics complain, especially in a free distribution model, that the result could be windfall profits for many corporations.

As you might imagine, in addition to whether permits are freely distributed or auctioned off, there are a number of other policy issues and decisions with cap and trade:

- **Where will the Caps Be Implemented?**: For example, is it "upstream," where carbon enters the supply chain (such as oil importers, for example), or downstream, where CO2 is emitted (e.g., manufacturers)?
- **Managing Volatility:** In periods of heavy demand, such as an extremely cold winter, permits could be in such high demand that the price skyrockets and becomes simply unaffordable to business. The result could theoretically be utilities and factories shutting down over a lack of permits, though it is unlikely in practice this would be allowed to happen. So, under some proposed plans businesses would be able to "bank" unused permits from previous years, or "borrow" from future allocations – though some doubt such "loans" would ever be paid back.
- **Creating Exceptions:** Related to the above, some recognize that price gyrations to the high side could bring a cap and trade program to its knees. So, there are often proposals in which if permits reached a

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certain market price level, new permits would be sold at a "ceiling price." Or, firms could be given additional permits if carbon reducing technology does not advance as expected.

- **How will Actual Emissions be Calculated and Monitored Against Permits?** There are few clear answers to this question.
- **Political Manipulation:** How permit levels are decided, what industries are favored versus others, and a host of other political considerations have the potential to hinder the effectiveness of cap and trade programs and distort the market-based theories underlying the concept. Here come the lobbyists!

Carbon Taxes

Direct taxes on sources of carbon emissions (i.e., fossil fuels) are actually preferred by most subject matter experts, but the "tax" word in the approach makes it often less accepted by politicians than the more innocuous sounding "cap and trade."

With a carbon tax, a tax is placed on fossil fuel producers or importers at a rate that reflects the amount of carbon that will be emitted when the fuel is burned or used.

That tax would likely be levied at the first point of transaction from producer/importers to users (utilities, manufacturers, carriers), increasing the fuel price. So, market mechanisms in theory should drive users away from more carbon-intensive fuels to more carbon-efficient ones, or to find ways to reduce their costs by using less of a given fuel.

The tax would be based on carbon emissions per BTU, which are precisely known. As such, coal would likely have by far the highest tax, followed by oil in the middle and finally natural gas, which has a very favorable BTU to emissions ratio. Provisions would be made to exempt fossil fuels that are used in non-carbon emitting applications (e.g., oil used in making plastics).

Many believe a carbon tax would be simpler, more transparent, and less subject to political manipulation than a cap and trade program. However, the key question of course is at what levels the taxes would be set. Proposals range wildly, from a few dollars per metric ton of emissions to $200 or more – not only incredible differences in percentage terms, but also in the impact on business. One study of different program proposals found an average recommendation of $12 per metric ton of emissions, but what would actually wind up in legislation is a total unknown. Most believe the tax level would need to be significantly ratcheted up over time.

It is also not clear how a carbon tax would be handled if technology was developed to abate carbon emissions from a given fuel type (e.g., "clean coal" technology), while such developments would be well handled under cap and trade.

What to Do with the Revenues?

With either an auction-based cap and trade program, or a carbon tax regime, the government could end up collecting a huge level of taxes – perhaps hundreds of billions of dollars per year.

Not only could this place a huge burden on the economy, many also say that it could be a highly regressive tax. Costs are ultimately passed on to consumers, and lower income consumers pay a higher percentage of their incomes on such things as utility bills and gasoline whose prices would be driven higher by the programs.

Many therefore recommend "revenue neutral" plans, in which almost all taxes collected from carbon-related tax revenue changes are rebated to citizens based on any of several formulas (such as "dividend" payments or a reduction in other taxes).

Others, however, want to see the revenues used for research and development on such things as alternative energies – or to fund other government programs.

With each proposal, the devil is in the details, meaning the impact on companies, their supply chains, a country's competitiveness, and more can be dramatically impacted not only by which if any path is pursued, but the level and timing of the programs. How "offshoring" will be handled is one huge source of uncertainty, for example.

Regardless, if either type of program is implemented to any significant degree, it totally changes the rules and impact of Green supply chain strategies.

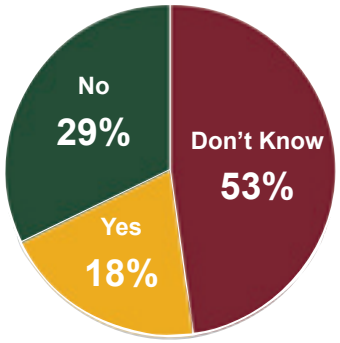
For a more detailed discussion of cap and trade versus carbon taxes, visit our resource center at: www.thegreensupplychain.com

CO2 EMISSIONS
Tracking & Monitoring

One big elephant in the room when it comes to carbon emissions is the challenge companies will have calculating, monitoring and tracking CO2 emissions internally and across their trading partners.

Obviously, today's accounting principles, let alone software, were not designed with CO2 emissions tracking in mind. As a result, carbon emissions data from almost any company or supply chain right now should probably be taken with a grain of salt, if not a large helping.

Are Companies Planning to Implement Software to Monitor and Track Carbon Emissions?



Source: Gartner

Clearly, there are technical and process challenges in accurately collecting the data, including some fairly basic questions about what should really be counted where. Next will be even tougher questions about how to allocate, for instance, a company's share of the carbon emissions from its use of less-than-truckload (LTL) carriers, and if or how you need to track CO2 data from your supplier's supplier.

In addition, the reality is that currently, companies generally have some incentive to over-state their current levels of carbon emissions, when the stakes are low, so as to be able to show marked improvement later when Wal-Mart, HP or the government comes asking again in the future. Make yourself look like a carbon hog right now, and tremendous gains in percentage improvements will be easy later on.

Software Vendors Beginning to Offer Tools

As Green supply chain thinking gained momentum over the past few years, a slew of vendors have announced "carbon calculators" of some kind or another. Some were more marketing exercise than serious product, but slowly real tools are coming to be made available.

As one example, a few supply chain network design/ optimization software vendors have started to explicitly incorporate the carbon emissions that will result from different network design strategies – clearly a critical consideration if cap and trade type legislation is eventually passed.

At the network design level, companies should be able to manage with a fairly general estimate of the emissions profiles for different modes of transport, facility types and locations (for example, is a potential location for a given distribution center in an area that is served by a coal-fired electric plant or a nuclear one?).

But even here, similar types of scenario analysis will be required. Companies will have to plan using various levels of carbon emission costs in the future, just as they have been doing recently based on different scenarios for the cost of fuel.

In terms of detailed reporting and potential cap and trade impacts, however, measurement will need to get more precise – and as usual, the use of manual tools will only take a company so far.

The researchers at Gartner, for example, said in a recent report that they recommend all medium and large companies "start building processes and systems to gather carbon emissions data from their global operations and consider introducing a shadow carbon price for assessing all new projects."

Gartner adds that "calculating emissions is challenging, and enterprises need to be able to provide evidence and traceability of any improvements they've made if such performance improvements are to be counted in their favor."

As shown in the graphic above, relatively few US companies (18.4%) have current plans to implement focused carbon emissions tracking solutions. But tracking emissions in spreadsheets will soon prove overwhelming.

"It is only a matter of time before companies will have to report carbon emissions," says Gartner's Simon Mingay. "Our advice is to start now, save a lot of time and hassle, and do it properly and well."

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Consider the hundreds, thousands, or tens of thousands of products and components many companies handle. Some may be made internally, others sourced, sometimes from other manufacturers, sometimes from distributors – each SKU with its own "carbon footprint" that may need to be tracked. It will literally be like having to maintain a second set of books.

The reality is that it is going to require a complicated web of actual calculation, estimates, and acceptance of the reporting of trading partners, who in turn will be dealing with their own set of similar issues.

There are some sources that can help. The Carbon Disclosure Project offers templates and data collection services for companies to measure their own and their suppliers' carbon emissions.

A few software solutions are starting to develop their own "emissions factors" for a wide range of products and components – in other words, a ton of stainless steel would be pre-assigned a given emissions level. While it seems such aggregation is inevitable, obviously the use of these types of averages could penalize a company that procures or makes products more carbon efficiently.

We also expect to see more "point" solutions that can be rolled up to help determine corporate numbers. In other words, it might be relatively easy for a TMS vendor to ultimately be able to very accurately calculate CO2 for transportation moves – but the TMS won't help much in what manufacturing is doing, which will have its own systems. All of this CO2 from different applications will be fed to a "CO2 data warehouse" or something similar.

That in turn means that companies evaluating almost any new piece of supply chain software should be asking the vendors about their capabilities and plans for carbon tracking.

Supplier Reporting

Supplier CO2 and Green performance management is also likely to be increasingly important. "Green-ness" already is part of the vendor scorecard for many suppliers at Wal-Mart, and many other retailers, wholesalers, and manufacturers are likely to follow suit.

Such Green scorecards are likely to have two components: (1) a more qualitative element, that may give a vendor a score based on the perceived progress it is making on say reducing product packaging; (2) quantitative measures, such as how efficient a supplier is in transportation management (see graphic below).

In total, it is certain that the growing power of "supply chain performance management" will need to take on a new and very Green aspect as well over the next few years. SCD

Supplier Scorecards will Increasingly Measure Green Efficiency

Source: Compliance Networks

Discount Parade Stores
Green Scorecard for Funboy Toys 788889

	>2 Shipments in a week from same origin (non-Truckload)		LTL shipments on consecutive days	
Violations	Trends		Violations	Trends
Violations per Order			Violations per Order	
01/01/2008 to 03/28/2008	Goal	95.0%	Goal	95.0%
Index 85.6%	Actual	91.7%	Actual	91.7%
All vendors index 84.2%	Shipments	87	Shipments	79
Ranking is 35 of 1236 vendors	All vendors average	92.3%	All vendors average	92.3%

	> 3 shipments for a PO		Same PO shipped via non-Truckload on consecutive days		Same day/same origin freight bills not consolidated	
Violations	Trends		Violations	Trends	Violations	Trends
Violations per Order			Violations per Order		Violations per Order	
Goal	95.0%		Goal	95.0%	Goal	95.0%
Actual	91.7%		Actual	91.7%	Actual	91.7%
Shipments	85		Shipments	85	Shipments	78
All vendors average	92.3%		All vendors average	92.3%	All vendors average	92.3%

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