

MIT CTL RESEARCH PAPER

**CASE STUDIES IN CARBON-  
EFFICIENT LOGISTICS**

**Ocean Spray - Leveraging  
Distribution Network  
Redesign**

**BY DR. EDGAR E. BLANCO**

RESEARCH DIRECTOR  
MIT CENTER FOR TRANSPORTATION &  
LOGISTICS

**WINTER 2013**

*Sponsored by the  
Environmental Defense Fund*

# Ocean Spray: Leveraging Distribution Network Redesign

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## Case Study Highlights

In this case study we present two Ocean Spray initiatives -- distribution network redesign and intermodal shift from road to rail -- that in combination led to a 20% reduction in transportation CO<sub>2</sub> emissions, while achieving comparable cost savings across the transportation network.

### Shifting to Rail – A Collaborative Approach

Ocean Spray, CSX (the rail operator) and fruit shipping companies partnered in order to enable Ocean Spray to ship more products intermodally from their New Jersey distribution center to their Florida facility. Prior to the collaboration, these boxcars were returning empty to the Florida region. Shipments that shifted to intermodal generated 65% less emissions while saving over 40% of transportation costs. To facilitate this transition several modifications had to occur:

- Ocean Spray increased their load planning to accommodate the increased size of the rail boxcar vs. the traditional truck container;
- New arrangements with third party logistics provider were made to take care of delivering and collecting the rail boxcar;
- To guarantee on-time delivery of all shipments, Ocean Spray and the fruit shipping companies needed visibility to their shipments; and
- The payment process needed to be adjusted to simplify relationship with third party logistics provider (3PL).

### Distribution Network Redesign

Ocean Spray added new manufacturing and distribution capabilities in Florida to support the company's growing customer base. To fully and effectively utilize these additions, Ocean Spray conducted a national network re-design project to determine which customers will be served from the new location. Ocean Spray projected that over 17% of the total shipments will be served from the new facility. This redesign will:

- Reduce the required miles by 4.5 million miles for delivery of the same quantity of product. The reduced mileage is estimated to save 14,000 tonnes of CO<sub>2</sub> per year, a 17% reduction in CO<sub>2</sub> with over 70% of these savings coming from the southeast region of the United States.
- Save an estimated 10% associated with shipping costs by combining and reducing the number of shipments and distance travelled.

## About Ocean Spray

Ocean Spray is an agricultural cooperative owned by more than 700 cranberry growers in Massachusetts, Wisconsin, New Jersey, Oregon, Washington, Canada and Chile, as well as 35 Florida grapefruit growers. Ocean Spray was formed over 80 years ago by three cranberry growers from Massachusetts and New Jersey. Florida grapefruit growers joined the Cooperative in 1976. Ocean Spray is North America's leading producer of bottled juices and juice drinks, and has been the best-selling brand name in the bottled juice category since 1981. Ocean Spray posted fiscal 2012 gross sales of \$2.2 billion and net proceeds of \$338million.

### Shifting to Rail – A Collaborative Approach

Road-rail intermodal is a popular method for shifting transportation from trucks (road) to trains (rail), offering shippers the same convenience of point-to-point service that trucking offers combined with the cost-efficiency gains from rail. From 1993 to 2005 intermodal rail units increased by 63%.<sup>1</sup> While a shift to intermodal freight may replace only a small amount of current truckload freight traffic it is increasingly popular with shippers due to the cost reduction potential.

In 2011, after a new distribution center became operational in Lakeland, Florida, Ocean Spray identified a road-rail intermodal opportunity from the east coast distribution center. The rail operator, CSX, had been transporting fresh fruits in boxcars from Florida to New Jersey. Once the fruit was offloaded, empty boxcars were then sent back to Florida for future shipments. CSX and the fruit shippers were actively looking for partners to leverage this backhaul capacity to move products from New Jersey to Florida in approximately 175 boxcars each week.

Ocean Spray was an ideal partner to utilize some of this available backhaul capacity for several reasons. First, the Ocean Spray distribution center in Bordentown, New Jersey, is 60 miles from CSX rail terminal where empty boxcars were stored; a short distance compared to the thousand-mile journey to Florida. Second, the Ocean Spray distribution center in Lakeland, Florida is 65 miles from the destination rail terminal in Bradenton, Florida where empty boxcars needed to be repositioned for future fruit shipments. Finally, the resulting intermodal transport would save over 40% transportation costs compared to the current trucking method.

**Revise Shipping Loads to Maximize Savings:** The first step in evaluating if this backhaul opportunity was viable was to determine if Ocean Spray and the fruit shipper had compatible shipment requirements. An average Ocean Spray truckload shipment holds 19 to 28 pallets of product. CSX boxcars fit an average 38 pallets. To accommodate this difference, Ocean Spray needed to revise its shipping process to target 38 pallets on each shipment.

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<sup>1</sup> Association of American Railroads, 2006

**Coordinate Logistics Between the Two Companies:** The next step in this process was to have a seamless coordination between the two companies. Ocean Spray and the fruit shipper agreed to employ third party logistics provider (3PL) Wheels Clipper to manage coordinating and billing of all boxcar movements between the rail terminals and the Ocean Spray distribution centers. Due to the volume and past experience with rail operations, the two companies decided that the fruit shipper should take the lead on this aspect of the project. To facilitate this coordination Ocean Spray notifies the fruit shipper of the number of loads (already adjusted to maximize boxcar usage). The 3PL then arranges for their carriers to pick up the shipment at Ocean Spray's DC and transfer them to the rail boxcar at the New Jersey terminal. Once the boxcar arrives in Florida, a carrier must be ready to move the shipments to the Ocean Spray distribution center. The 3PL and CSX provide Ocean Spray in-transit information of the shipment.

**Testing Out the System:** Several pilot runs were executed to guarantee that Ocean Spray and the juice manufacturer were able to coordinate load pickup and delivery within the required time windows. The pilots also confirmed that the product was handled properly during the intermodal drayage transfer points and that the total intermodal transit times requirements fit Ocean Spray operational needs. When transported by truck, a shipment took 3 days to move from New Jersey to Florida. The new intermodal solution takes 4-5 days. The increased shipping time required additional logistical coordination. Ocean Spray elected to shift "transfer" shipments to intermodal, that is, planned movements within full control of the planning and transportation organizations. This allowed Ocean Spray to adjust inventory and transportation to accommodate the extra transit time without impacting service levels to final customers.

For the 12-month year that ended in February 2012, Ocean Spray shifted 616 truckloads (or 308 boxcars) from truckload to intermodal, saving an estimated 40% on transportation costs. This represents over 80% of the transfer shipments between New Jersey and Florida. Although other shipments were eligible for intermodal movement, they were not transported due to unavailable capacity in the intermodal operation.

#### Estimating GHG Emission Reduction

In order to compute the reduction in CO<sub>2</sub> emissions we need to compare the total emissions of road versus intermodal transportation. Ideally, fuel consumption data should be used to calculate CO<sub>2</sub> emissions. However, shippers like Ocean Spray that do not operate their own trucks and work with a large number of carriers, do not regularly have access to fuel consumption data. We will use the following formula to estimate the shipment CO<sub>2</sub> emissions:

$$\text{CO}_2 \text{ Emissions}_{\text{road shipment}} = \text{Shipment Weight} * \text{Road Distance} * \text{Road Emission Factor}$$

The *Road Emission Factor* represents the amount of CO<sub>2</sub> generated by moving one ton<sup>2</sup> of cargo one-mile using road transportation. We used 149.7 grams of CO<sub>2</sub> per ton-mile as the road emission factor. This emission factor corresponds to the average emissions of all fleets included by the EPA SmartWay Shipper Tools<sup>3</sup>.

The emissions of the intermodal shipment need to be computed by adding up each of the different segments required to move a shipment from point A to point B (see Figure 1).

1. Moving the shipment from the point of origin and loading it onto the rail ramp using a truck
2. Moving the shipment from the point of origin to the destination via rail
3. Moving the shipment from the end of the rail line to the final destination via truck

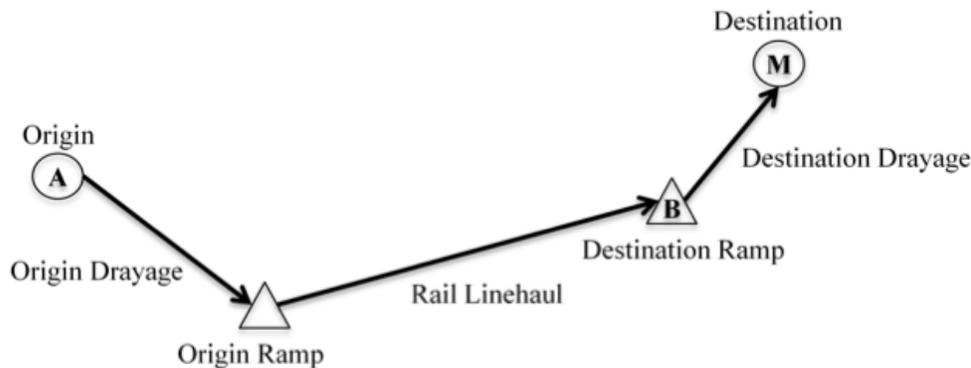


Figure 1. Intermodal Movement

The total emissions for intermodal transportation can now be computed as follows:

$$\text{CO}_2 \text{ Emissions}_{\text{intermodal shipment}} = \text{Shipment Weight} * \text{Origin Drayage} * \text{Drayage Emission Factor} + \text{Shipment Weight} * \text{Rail Linehaul} * \text{Rail Emission Factor} + \text{Shipment Weight} * \text{Destination Drayage} * \text{Drayage Emission Factor}$$

We used 25.2 grams of CO<sub>2</sub> per ton-mile as the rail emission factor.<sup>4</sup> Since no reliable data was available on the drayage transportation, we used the same emission factor as road transportation.

Table 1 compares the annual CO<sub>2</sub> emissions of intermodal vs. truckload:

<sup>2</sup> In this document, we will use the word “ton” as commonly used in the US: one ton is equal to 2,000 lbs. This is internationally referred to as a “short-ton” to differentiate it with a “tonne” or “metric-ton” that is equivalent to 2,204 lbs.

<sup>3</sup> Source: EPA SmartWay Program Shipper Tools, 2012.

<sup>4</sup> Source: GHG Protocol, CO<sub>2</sub> Emission Factors by Weight Distance, August 2012. CO<sub>2</sub> emissions are commonly reported in metric units (grams, kilograms and tonnes)

Mode	Distance per Shipment	Total Annual Weight	Total CO2 Emissions
<b>Truckload</b>	1,100 miles	11,550 tons (616 loads)	1,900 tonnes <sup>5</sup>
<b>Intermodal</b>	120 Drayage + 1,200 rail	11,550 tons (308 boxcars)	565 tonnes

*Table 1. Summary of Emissions of Truckload vs. Intermodal*

Besides transportation rate savings of over \$200 per load, our analysis showed that by shifting to intermodal transportation Ocean Spray has saved over 1,300 tonnes of CO<sub>2</sub>, a 68% reduction, equivalent to saving over 100,000 gallons of fuel or removing more than 180 passenger vehicles off the road.

### **Zero Emissions Shipments?**

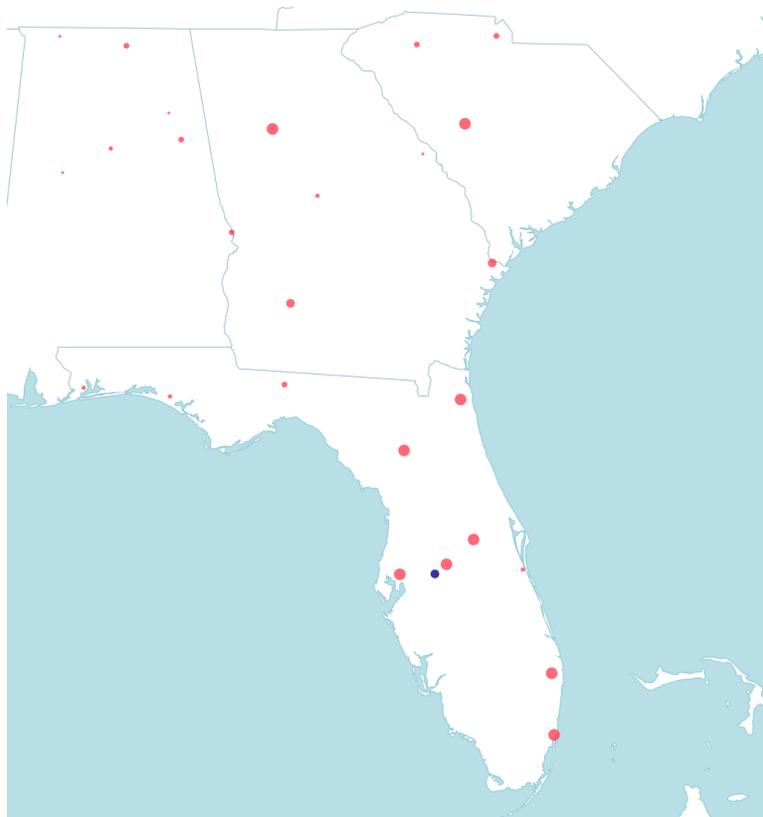
In this example, the rail line haul used by Ocean Spray to move products from New Jersey to Florida was already operational. The marginal contribution on fuel consumption that Ocean Spray cargo added to the rail transportation was very small. It could be argued that the rail emissions should have been allocated to all the other CSX customers using that service. In our calculations we are assigning a proportional amount of these emissions to Ocean Spray even though some of those were already being generated prior to implementing the modal shift. Could the Ocean Spray rail shipments be considered “zero-net emission”?

In the short term they may well be; the goods are now being moved without CSX generating additional emissions. Our calculation is only allocating emissions to Ocean Spray that were previously assigned to other shippers. During its next emissions computation, CSX should start seeing a decrease in the emission factor and everyone will then reap the benefits of the increased efficiency. However, if the service is overloaded, emissions per ton-mile may increase again. If this were the case, the resulting overall emissions, would still be lower than truckload emissions.

<sup>5</sup> one tonne = 1,000 kgs = 1.1 ton = 2,205 lbs

## CO<sub>2</sub> Impact of a Distribution Network Redesign

To support customer growth, Ocean Spray added new manufacturing and distribution capabilities in Florida. To properly realign customers, transportation flows and to integrate this new operation, Ocean Spray conducted a national network re-design project to determine which customers will be served from the new location. Ocean Spray projected that over 17% of the total shipments will be served from the new facility (see Figure 2).



*Figure 2. Example of markets (red dots) to be served from the new Ocean Spray operation in Florida (blue dot)*

After optimizing the network to minimize total transportation costs, Ocean Spray estimated that there would be a reduction potential of over 10% on annual transportation costs, with the bulk of the savings coming from serving the Florida, Georgia, Alabama and South Carolina markets more efficiently.<sup>6</sup> Table 2 shows some basic statistics comparing both networks. Ocean Spray reduced 18% miles traveled across its network through increase capabilities in Florida.

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<sup>6</sup> This cost reduction only reflects transportation and does not include any of Ocean Spray investments in facilities and labor to support the Florida operation.

Distribution Network	Shipments	Distance Traveled	Weight - Distance Shipped
<b>Before Florida Operation</b>	52,500	24.5 million miles	490 million ton-miles
<b>After Florida Operation</b>	52,500	20.2 million miles	402 million ton-miles

*Table 2. Impact of Adding Florida Operations in Logistics Flows*

Using the same data that was collected for the network redesign project, we can estimate the annual reduction of CO<sub>2</sub> by using the following formula:

$$\text{CO}_2 \text{ Emissions}_{\text{road shipment}} = \text{Shipment Weight} * \text{Road Distance} * \text{Road Emission Factor}$$

We used again the 149.7 grams of CO<sub>2</sub> per ton-mile as the road emission factor and applied it to the same shipment level data used for optimizing the network. We estimate that Ocean Spray will be saving 14,000 tonnes of CO<sub>2</sub> per year, a 17% reduction in CO<sub>2</sub> with over 70% of those savings coming from reduced mileage into the southeast region of the United States.

#### Scope and Precision

All carbon footprint calculations need to be very transparent with regard to the scope and level of detailed use. We only included transportation emissions for the Ocean Spray network redesign calculations. The calculations described included all the product flows in the network. However, we did not include any emissions due to electricity, packaging or waste of the newly added facility. Some of the CO<sub>2</sub> (and cost) savings may be offset by increases in emissions (and cost) elsewhere in the company or the supply chain. Transportation is just one piece of the puzzle.

In terms of precision, we conducted a detailed validation of transportation emissions using higher-level resolution of the transportation network (e.g. considering different truck types, empty miles and utilization levels). Since GHG Protocol and carrier specific emission factors do vary (see Caterpillar Case Study) the absolute emissions may change. However, the results were very consistent in terms of relative savings. Why? Ocean Spray covers all major markets in the United States so variations tend to average back to the mean and total savings are robust.

## Summary

Companies regularly redesign their transportation networks to better server their customers. These network adjustments usually translate into cost savings due to reduce mileage or the shifting of transportation modes whenever possible. As the Ocean Spray case study demonstrates, an improved and more efficient distribution network often results in significant CO<sub>2</sub> emissions savings since they are related to the same drivers that reduce transportation costs: less miles and more fuel efficient modes. Ocean Spray is planning to include CO<sub>2</sub> savings on a regular basis to evaluate its transportation decisions. This will allow them to refine their emission factor data over time, and further uncover emission reduction opportunities.

## ACKNOWLEDGEMENTS

This research would not have been possible without the funding and support of the Environmental Defense Fund (EDF). Special thanks to Jason Mathers for his support, guidance and encouragement despite the numerous delays, but most importantly, for his commitment to allow the research to proceed independently throughout the case study development process.

I would like to thank my research team and collaborators at the MIT Center for Transportation & Logistics: Dr. Tony Craig, Dr. Cissy Yang, Peter Oberhofer (visiting from WU Vienna) and Professor Jan Fransoo (visiting from TUE Netherlands) that participated in the analysis and review of the case studies at various stages. I would also like to acknowledge the incredible help from Lena Goodwin whose writing and editorial support made this case study a reality. To all the MIT Center for Transportation & Logistics staff, especially Tara Faulkner and Ken Cottrill, that suffered the deadlines and pressures of getting this case study out the door.

Finally, I would like to express my gratitude to Kristine Young, Becky Weber, June Youngs, Wayne Tessin, Ron Day and Doug Ward from Ocean Spray that invested their time and effort in providing all the information we needed and had the patience to answer our questions despite our long periods of silence.