LIFE CYCLE INVENTORY
OF REUSABLE PLASTIC CONTAINERS
AND DISPLAY-READY CORRUGATED CONTAINERS
USED FOR FRESH PRODUCE APPLICATIONS

FINAL REPORT

Prepared For

REUSABLE PALLET & CONTAINER COALITION

By

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PREFACE

The report that follows is a Life Cycle Inventory (LCI) of two types of shipping containers used for shipping fresh produce: reusable plastic containers (RPCs) and display-ready common footprint corrugated containers (DRCs). The study was conducted for the Reusable Pallet and Container Coalition (RPCC) under the management of Jeanie Johnson, Executive Director of RPCC.

At Franklin Associates, the project was managed by Beverly J. Sauer, who served as primary life cycle analyst in developing the model, running the models and analyzing results, and preparing the report. James Littlefield assisted with data analysis and modeling. William E. Franklin provided overall project oversight as Principal in Charge.

Franklin Associates gratefully acknowledges significant contributions to this project by RPCC member companies, whose assistance in providing data on RPC processes and characterizing the operation of RPC pooling systems was invaluable.

In analyzing and presenting the results of this LCI study, the report makes no claims regarding the superiority or equivalence of the container systems studied. Comparative assertions are defined by ISO 14040 as “environmental claim(s) regarding the superiority or equivalence of one product versus a competing product which performs the same function.” The authors discourage the use of this study as the sole basis for comparative assertions of environmental superiority or preferability.

This study was conducted for RPCC by Franklin Associates as an independent contractor. The findings and conclusions presented in this report are strictly those of Franklin Associates. Franklin Associates makes no statements nor supports any conclusions other than those presented in this report.

EXECUTIVE SUMMARY
FOR
LIFE CYCLE INVENTORY
OF REUSABLE PLASTIC CONTAINERS
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INTRODUCTION

Continuous environmental improvement has become a principle of most business and government organizations, with particular attention to reductions in energy use, reductions in greenhouse gases (GHG) and reductions in solid waste. The report that follows is a supply chain analysis of two types of packaging used for shipping fresh produce. The two types of containers evaluated are reusable plastic containers (RPCs) and display-ready common footprint corrugated containers (DRCs). The analysis includes different sizes and weights of containers used in ten produce applications.

This study of the two types of containers is a Life Cycle Inventory (LCI), which identifies and quantifies energy and material inputs and emissions to the air, water, and land over the life cycle of a product system. The life cycle steps analyzed in this study include extraction of raw materials from the earth, materials and container manufacture, outgoing transportation of containers, backhauling and washing of empty RPCs, recycling of DRCs and RPCs, and end-of-life disposition. Thus, the study is a full systems analysis for the entire supply chain for the two types of containers. The discussion of LCI results focuses on energy use, GHG releases, and solid waste.

PURPOSE OF THE STUDY

The purpose of this study is to identify and quantify the energy, solid wastes, and atmospheric and waterborne emissions associated with RPCs and DRCs used for shipping fresh produce. Ten different high-volume produce applications were analyzed.

KEY FINDINGS

For the average condition produce shipping scenarios analyzed within the defined scope of this study, findings indicate that, on average across all 10 produce applications, RPCs:

- Require 39% less total energy
- Produce 95% less total solid waste
- Generate 29% less total greenhouse gas emissions

than do DRCs for corresponding produce applications. These findings can be explained as follows:

One factor dominates the findings. Multiple trips ("turns") in an RPC closed operating system lead to materials efficiencies that create relatively low environmental burdens that are only partly offset by backhaul and cleaning steps. In the DRC system a container is manufactured for each trip to retail. Recovery and recycling rates for DRCs are high, but the production step (including recycling) introduces a higher level of burdens. In the case of RPCs and DRCs, multiple reuses of RPCs result in lower environmental burdens than single-trip DRC containers.

- **The more lifetime uses that can be achieved for an RPC, the lower the environmental burdens for container production that are allocated to each use of the container.** Thus, the success of a reusable container system depends on keeping RPCs in circulation for repeated reuse and recycling.

  Maximum reductions in container production burdens and disposal burdens are achieved by multiple uses of a container without remanufacturing (i.e., RPC reuse compared to DRC recycling).

- Total System Energy Results

  In almost every product application studied, the benefits of the closed-loop RPC pooling operation more than offset the benefits of lighter container weight and a high recycling rate for corrugated containers. As a result, total energy requirements for RPCs are lower than corresponding DRCs in all average use scenarios. RPCs also have lower total energy requirements than corresponding DRCs in eight out of ten alternative scenarios evaluating the effects of lower reuse rates and higher loss rates for RPCs compared to lightweighted DRCs.

- Total System GHG Results

  GHG results generally track closely with fossil fuel consumption, since that is the source of the majority of GHG emissions. GHG comparisons for the RPC and DRC average scenarios are lower for RPCs for 18 of 20 average scenarios covering 10 produce applications.

- Total System Solid Waste Results

  RPCs produce less solid waste than corresponding DRCs in all produce applications and scenarios. This is due to several key factors:

  - The burdens for production of RPCs are allocated over a (large) number of useful lives,
  - RPCs that remain in the closed-loop pooling system are recycled when they are removed from service,
  - Losses of RPCs from the closed-loop system are small,

  - DRCs make only one trip before they are recycled (requiring repulping and remanufacture) or disposed.

- EPA has long used the waste management hierarchy of "Reduce, Reuse, Recycle." This LCI considers all three techniques: reduction in weight of DRCs, reuse of RPCs, and recycling of both RPCs and DRCs. The results indicate that, for the produce applications studied, **reuse** with closed-loop recycling at end of life is the most efficient means of reducing not only solid waste but also energy use and GHG emissions. Reduction in container weight was observed to reduce not only the environmental burdens for container production and end-of-life management, but also the burdens for container transportation (less weight to haul = less fuel consumption). In this study, lightweighting was evaluated only for DRCs; however, the observations about the benefits of lightweighting hold true for any type of container.

The following sections describe in more detail the systems studied, data sources, key modeling assumptions, and LCI results.

SYSTEMS STUDIED

Two general types of container systems are analyzed in this study: RPCs and DRCs. Various sizes and weights of containers are analyzed in the study for use in ten fresh produce applications. The produce applications studied were selected from high-volume commodities representing a range of product sizes and weights and a range of container sizes used for packing. Table ES-1 shows the container weights and packing data for each fresh produce application.

Table ES-1

CONTAINER WEIGHTS AND PACKING

	Average Weight per Empty Container (lb)		**Pounds of Produce per Container**		**Thousand Container Movements Required to Ship 1,000 Tons of Produce**	
	RPC	**DRC**	**RPC**	**DRC**	**RPC**	**DRC**
Apples	5.4	1.8	41	40	48.5	50.0
Bell Peppers	4.8	2.0	25	26	79.4	76.9
Carrots	5.1	2.0	48	48	41.7	41.7
Grapes	3.3	1.7	19	21	105	95.2
Lettuce - head	5.3	2.5	35	40	56.8	50.0
Oranges	4.8	2.2	40	40	50.0	50.0
Peaches/Nectarines	3.5	1.9	34	35	58.4	57.1
Onions	3.9	1.8	40	40	50.0	50.0
Tomatoes	3.9	1.5	28	28	71.4	71.4
Strawberries	2.5	0.9	9	9	222	222

The corrugated containers analyzed in this study are "common footprint" containers that have the same base dimensions as RPCs; thus, the pallet and truck loading are very similar for RPCs and DRCs in corresponding produce applications. There are some minor loading differences due to variations in container heights. Also, in some applications trucks pack out by weight sooner with RPCs compared to corresponding DRCs due to the heavier container weight for RPCs.

The RPCs analyzed in this study operate in a closed pooling system. In this type of system, ownership of the containers is maintained by a company (the pooler) that operates depots at various locations across the country. The depots are the locations where containers are issued to users and returned from users. The user leases the containers from the pooler, and the pooler inspects containers after use, cleans them, and keeps them in good repair so they can be used over and over again. In addition to high reuse rates, another benefit of maintained ownership is that the pooler maintains control of the containers for end-of-life management. Damaged containers are removed from service by the pooler and sent to RPC manufacturers to be reground and made back into containers.

RPCs are modeled at the average weight, lifetime use rate, and loss rate reported by four poolers. DRCs are modeled at the reported container weight for one-piece folded boxes. Additional scenarios are evaluated for sensitivity analysis, to examine the effects of reduced backhaul distance for RPCs, a lower reuse rate and higher loss rate for RPCs, and container lightweighting for DRCs.

FUNCTIONAL UNIT

In order to ensure a valid basis for comparison for the container systems studied, a common functional unit is essential. For this study, the functional unit for each system is shipment of 1,000 short tons (two million pounds) of each type of produce using RPCs and DRCs.

SCOPE AND BOUNDARIES

The produce container system models include the following steps:

- Production of virgin polypropylene resin (beginning with raw material extraction) and RPC manufacture
- Production of corrugated containers with industry average recycled content (including collection and processing of postconsumer corrugated boxes and industrial scrap as well as virgin inputs to box manufacture)
- Transportation of containers to growers
- Transportation of packed containers from growers to retail
- Backhauling, washing, and reissue of RPCs
- Recycling and disposal of DRCs at end of life
- Recycling of RPCs retired from service
- Disposal of RPCs lost during use

The analysis does not include environmental burdens for growing the produce, nor is any additional packaging of produce (e.g., plastic film bags, individual strawberry containers, etc.) included in the analysis. Printing of corrugated boxes and labeling of RPCs is not included. The analysis does not attempt to evaluate differences in produce damage and spoilage associated with use of the different types of containers. The analysis does not include any analysis of differences in labor associated with the different containers.

DATA SOURCES

Data on RPC systems, including RPC weights, reuse and loss rates, loading, transportation modes and distances, and washing, were provided by RPCC member companies. Weights and loading for DRCs were provided by a DRC producer. DRC weights were validated using Corrugated Packaging Alliance (CPA) case studies on three produce applications that correspond to applications analyzed in this study.

Production of RPCs was modeled using industry average data for the production of polypropylene resin and RPC fabrication data provided by RPC producers. Production of DRCs was modeled using industry average data for the production of the various virgin and recycled paperboard inputs to linerboard and medium, production of linerboard and medium, and box fabrication, recovery, and recycling. Paperboard industry statistics were used to model the composition and recycled content of linerboard and medium and the iterative cycles associated with recovery and recycling of boxes at end of life.

MODELING APPROACH

Key data and issues in modeling the container systems include RPC lifetime trip rates, pooling system operation, RPC backhauling, DRC box weights, and end-of-life management of containers. A more detailed discussion of individual issues can be found in the corresponding sections of Chapter 2.

RPC Lifetime Trip Rates

Data on average RPC lifetime trip rates were provided for this study by RPCC member companies involved in produce shipping using pooled RPCs. The total number of lifetime trips for an RPC is equal to the number of trips ("turns") per year times the number of years the container remains in service. The number of turns per year depends on the transportation distances and handling logistics, not on the properties of the RPC itself.

This study uses the standard LCI basis of product functionality, which in this case is the average number of trips an RPC is expected to make before it is removed from service for wear or damage, regardless of the number of years it takes to make that number of trips. The lifetime trip rate affects the modeling of the number of RPCs (and associated resin) that must be produced to replace the RPCs "used up" for shipping 1,000 tons of produce, as described in the following section.

RPC Pooling Operation

An important assumption in the modeling of RPC systems in this analysis is the assumption that the pooling system is a shared-use pool operating at steady state. That is, it is assumed that a pool of RPCs is already in existence and available for any and all applications (produce or other) that use each size of RPCs. Thus, each produce system is charged with replacing the number of RPCs "used up" by shipping that commodity, based on the number of shipments in RPCs required to move the produce divided by the useful lives per RPC, plus replacement of losses of RPCs during use, e.g., due to theft.

Although an excess supply of RPCs ("float") must be in place throughout the system in order to ensure that a sufficient number of RPCs are circulating to and from growers and retailers within the time frame to meet their needs, these RPCs are available for any and all uses of each size RPC rather than designated specifically for a certain type of produce.

For a shared-use pool of RPCs, any use of the RPCs for any application is withdrawing RPC **uses** from the pool rather than individual containers. To calculate the number of RPCs "used up" for shipping 1,000 tons of produce, the number of RPC trips required to ship 1,000 tons is divided by the number of lifetime trips per RPC and adjusted for the loss rate to determine the number of RPCs that must be produced to replace the RPC uses withdrawn from the pool.

RPC Backhauling

The pooling system operates nationwide, enabling growers to obtain RPCs from the nearest pooling location, regardless of where the RPCs were used prior to arrival at that pooling location. For this study, poolers reported the full backhaul distance from produce retailer to pooler back to grower (including routing through a washing facility) *specific to each produce application*.

In reality, taking into account movements of RPCs from all uses to all pooling locations, the average distance from an end user to a pooling location to a grower is likely considerably shorter, since empty RPCs returned to a pooler may be reissued to any user needing that size RPC; they are not required to be returned to the original grower location. However, because it is not possible to estimate with certainty where the empty RPCs came from to the pooling location, this analysis modeled RPC backhauling for each commodity as if the RPCs used for each type of produce were returned to the growers of that type of produce. This would be the maximum backhaul distance. For sensitivity analysis, each commodity is also evaluated at 20% reduced backhaul distance to illustrate the probable effect of shared-use pool operation.

DRC Box Weights

The weights of DRCs used in the average scenario are the weights reported by a producer of DRC containers and represent the weight of a one-piece folded box, which is the more prevalent DRC used in produce applications according to a contact at the CPA. Bliss boxes are another type of DRC container that can be used. Bliss boxes provide more strength per unit weight, but are more expensive and require that the user purchase equipment to convert the blank into a box by folding and gluing.

The DRC box weights provided by the DRC producer were compared to box weights in three case studies on costs of produce shipping in RPCs and corrugated published by the CPA. For the three produce applications (apples, oranges, and grapes), the corrugated box weights used in the CPA studies were 10 to 20 percent higher than the box weights modeled in the LCI study for the same produce applications. Thus, the weights used in the LCI study for the "average" DRC scenario already appear to be somewhat conservative for corrugated. In addition, to account for potential lightweighting of corrugated containers (e.g., achieved through redesign or perhaps use of a bliss box), the conservative scenario in the LCI evaluated DRCs at 10 percent lightweighting, i.e., 90 percent of the weight reported by the DRC producer.

End-of-life Management

RPCs. Poolers report that RPCs that are removed from service are returned to RPC producers, where they are reground and used to produce new RPCs, which will in turn be recycled when they are retired from service. This is considered closed-loop recycling. No burdens for disposal are assigned to the RPCs that remain in the system and are repeatedly recycled back into RPCs when they are removed from service after each multi-trip, multi-year life cycle. Retired RPCs that are not recycled back into RPCs would most likely be recycled into durable products such as plastic lumber, indefinitely diverting the material from disposal.

Although the material in the RPCs may ultimately be recycled many times, this analysis uses a conservative approach in allocating the burdens for production of the virgin material between the initial use and the first recycled use, rather than allocating over a larger number of lifetime cycles of RPC use and recycling.

All RPCs that are lost from the system during use are modeled as entering the municipal solid waste stream, where they are managed by a combination of landfilling and waste-to-energy incineration, as described below.

DRCs. The recovery rate for corrugated containers is about 70 percent overall in the U.S.[1]; however, recovery of corrugated containers from grocery stores is much higher and is modeled in this study at a rate of 95 percent. Thus, only 5 percent of corrugated containers are modeled as being directly disposed after use. For the 95 percent of boxes

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[1] U.S. Environmental Protection Agency. **Municipal Solid Waste in the United States: 2001 Facts and Figures.** EPA/530-R-03-011. October 2003. Table 22.

that are recovered, burdens for production and disposal of the box are allocated between the produce box and secondary uses of the recovered fiber based on the percentages of open- and closed-loop recycled content in the box. Further explanation of this allocation can be found in the Recycling Allocation section of Chapter 1.

For RPCs and DRCs that are disposed, disposal is modeled as 80 percent landfill and 20 percent waste-to-energy incineration[2]. An energy credit is assigned to each system based on the weight of containers burned and the higher heating value of the material.

LCI RESULTS

Energy, solid waste, and greenhouse gas results for each application are summarized in Table ES-2.

For each produce application, Table ES-2 shows results for three RPC scenarios and two DRC scenarios, representing average container weights, reuse rates, and losses as well as scenarios with reduced RPC backhauling, reduced RPC reuse rate, increased RPC loss rate, and DRC lightweighting. Lower reuse rates and higher loss rates for RPCs mean that more containers must be manufactured to transport the same quantity of produce, more lost containers end up in solid waste, and there is more material to be recycled from retired containers.

DRCs results are shown for container weights reported by a DRC producer and for 10 percent lightweighting. For the DRCs, lightweighting reduces manufacturing requirements, transportation requirements, and disposal burdens.

Table ES-2 shows percent difference comparisons between RPCs and DRCs for the following scenarios:

- Average RPC (average reuse and loss rate) at maximum backhaul distance compared to average DRC (reported weight for folded box)
- Average RPC (average reuse and loss rate) at 20% reduced backhaul distance (“80% BH” in table) compared to average DRC
- Conservative scenario: RPC at 75% of average reuse rate, twice the average loss rate, maximum backhaul distance compared to DRC with 10% lightweighting.

Based on the experience and professional judgment of the analysts and supporting statistical arguments (see Chapter 3), a minimum percent difference of 10% is used as the threshold for considering a difference in energy results meaningful, while a minimum percent difference of 25% is used for GHG. Differences that are inconclusive (e.g., below these thresholds) are shaded in gray in the table.

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[2] Ibid. Table 29.

Table ES-2
Summary of LCI Results for All Produce Container Scenarios
(All results reported on basis of 1,000 tons of produce shipped)

TOTAL ENERGY (million Btu)

	RPCs			DRCs		Percent Difference*		
	avg	avg with 80% BH	conserv	avg	conserv	avg DRC, avg RPC	avg DRC, avg RPC w/80% BH	conserv
Apples	853	789	900	1,073	966	23%	31%	7%
Bell Peppers	1,121	1,040	1,188	1,818	1,637	47%	54%	32%
Carrots	531	504	567	981	883	60%	64%	44%
Grapes	1,080	1,010	1,141	1,920	1,729	56%	62%	41%
Lettuce - head	905	839	958	1,485	1,338	49%	56%	33%
Oranges	650	601	692	1,241	1,117	63%	70%	47%
Peaches/Nectarines	671	621	707	1,284	1,156	63%	70%	48%
Onions	533	501	566	1,075	968	67%	73%	52%
Tomatoes	797	736	846	1,241	1,117	44%	51%	28%
Strawberries	1,975	1,858	2,071	2,455	2,212	22%	28%	7%

TOTAL SOLID WASTE (tons)

	RPCs			DRCs		DRC/RPC		
	avg	avg with 80% BH	conserv	avg	conserv	avg DRC, avg RPC	avg DRC, avg RPC w/80% BH	conserv
Apples	1.35	1.32	1.60	25.3	22.8	18.8	19.2	14.2
Bell Peppers	1.99	1.96	2.37	43.2	38.9	21.7	22.1	16.4
Carrots	1.04	1.03	1.25	23.4	21.1	22.4	22.7	16.8
Grapes	2.15	2.12	2.50	45.5	41.0	21.2	21.4	16.4
Lettuce - head	1.53	1.50	1.82	35.1	31.6	23.0	23.5	17.3
Oranges	1.23	1.21	1.47	30.2	27.2	24.5	24.9	18.5
Peaches/Nectarines	1.25	1.23	1.45	30.5	27.5	24.4	24.8	18.9
Onions	1.09	1.07	1.28	25.7	23.1	23.7	24.0	18.2
Tomatoes	1.57	1.54	1.84	30.1	27.1	19.2	19.6	14.7
Strawberries	4.03	3.98	4.57	55.6	50.1	13.8	14.0	11.0

TOTAL GREENHOUSE GAS (tons CO2 equivalents)

	RPCs			DRCs		Percent Difference*		
	avg	avg with 80% BH	conserv	avg	conserv	avg DRC, avg RPC	avg DRC, avg RPC w/80% BH	conserv
Apples	62.7	57.5	64.3	67.1	60.5	7%	15%	-6%
Bell Peppers	81.3	74.7	83.6	113	102	33%	41%	20%
Carrots	37.8	35.6	39.0	61.1	55.1	47%	53%	34%
Grapes	78.3	72.6	80.4	120	108	42%	49%	29%
Lettuce - head	65.9	60.5	67.7	92.8	83.6	34%	42%	21%
Oranges	46.6	42.7	48.1	76.9	69.2	49%	57%	36%
Peaches/Nectarines	49.0	44.9	50.2	80.1	72.2	48%	56%	36%
Onions	38.2	35.7	39.4	67.0	60.3	55%	61%	42%
Tomatoes	57.5	52.5	59.3	77.0	69.3	29%	38%	16%
Strawberries	145	135	148	155	140	7%	14%	-6%

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* Percent difference = (difference between system results)/(average of system results)
Percent difference is considered inconclusive if <10% for total energy or <25% for GHG.
Inconclusive results comparisons in the table are shaded gray.
Average scenario defined as RPC with average use/loss rates (separate results for maximum and 80% backhaul) and reported weight DRC.
Conservative scenario for RPC is use rate at 75% of average and loss rate 2 x the average loss rate. Conservative scenario for DRC is 10% lightweighting.

Energy Results

Energy totals include process energy and transportation energy. For RPCs, total energy also includes the energy content of fuel resources (petroleum and natural gas) used as material feedstocks for the production of plastic resin.

DRCs require more energy than RPCs for cradle-to-production manufacture of containers, transportation of new containers to growers, and end-of-life management. RPCs require more energy for transportation of packed containers from growers to grocery stores. RPCs also require energy for backhauling and washing; there are no corresponding energy requirements for DRCs.

Total energy comparisons are summarized in Table ES-2 and shown graphically in Figures ES-1 for average scenarios and ES-2 for conservative scenarios. All comparisons in all scenarios are lower for RPCs except the conservative scenario comparisons for apples and strawberries, where the differences were inconclusive.

Solid Waste Results

Total solid wastes include process wastes, process fuel-related wastes, fuel-related wastes for container transportation, and postconsumer wastes. Process wastes are wastes that directly result from a process, such as sludges, unusable byproducts, unrecycled off-spec product or trim scrap, etc. Fuel-related wastes are the wastes associated with the production and combustion of fuels used for process energy or for transportation fuel. Postconsumer wastes are the wastes resulting from the end-of-life management of containers and include landfilled containers and ash from containers that are burned.

Comparisons of solid waste by weight are summarized in Table ES-2 and shown graphically in Figure ES-3 for average scenarios and Figure ES-4 for conservative scenarios. RPC systems produce a fraction of the solid wastes produced by corresponding DRC systems. On average, DRCs produce 21 times as many tons of solid waste as average RPCs with maximum and 20% reduced backhaul, and 16 times more solid waste than RPCs in the conservative scenario.

Emissions Results

Detailed lists of the atmospheric and waterborne emissions for each container system in each business unit are shown in Chapter 2. The discussion here focuses on the high priority atmospheric issue of greenhouse gas (GHG) emissions. The primary three atmospheric emissions reported in this analysis that contribute to global warming are fossil fuel-derived carbon dioxide, methane, and nitrous oxide. (Carbon dioxide released from the combustion of wood wastes is considered “climate neutral”, as it simply returns to the atmosphere the carbon dioxide that was taken up by the tree during its growing cycle.) The global warming potential shown in Table ES-2 and Figure ES-3 for each system is the sum of the weights of fossil carbon dioxide, methane, and nitrous oxide emissions multiplied by their 100-year global warming potentials.

A summary of GHG results is shown in Table ES-2. Figure ES-5 shows comparative GHG results for average scenarios, and Figure ES-6 shows comparative results for conservative scenarios. For the average scenarios, total GHG emissions for RPCs are lower than for corresponding DRCs for all applications except apples and strawberries. These are the applications that had the closest energy results. GHG results generally track closely with fossil fuel consumption, since that is the source of the majority of GHG emissions. For the conservative scenario comparisons, RPCs had lower GHG emissions in half the comparisons, and half were inconclusive. Lower RPC use rates and higher loss rates increase the GHG emissions for RPC production, while the container transportation GHG that dominate GHG for RPCs remain constant. Lightweighting DRCs reduces GHG burdens for all life cycle stages – production GHG, which are the dominant source of GHG for DRCs, transportation GHG, and end-of-life GHG.

Figure ES-1. Average Scenario Energy Comparison
(RPC at avg reuse and loss rate, max backhaul and 80% backhaul; DRC at reported weight)

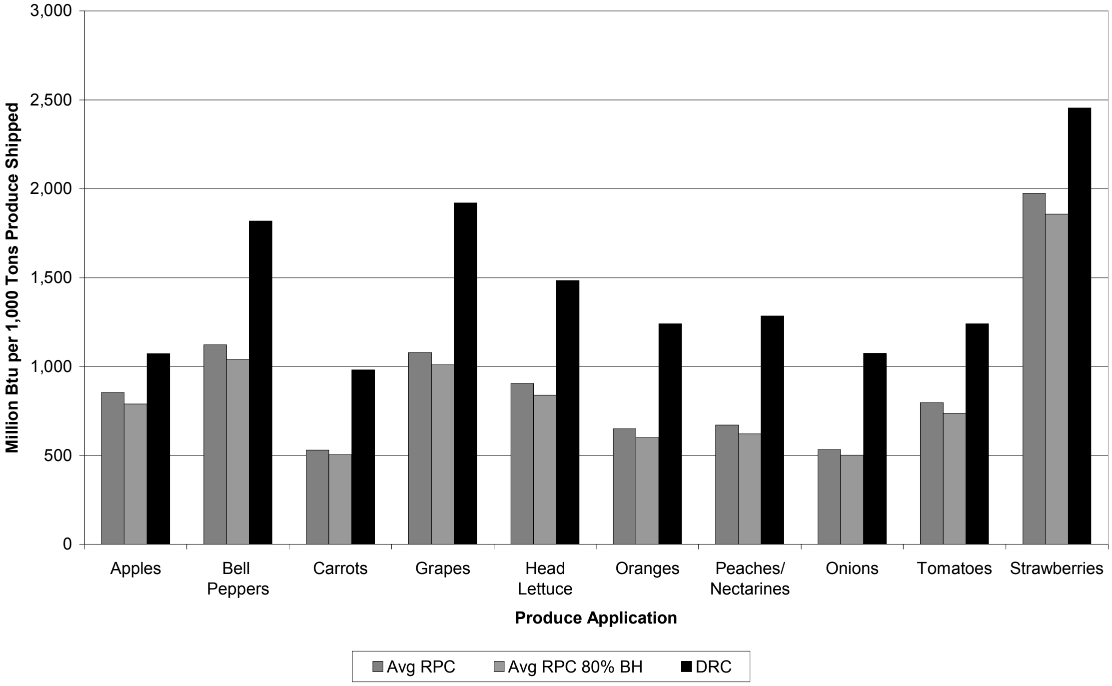

Figure ES-2. Conservative Scenario Energy Comparison
(RPC at 3/4 avg reuse rate and 2x avg loss rate, 10% lightweighted DRC)

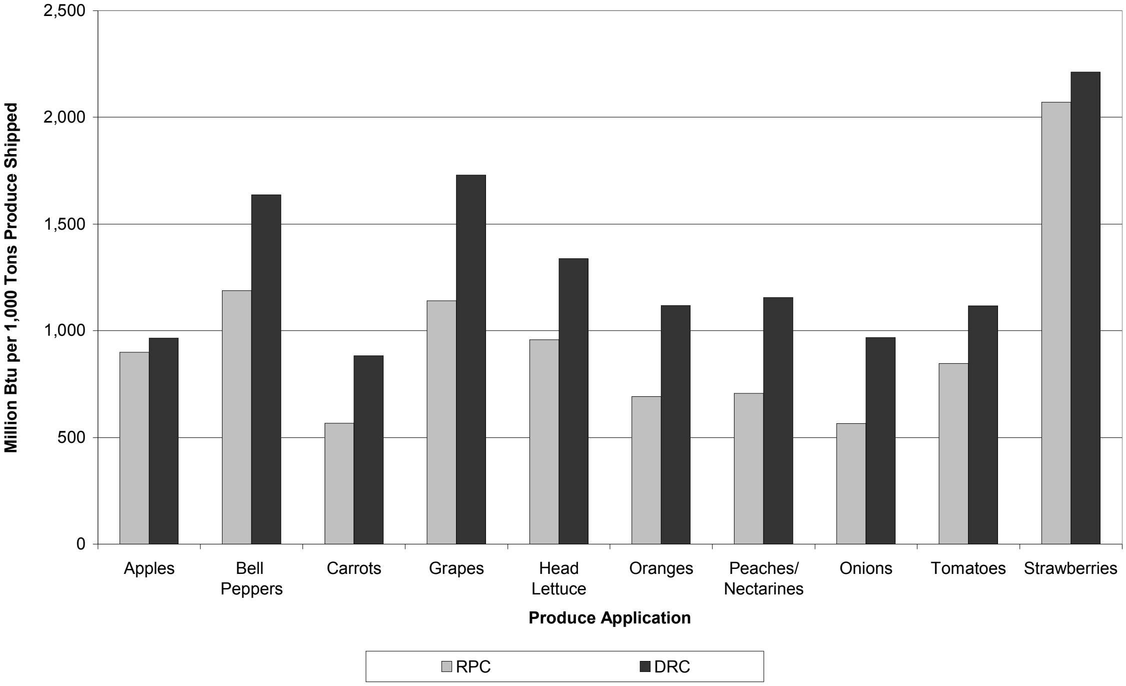

Figure ES-3. Average Scenario Solid Waste Comparison
(RPC at avg reuse and loss rate, max backhaul and 80% backhaul; DRC at reported weight)

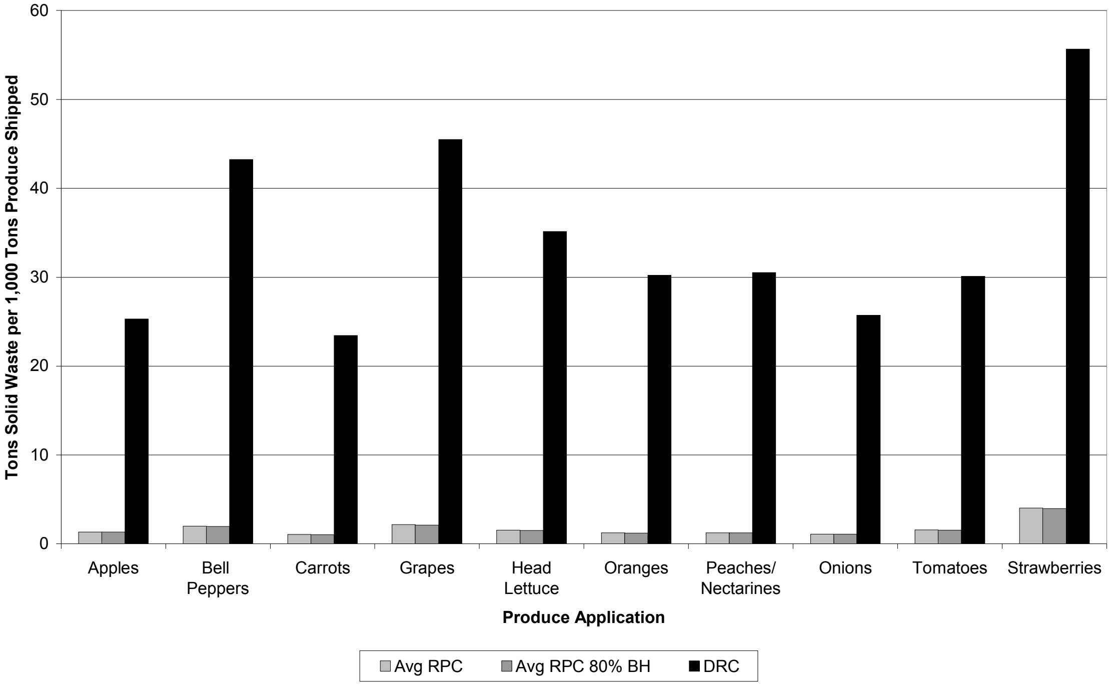

Figure ES-4. Conservative Scenario Solid Waste Comparison
(RPC at 3/4 avg reuse rate and 2x avg loss rate, 10% lightweighted DRC)

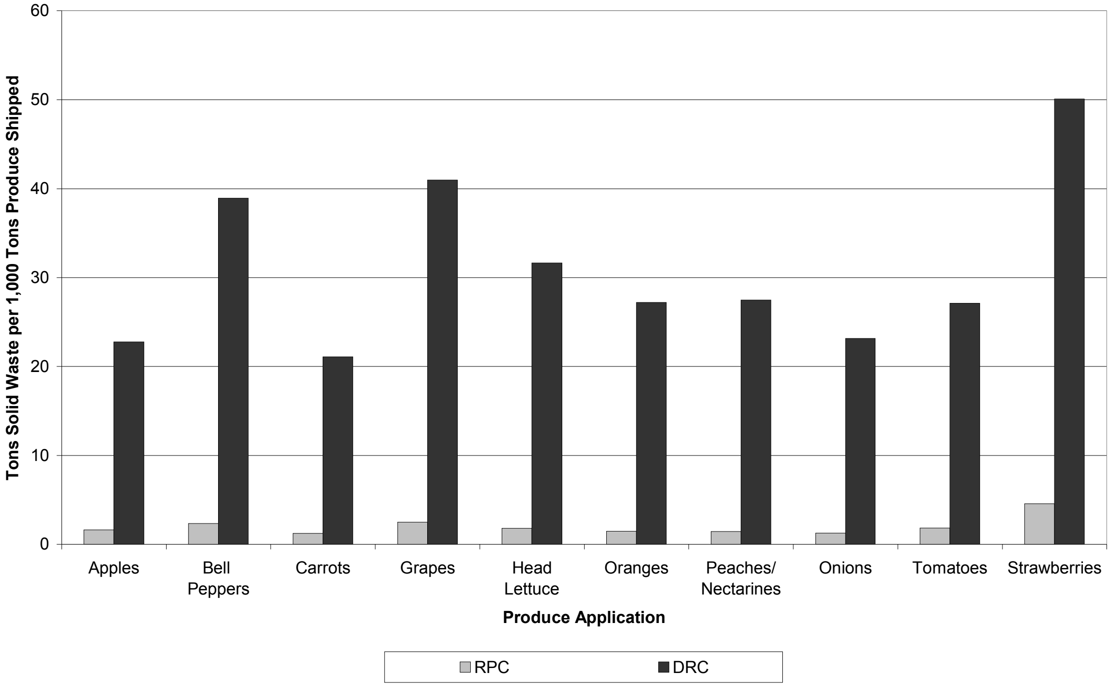

Figure ES-5. Average Scenario GHG Comparison
(RPC at avg reuse and loss rate, max backhaul and 80% backhaul; DRC at reported weight)

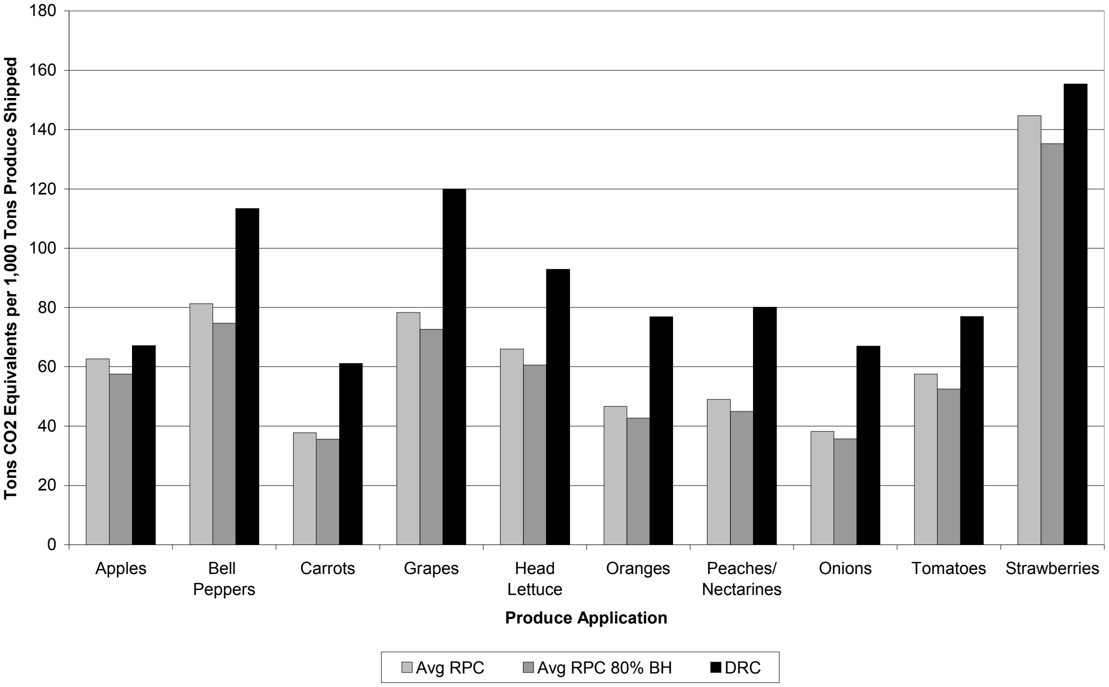

Figure ES-6. Conservative Scenario GHG Comparison
(RPC at 3/4 avg reuse rate and 2x avg loss rate, 10% lightweighted DRC)