

# *Global Markets and Supply Chain Challenges*

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## What We'll Cover ...

- Supply Chain Challenges
- Sustainability drivers
- The impact of
  - Distribution network
  - Oil price
  - Sourcing strategies
- Summary

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## Today's Supply Chain Challenges

- Global supply chain with long lead times
- Rising and shifting customer expectations
- Increase in labor costs in developing countries

The Average Annual Wage Increase between 2003 and 2008  
in different Countries

Country	Brazil	China	Malaysia	Mexico	US
Average Annual Wage Increase	21%	19%	8%	5%	3%

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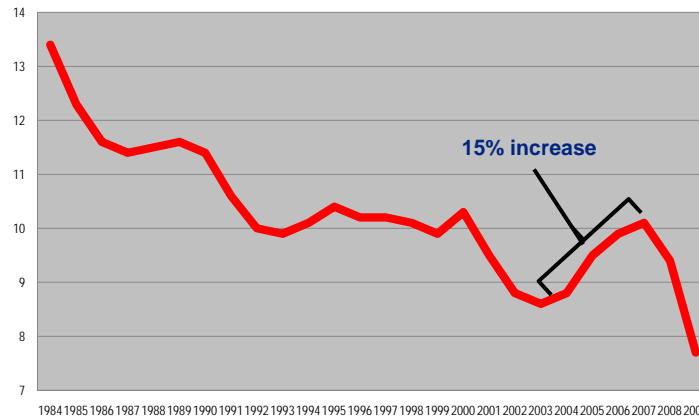
## Today's Supply Chain Challenges

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- Increase in logistics costs

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## Changes in Logistics Costs between 1984 and 2009

US Logistics Costs as Percent of GDP



- Rising energy prices
- Rail capacity pressure
- Truck driver shortage
- Security requirements

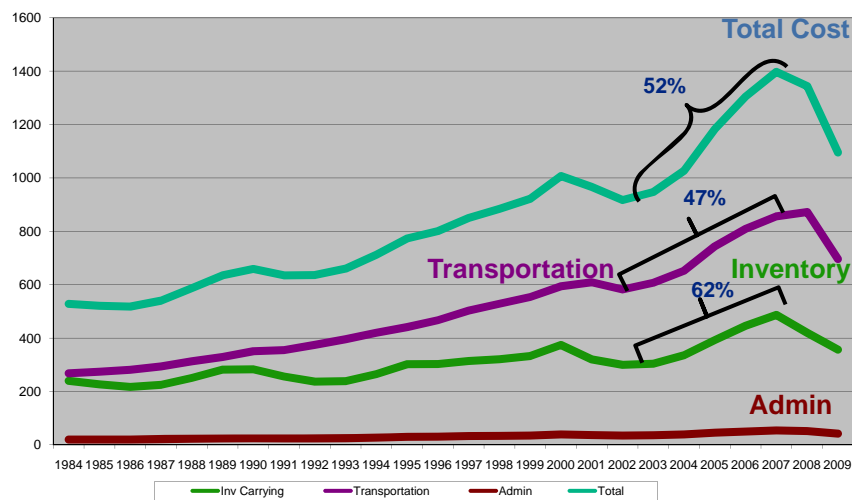
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Source: 19<sup>th</sup> Annual Logistics Report

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## Total US Logistics Costs 1984 to 2009 (\$ Billions)

Total US Logistics Costs in \$MMs



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Source: 19<sup>th</sup> Annual Logistics Report

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## Today's Supply Chain Challenges

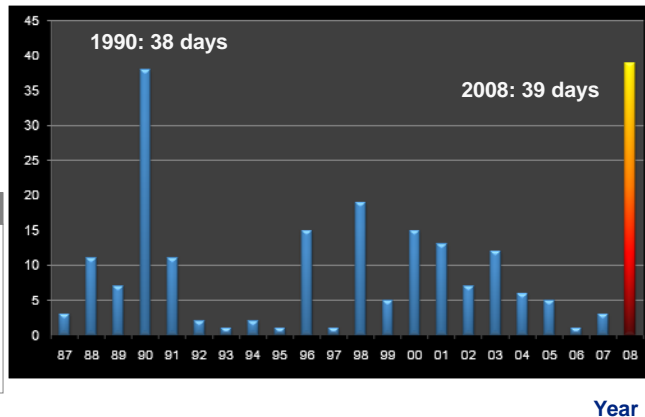
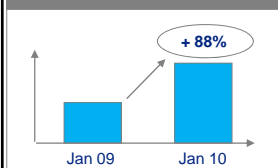
- Global supply chain with long lead times
- Rising and shifting customer expectations
- Increase in labor costs in developing countries
- Increase in logistics costs
- Increase in risks
- Unprecedented Volatility

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## Unprecedented Volatility --- Oil Price

Number of days the price of oil changed 5% or more

Oil Price In the Last 12 Months



In 2008 the price of oil changed 5% or more from its previous close on 39 days making it the most volatile year since 1990.

Source: NYT

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## Volatile steel market



**In the steel industry, lead times have decreased from 40-60 weeks in 2004-2006 to 10-15 weeks in 2008-2009 as the economy went into a recession.**

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## Today's Supply Chain Challenges

- Global supply chain with long lead times
- Rising and shifting customer expectations
- Increase in labor costs in developing countries
- Increase in logistics costs
- Increase in risks
- Unprecedented Volatility
- Importance of sustainability

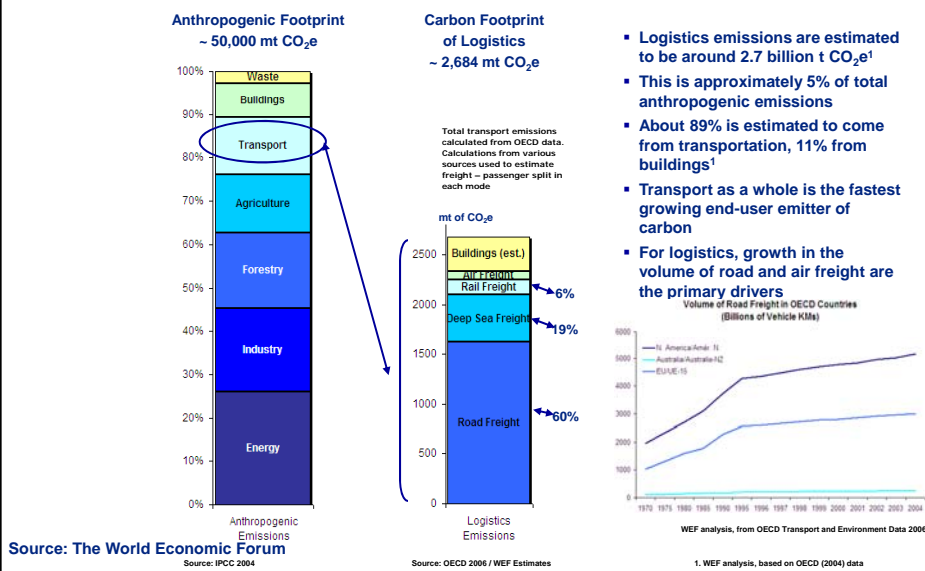
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## The Green Supply Chain: Why

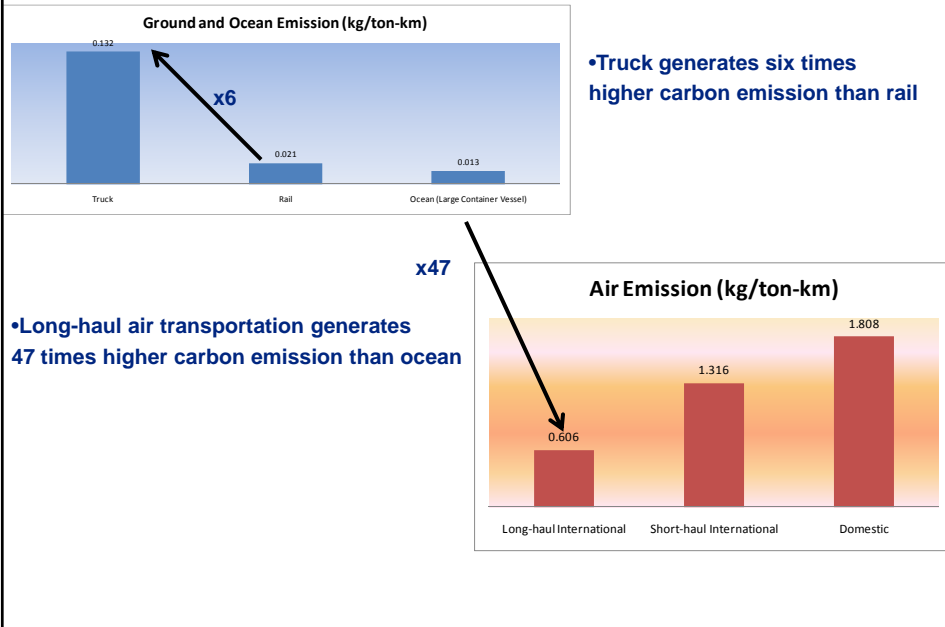
- **Supply chain Efficiency**
  - High transportation costs
- **Financial Incentives in Europe**
  - Kyoto agreement established carbon emission limits
  - European Emission Trading Scheme
- **Regulatory pressure is likely to increase**
- **Growing pressure on companies**
  - Consumers, B2B customers, Employees, Banks, Insurance companies
- **Competitive pressure**

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## The freight sector is a large and growing emitter of carbon dioxide...



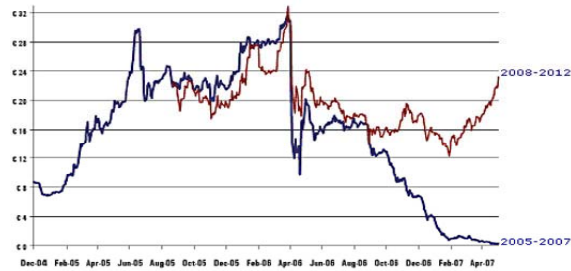
## Transportation Mode: Emission Efficiency



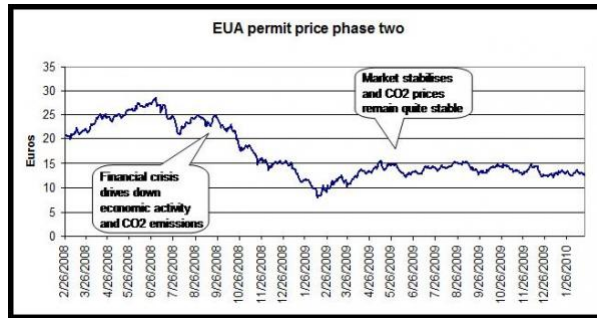
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## EU Market price for Carbon Emission Permits



Phase 2 permit price



## The Green Supply Chain: Why

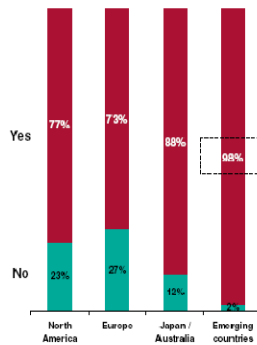
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## Demanding Customers and Competitive Pressure

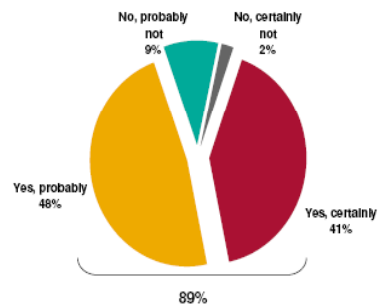
People in emerging countries are the most concerned and ready to act

In their decision to choose a provider individuals value actions taken to address Climate Change

"Do you think that climate change will directly impact your life?"



"If an energy provider was proposing products / services that help reduce the level of carbon emission would you be willing to switch to this provider?"






Source: Accenture End-Consumer Survey on Climate Change, 2007.

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## ... and retailers are responding

- Environmental Scorecard
- Consumer labelling introduced by
  - The Japanese Government
  - Carbon Trust
  - World Resource Institute
  - Retailers
- Include end-to-end carbon emission from production to delivery
- Expected to have direct impact on carbon emission

Retailer	Retailer Response
	<ul style="list-style-type: none"> <li>• Carbon reduction targets, through an environmental scorecard</li> </ul>
	<ul style="list-style-type: none"> <li>• Carbon labelling system introduced on products</li> <li>• Sustainable Consumption Institute funding</li> <li>• <del>Smart building initiatives</del></li> </ul>
	<ul style="list-style-type: none"> <li>• Environmental innovation through store design, transportation, and supplier arrangements to reduce energy consumption, carbon emissions and general waste output.</li> <li>• Customers encouraged to recycle plastic shopping bags and sturdy, low-density polypropylene bags available for purchase.</li> </ul>

Source: The World Economic Forum

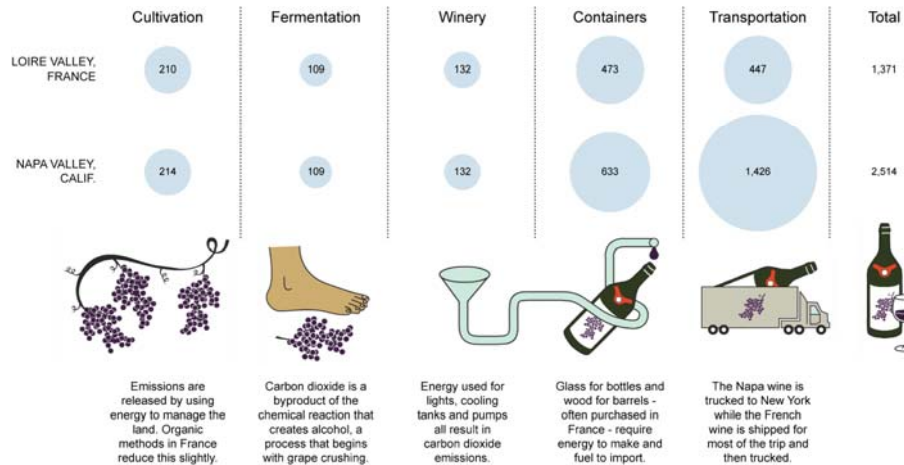
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## Environmental Scorecard and Best Practice

- Need for an environmental scorecard
  - Carbon footprint
  - Cube utilization
  - Deadhead distance
  - Product-miles or food-miles
  - Fuel consumption and energy cost
  - Waste disposal cost

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## Carbon footprint for red wine sold in New York City



Source: NYT

## Environmental Scorecard and Best Practice

- Need for an environmental scorecard
  - Carbon footprint
  - Cube utilization
  - Deadhead distance
  - Product-miles or food-miles
  - Fuel consumption and energy cost
  - Waste disposal cost
- Best practice through supply chain planning
  - Direct: Trade-off between cost, service and carbon footprint
  - Indirect: Improving transportation efficiency
  - Direct: Reduce waste

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## Wal-Mart Green's Campaign....

- In October 2005, Wal-Mart's CEO Lee Scott presented an environmental plan to reduce energy use, waste, and greenhouse gas emissions
- Wal-Mart is focusing not only on its own operations, but its suppliers' operations as well.
- Wal-Mart's target is to cut greenhouse gas emissions by 20 percent by 2012
- Starting at the beginning of 2008, the retail giant is rating its providers' performance on an environmental scorecard that includes
  - Greenhouse gas emission
  - Cube utilization
  - Recycled content
  - Renewable energy

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## Wal-Mart Green's Campaign pays off

- Wal-Mart's 3PL provider in Canada, has
  - Changed the way it ships products to 10 stores in Nova Scotia and Prince Edward Island from road to rail which led to reduction of carbon emissions by 2,600 tons.
  - In addition, the 3PL provider converted 20 truck generators to electric power, saving about 10,000 gallons of fuel.
  - These two measures combined are expected to yield more than \$2 million in annual cost savings.

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## Carbon Footprint Analysis -- Data Input

Supply Chain Activity	Data Required
Transportation	By carrier in the model, the user either enters the Fuel Efficiency (e.g. miles per gallon) and Carbon Conversion factor (kg CO <sub>2</sub> per gallon) <i>or</i> CO <sub>2</sub> per Freight (kg CO <sub>2</sub> per ton-mile)
Warehouses	By warehouse location, the user enters the Energy Consumption (e.g. kWh per sq. ft.), the Carbon Conversion Factor (kg CO <sub>2</sub> per kWh) and the Area to Apply (entire size of whse, or avg. inventory volume)
Plants	By plant location, the user enters the Energy Consumption per Space (e.g. kWh per sq. ft.), the Energy Consumption per Capacity (e.g. kWh per production hr) and a Carbon Conversion Factor (kg CO <sub>2</sub> per kWh).
Production	By product, the user enters the Energy Consumptions associated with the production of that product, as well as any materials used in that product (kWh per unit) and a Carbon Conversion Factor (kg CO <sub>2</sub> per kWh).

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## Example of Data Required

- To aid the user, example data is provided
  - US Government sources and the World Resources Institute.
- Data includes:
  - Carbon emissions by fuel type
  - Average fuel efficiency values
  - Carbon-Freight factors for waterborne and rail
  - Electricity emissions factors by US State, and country
  - Electricity consumption by building characteristics
    - ▶ Building size; Geographic region; number of workers; principal activity; year constructed.....

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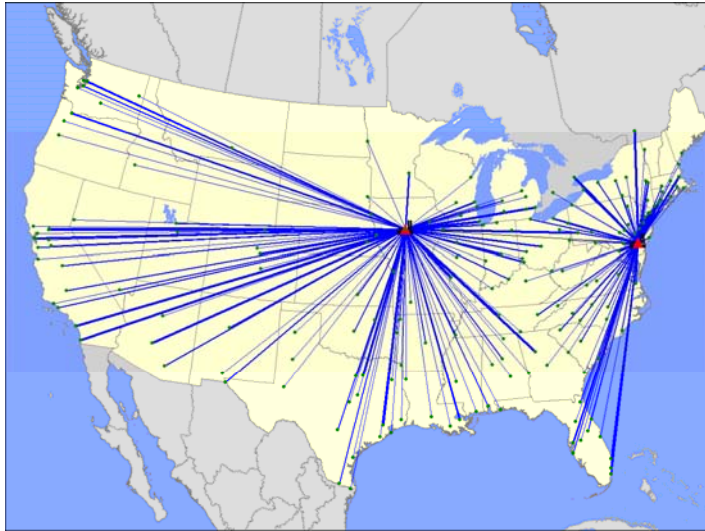
## Case Study 1: Distribution Network Design

- Manufacturer of Office Furniture
  - Steel Cabinets
- US based manufacturing & distribution network
  - Manufacturing and distributions from 2 sites- Des Moines, IA and Dover, DE
- Two objectives:
  - Redesign distribution network to reduce costs and improve customer service
  - Reduce Carbon Footprint to align with corporate environmental objectives
- The challenge: Find the appropriate trade-off between reducing cost and reducing Carbon Footprint

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## Office Furniture Manufacturer Distribution Study: Baseline

2 Plants  
2 Existing DC's  
58 Potential DC's  
200 Customers  
11 Product Families



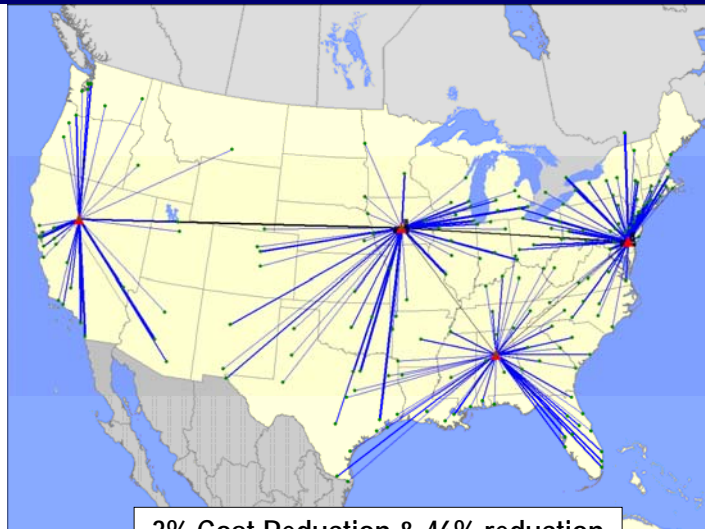
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## Office Furniture Manufacturer Distribution Study: Baseline

- Apply network modeling to design a distribution network that satisfies customer demand at the lowest possible cost, while considering the Carbon Footprint of the new network
- Consider all logistics costs as well as carbon emission from plants, DCs, and the various modes of transportation.
  - Carbon emission per kWh is different from state to state due to different power generation technology
    - ▶ Grid Electricity, Natural Gas, Diesel, Petrol, Coal, etc.

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## Optimized Network



3% Cost Reduction & 46% reduction  
in average distance to customer

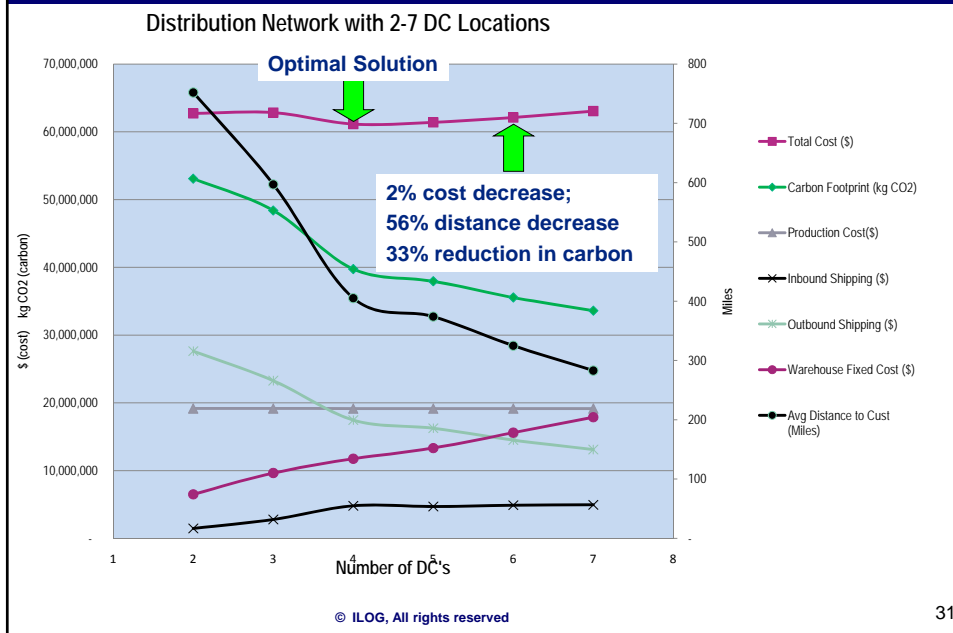
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## Tradeoffs in Network

- As additional DCs enter the network, the following occur:
  - DC Fixed Costs increase
  - Outbound Transportation Costs decrease
  - Average distances to customer decrease
  - Carbon Footprint tends to decrease
    - ▶ **Why?**
      - *Inbound transportation is mostly rail which has less environmental impact than truck*
      - *As DC's increase, a greater proportion of total freight is plant-warehouse transportation (rail)*
      - *Increased CO2 from more facilities does not outweigh reduction in transportation CO2 emissions*

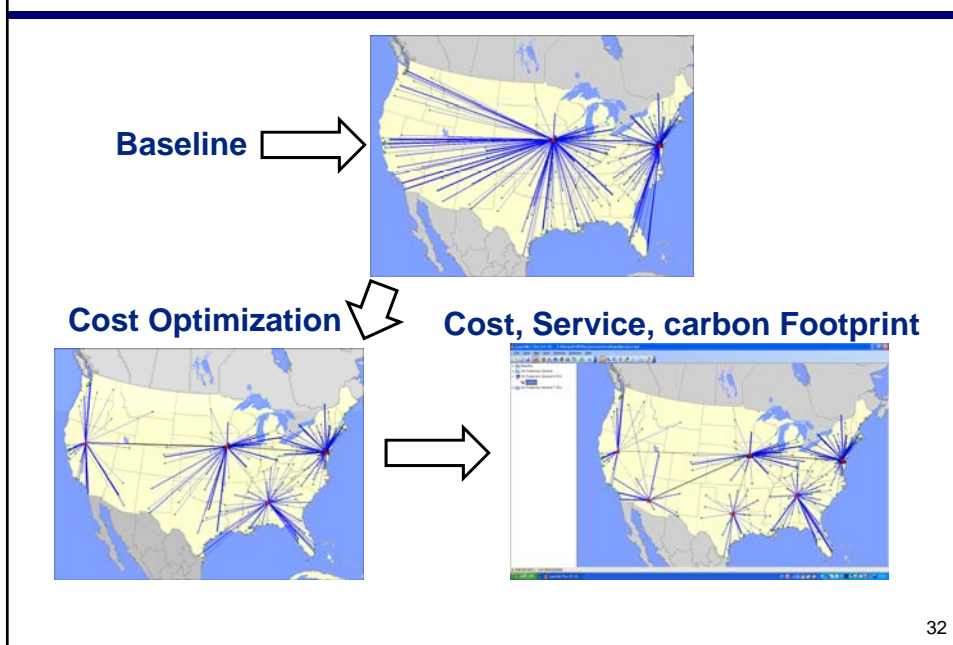
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## Trade-Off Curve between number of DC's, costs, service and carbon footprint



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## From Baseline to better costs, service and carbon footprint



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## Case Study 2: The Impact of Oil Price

- Manufacturer of consumer packaged goods
- Manufacturing is possible in three locations:
  - Philadelphia- Highest production cost
  - Omaha-
  - Juarez, Mexico- Lowest production cost
- 60 potential DC locations
- 888 aggregated customers
- Inbound transportation uses commercial TL carriers
  - TL averages 40,000 lbs/shipment
- Outbound transportation uses a private fleet
  - Private fleet averages 20,000 lbs/shipment

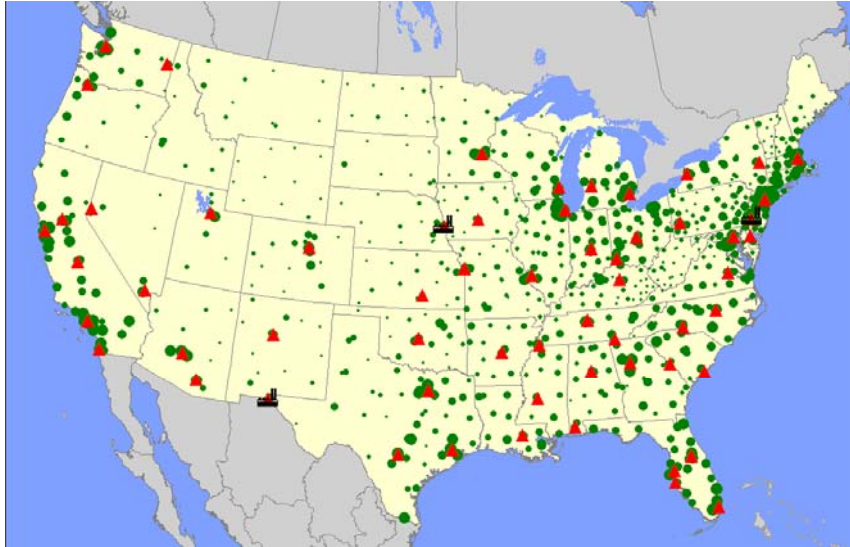
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## Case Study - Objectives

- Determine the best number and location of distribution centers, as well assignment of customers to DC's.
- Determine the best allocation of production to their manufacturing locations.
- Understand how the optimal network would change as oil prices fluctuate
  - Roughly 25% of the supply chain costs are in transportation

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## Network Visualization



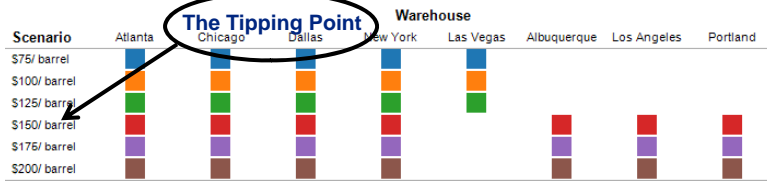
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## Discussion of Tradeoffs

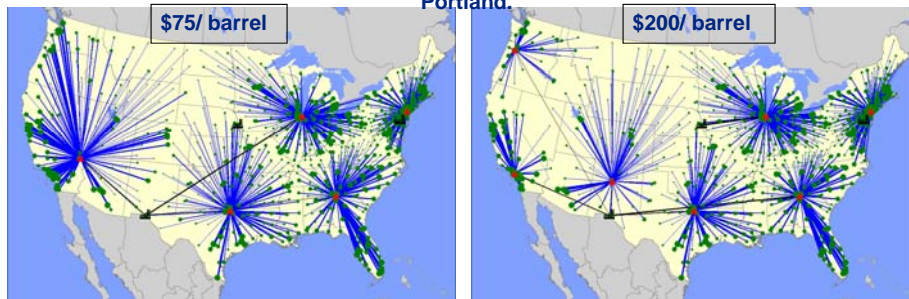
- As crude oil price increases, transportation costs become more important relative to production, inventory and facility fixed costs.
- Oil price vs. inventory carrying and facility costs
  - Additional DCs are more attractive
    - ▶ As outbound transportation becomes more expensive, it becomes increasingly important to minimize the distance of the final leg.
- Oil price vs. production costs
  - Production moves nearer to demand
    - ▶ Cheaper manufacturing in Mexico is offset by higher transportation costs.

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## Oil price vs. inventory carrying and facility costs



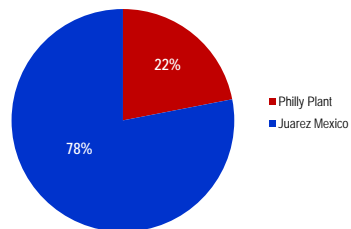
Moving from \$125/ barrel to \$150/ barrel changes the optimal number of DC's from 5 to 7. In particular, you can think of Las Vegas being replaced by Los Angeles, Albuquerque, and Portland.



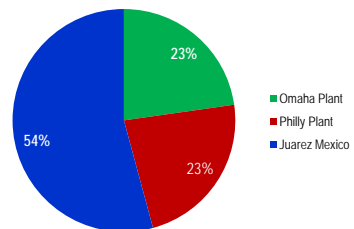
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## Oil price vs. production costs

\$75/ barrel



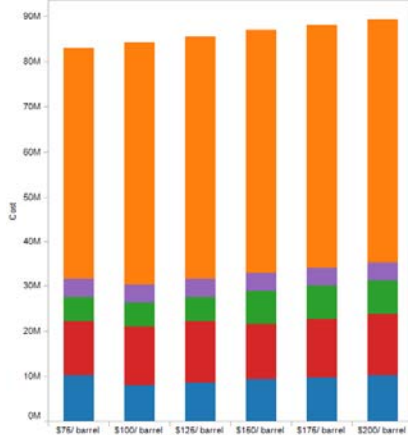
\$200/ barrel



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## Total Cost Comparison

Cost Type	\$75/ barrel	\$100/ barrel	\$125/ barrel	\$150/ barrel	\$175/ barrel	\$200/ barrel
Production Cost	51,352,370	53,978,928	54,034,995	54,032,003	54,071,680	54,149,335
Warehouse Holding Cost	3,994,055	3,994,055	3,994,055	3,994,055	3,994,055	3,994,055
Warehouse Fixed Costs	5,250,000	5,250,000	5,250,000	7,350,000	7,350,000	7,350,000
Warehouse to Customer Shipping ..	12,138,280	12,951,623	13,796,249	12,205,702	12,913,436	13,598,938
Plant to Warehouse Shipping Cost	10,179,282	8,083,064	8,502,896	9,287,443	9,730,287	10,155,038
<b>TOTAL COST</b>	<b>82,913,987</b>	<b>84,257,670</b>	<b>85,578,194</b>	<b>86,869,203</b>	<b>88,059,459</b>	<b>89,247,365</b>



**3% increase in total cost  
as the price of a barrel  
increases from \$100 to \$150**

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## What We'll Cover ...

- Supply Chain Challenges
- Sustainability drivers
- The impact of
  - Distribution network
  - Oil price
  - Sourcing strategies
- Summary

## Key Points

- **The environment:** Green considerations may force a change in distribution and manufacturing strategies
- **Emerging technologies:** on-board GPS with centralized information; aerodynamic tractor-trailers, kite-assisted ocean freight, automatic tire inflation systems, or single-wide tires

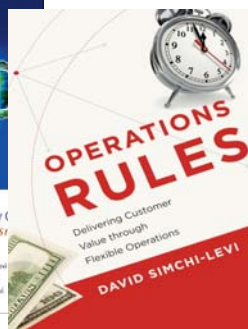
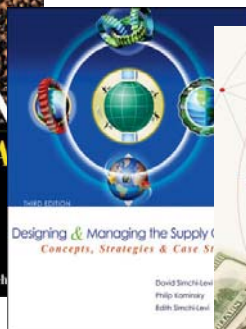
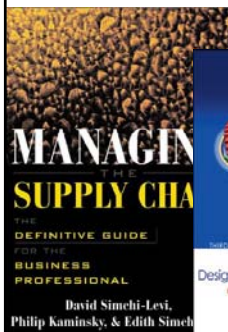
### Marks & Spencers UK Transport

- Introduction of New trailer fleet
- 140 ordered by M&S
  - 10% improvement in fuel economy
  - 10% increase in cubic volume
  - 20% reduction in CO2 emissions



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## Your Turn!



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