FINAL REPORT

Cost-Benefit Analysis

of Six Market Development

Policy Options

July 1993

A Report by California Futures
Prepared for
California Integrated Waste Management Board

California FUTURES

This document is printed on recycled paper.

NOTE: Legislation (SB 63, Strickland, Chapter 21, Statutes of 2009) signed into law by Gov. Arnold Schwarzenegger eliminated the California Integrated Waste Management Board (CIWMB) and its six-member governing board effective Dec. 31, 2009.

CIWMB programs and oversight responsibilities were retained and reorganized effective Jan. 1, 2010, and merged with the beverage container recycling program previously managed by the California Department of Conservation.

The new entity is known as the Department of Resources Recycling and Recovery (CalRecycle) and is part of the California Natural Resources Agency.

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ACKNOWLEDGMENTS

This report provided a unique opportunity to look closely at several policies which, to date, have been discussed only in more theoretical terms. It could not have been prepared without the help of a number of people. California Futures would like to thank the California Integrated Waste Management Board and staff, in particular the Chairman, members, and staff of the Market Development Committee for their input. We would also like to thank the hundreds of experts in the field -- industry spokespeople, recyclers, government officials, and others -- that were interviewed as a part of this report. The information provided by these experts was invaluable. Thanks, also, to our subcontractors, Community Environmental Council, Resource Management Associates, and Escudero and Associates for their valuable contributions.

The findings in this report do not necessarily represent the opinions of the CIWMB or those that were interviewed. The cost-benefit models in this report are based on the best available information from a broad array of sources. As the status of data in the field of waste management and recycling improves, we expect that more detailed or precise figures will become available which might change the results of some of the models. Because of this, the chief value of this model is as a tool for comparing the likely direction and magnitude of market development costs and impacts, and not as a reliable indicator of the precise costs and benefits which would accrue from a specific policy. We welcome comments, suggestions, and data which would improve the model and analysis.

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July 1993

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CHAPTER 1
INTRODUCTION AND SUMMARY

The California Integrated Waste Management Act of 1989 (AB 939) requires that cities and counties divert 25% of their waste stream by 1995, and 50% by 2000. The explosive growth of recycling programs that will need to be put into place is creating an equally explosive growth of secondary materials looking for markets: an estimated 86% increase in paper recovery, 500% increase in plastic, 240% increase in glass, 50% increase in metals, and 1,800% increase in yard waste.[1]

To deal with this massive volume of materials, the California Integrated Waste Management Board (Board) developed a Market Development Plan that identifies goals, strategies, and actions for developing markets. In addition to this plan, the Board retained California Futures to identify policy options that would serve to stimulate markets. The first report, *Developing Sustainable Markets for California's Waste: Market-Based Policy Alternatives* identifies 22 policy options. This report presents a cost-benefit analysis of six of those 22 market development policy options. In addition, we present a waste generation and diversion table estimating state waste generation with and without these policies. The six policies which are analyzed, both with and without tradable credits, are:

- Impose manufacturer responsibility for 50% of the waste stream attributable to products or packages they manufacture (Policy Option 5).[2]
- Require beverage manufacturers to refill at least 15% of the bottles they sell (Policy Option 17).
- Require 80% recycled content in corrugated and boxboard (Policy Option 9).
- Require 30% recycled content in printing and writing paper (Policy Option 10).
- Require public agencies to use 80% compost or mulch from municipal solid waste (Policy Option 1).
- Require 40% recycled content in industrial containers (pails, crates, cases, drums and pallets) (Policy Option 16).

To estimate the costs and benefits of these policies, California Futures developed a model that encompasses the following:

- *Diversion impacts.* How much material will the policy divert?
- *Price and value of the diverted materials.* What is the value of the material that is diverted?

- *Job related impacts.* How many jobs will be created or lost as a direct result of the policy? How many indirect jobs will be created or lost? What is the value of these jobs?

- *The cost of collection, recycling, and processing.* How much does it cost to collect and process the material so that it is suitable for an end-user? How does this compare with the avoided cost of land disposal?

- *Costs to manufacturers.* What additional costs, if any, will manufacturers in the state incur if they are required to manufacture products as specified in the policy?

- *Capital investment.* What level of new capital investment could the policy stimulate in California?

- *Administrative costs.* How much will it cost the public and private sectors to implement the policy?

- *The net cost or benefit of the policy.* Will the policy result in a net cost or a net benefit to the state?

HIGHLIGHTS OF THE ANALYSIS

- *The most cost-effective policies are the 15% refillable market share for glass and plastic, the 80% recycled content in corrugated and boxboard policy, and the 30% recycled content in printing and writing paper policy.*

- *The greatest impact on diversion and markets will result from the manufacturer utilization policies and the 80% recycled content in corrugated and boxboard.*

- *The greatest benefit per job created results from the 80% public procurement of compost.*

- *The highest cost per job - about $1 million - created occurs with the 40% recycled content in plastic industrial containers.*

- *The highest administrative costs occur with the manufacturer utilization policies.*

- *The lowest administrative costs occur with the 30% recycled content in printing and writing paper.*

- *The manufacturer utilization policy becomes cost effective if plastic packaging is removed from the regulated materials. It changes from a net cost of $41 per ton to a net benefit of $68 per ton.*

- *The refillable policy has the potential to create large net benefits, even if the refilling percentage is increased.*

- *The 80% recycled content in corrugated and boxboard is both cost-effective and could create a substantial impact on diversion and paper markets.*

- *The 30% recycled content in printing and writing paper may have a greater impact on high-grade paper markets out of California, where most of this paper is produced.*

- *The 80% public procurement of compost policy has the potential to be cost-effective in theory, however this hinges on massive increases in the use of compost by public agencies, essentially as an alternative to landfilling.*

- *The 40% recycled content policy in plastic industrial containers is not cost-effective due to the high cost of recycling plastic. If the cost of plastic recycling were about $200 per ton, the policy could result in a net benefit.*

EXPLANATION OF THE COST-BENEFIT MODEL

The net cost or benefit of the policy sums the costs and benefits of several of the categories listed above, and provides a means of assessing and comparing the impacts of the policies. The net cost or benefit is determined from the following formula:

Net Benefit (Cost) =
Value of materials diverted
+ Net value of indirect jobs created
- Net cost of collection and recycling
- Total additional cost to end-users
- Public administrative costs
- Private administrative costs.

A positive value for the net benefit or cost means that the policy results in a net benefit to the state, while a negative value means that the policy results in a net cost to the state. A high value, either negative or positive in any one of three key factors in the above equation, can serve to drive the end result of the equation. These factors are: 1) the value of the materials, 2) the net cost of recycling, and 3) the cost to end-users. In general, a net benefit will result when the value of the materials diverted is high or when the net cost of collecting and recycling is negative. This occurs when the value of avoided land disposal is greater than the cost of recycling. The policy will, in general, result in a net cost when the cost of collection and recycling and/or the cost to end-users is high. The other three factors in the above equation, the net value of jobs created, public administrative costs, and private administrative costs, prove to be *relatively* minor contributors to the net benefit or cost of the policy.

The net cost or benefit does not break down the costs and benefits to the different groups impacted by the policy. Benefits and costs will accrue differently to each sector and for each policy. For example, benefits related to avoided land disposal accrue to local governments and rate payers that would normally be disposing of the material and paying for new landfills in the future. The cost to collect and recycle will be incurred by local governments and private recyclers. It may be offset by the benefits these groups receive from the value of the material diverted. The cost to the end-user will be borne directly by manufacturers that are impacted by the policy, as will private administrative costs.

The model evaluates the impacts of these policies over a seven year period, from 1994 through 2000. A net cost or benefit is calculated for each year as well as for the seven year period. Because low, mid, and high diversion and cost estimates are used for several of the categories in the model, the net cost or benefit is presented as a range rather than a single number. For most of the policies the mid-range figure represents the most realistic value given current conditions, while the low and high represent the range of results that might occur if those conditions change.

The following table briefly describes the categories in the model. A full description of the model and examples of the formulas used in the calculations is provided in Appendix A.

THE COST-BENEFIT MODEL

Category	Rationale	Comments
Diversion from policy.	Defines the amount of material the policy will divert and/or for which it will create markets.	Provides basis for further calculations in the model. If the total diversion is high, the model will be more sensitive to changes in cost and benefit factors.
Value of material diverted.	Represents the current economic value of the materials that are being diverted.	As long as the material has some positive value, this entry shows a positive benefit of the policy. A high value will generally result in a net benefit for the policy.
Collection and recycling costs.	Represents the cost of collecting and processing the material under current conditions.	This is a cost of the policy. High costs in this category can result in a net cost of the policy.
Value of avoided land disposal.	Represents the avoided cost of landfilling the material. The level is based on the present value of a new landfill in 2000, which is estimated to cost $124 per ton.	This represents a benefit that accrues to local governments that no longer landfill the material.
Net collection and recycling cost.	This is the difference between the collection and recycling cost and avoided land disposal.	A positive value here means it costs more to recycle the material than it costs to landfill -- there is a net cost to recycle. A negative value here means that it costs less to recycle than it does to landfill, and there is a net benefit to recycling.
Cost to end-user	Represents the additional cost to manufacturers (end-users) to use the secondary material in their products as compared to virgin materials.	This is a direct cost of the policy. For example, an industry might pay more, on a per ton basis, to meet the specifications of the policy. A high cost in this category can result in a net cost for the policy.
Jobs created or lost.	Represents the total number of jobs that result from the policy, summing direct and indirect jobs created and lost.	This category is not directly incorporated into the net cost or benefit of the policy. Net direct job costs are already accounted for in the above categories.
Net value of multiplier jobs created (or lost)	Represents the additional benefit (or cost) to the state's economy of multiplier (indirect) jobs created (or lost) by the policy.	Equal to the number of jobs multiplied by the average salary. If there is net job creation, the value of these jobs is a net benefit of the policy.

Capital investment	Represents additional capital investment in the state that occurs as a result of the policy.	This is not incorporated directly into the net benefit or cost of the policy.
Administrative costs	Represents the additional cost to the public and private sectors to implement the policy.	This is a direct cost of the policy.
Net Benefit or (Cost) of the policy	Provides an overall indicator of the impact of the policy and a means of comparing the policies.	A positive value here means that the policy has a net benefit to the state, a negative value means the policy has a net cost to the state.
Cost or Benefit per ton diverted.	Provides a means of comparing the impact of the policy on a per ton basis.	A positive value means the policy results in a benefit for every ton diverted, a negative value represents a cost to the state for every ton diverted.

Because many of the costs and benefits identified are estimates subject to variation, the chief value of this model is as a tool for *comparing* the likely *direction and magnitude* of market development costs and impacts, and not as a reliable indicator of the precise costs and benefits which would accrue from a specific policy. For example, the model can be properly used:

- To rank the six policies in approximate order of net cost and benefit, and to assess the magnitude and significance of costs and benefits.
- To estimate the magnitude of the policy's effect on supplies.
- To gain insights into the complex issue of job creation and net economic development.
- To identify the degree to which tradable credits may reduce the costs and enhance the benefits of recycled content policy in general.

While it would be convenient to make policy decisions simply based on these analyses, it is important to note that the outcome of the analysis can be changed by relatively modest changes in the assumptions in these models. Policies with large consumption levels - but small marginal benefits, such as the corrugated and compost policies, are particularly vulnerable to change. The net costs or benefits are extremely sensitive to relatively modest changes in figures in the model. To assess the impacts of these changes, we did a sensitivity analysis for each of the policy options. The results of these analyses are discussed in each chapter.

There are a number of impacts that a model such as the one developed here cannot quantify. The analysis of each alternative also includes a discussion of these impacts. Our aim in this analysis is not only to show the impacts of these policies, but to illustrate how the policies might actually work. Often, particularly with market-based mechanisms, there is a gap in understanding between the theory of the policy and its implementation. A clearer understanding of the practical impacts of these policies is essential if they are to become more widely accepted policy tools. Below, we identify some of the difficult-to-quantify impacts that are evaluated in this report.

- Administrative requirements and feasibility. Because recycled content credits are an untried policy, a better understanding of these issues is critical. General administrative issues are summarized in Appendix B.

- Incentives to substitute materials (with both positive and negative impacts).

- Long-term product degradation or quality concerns due to repeated use of secondary materials.

- Equity concerns. The policy may favor one firm or category of firms over another, or may favor one product at the expense of another. Whether or not this is equitable depends on what conditions one is trying to make equal.

- Market impacts. The policy may have market impacts other than those intended.

- The impact and relationship to existing recycling infrastructure. No new solid waste policy is implemented in a vacuum. We will examine how the policy relates to AB 939 and other policies.

- Practical and political feasibility. The political dynamics that underlie each policy are important, and will affect the development of legislation.

- Uncertainty concerns. One of the greatest barriers to new policies such as these is uncertainty about the potential impacts. Here, we will attempt to identify areas of uncertainty and assess potential outcomes.

SUMMARY OF CONCLUSIONS

The cost-benefit model in this report utilizes estimates of solid waste composition, diversion, market prices, recycling costs, and job creation. Detailed estimates used for job creation and loss, particularly in manufacturing, and capital investment, were not available. Therefore, the authors expect the conclusions below could be modified somewhat if more precise information were available. With that caveat, the conclusions of this draft report are as follows:

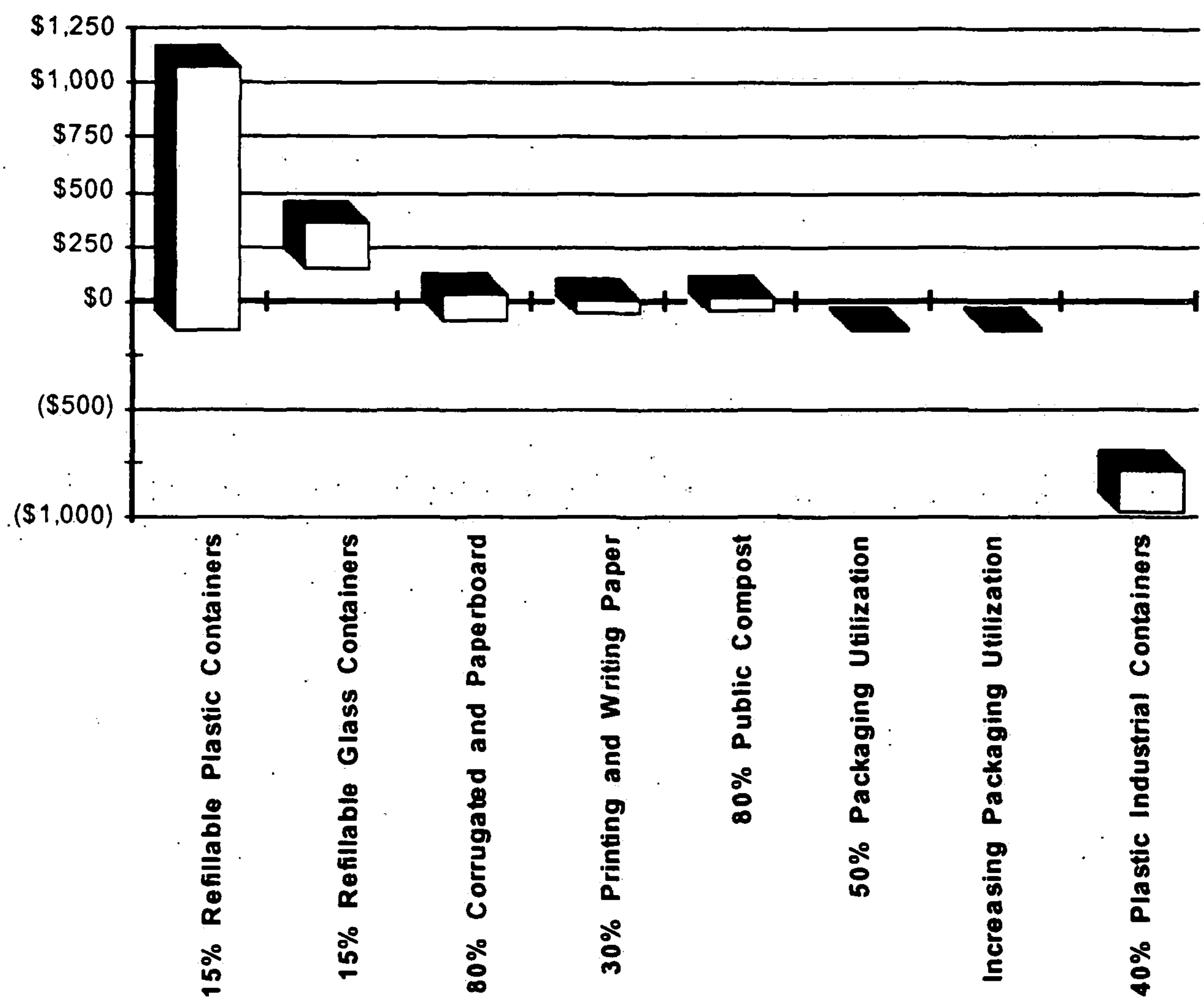
RANKING OF POLICIES

Cost-Effectiveness

The cost-benefit analysis results in the following ranking of the policy options in order of cost-effectiveness, based on the benefit or (cost) per ton of material diverted. The per ton benefit or (cost) represents the marginal benefit of the policy per ton diverted, and thus is used for the overall ranking. The range is due to different assumptions regarding the volume and value of the material diverted by each policy.

Table 1.1 RANKING BY COST-EFFECTIVENESS				
Policy	Rank	Low- $/ton	Mid- $/ton	High- $/ton
15% Refillable Plastic Containers	1	($44)	$1,013	$1,171
15% Refillable Glass Containers	2	$261	$397	$456
80% Corrugated and Paperboard	3	$13	$68	$115
30% Printing and Writing Paper	4	$53	$70	$101
80% Public Compost	5	($32)	$21	$28
50% Packaging Utilization	6		($41)	
Increasing Packaging Utilization	7		($42)	
40% Plastic Industrial Containers	8	($951)	($843)	($733)

Chart 1.1 RANKING BY COST-EFFECTIVENESS



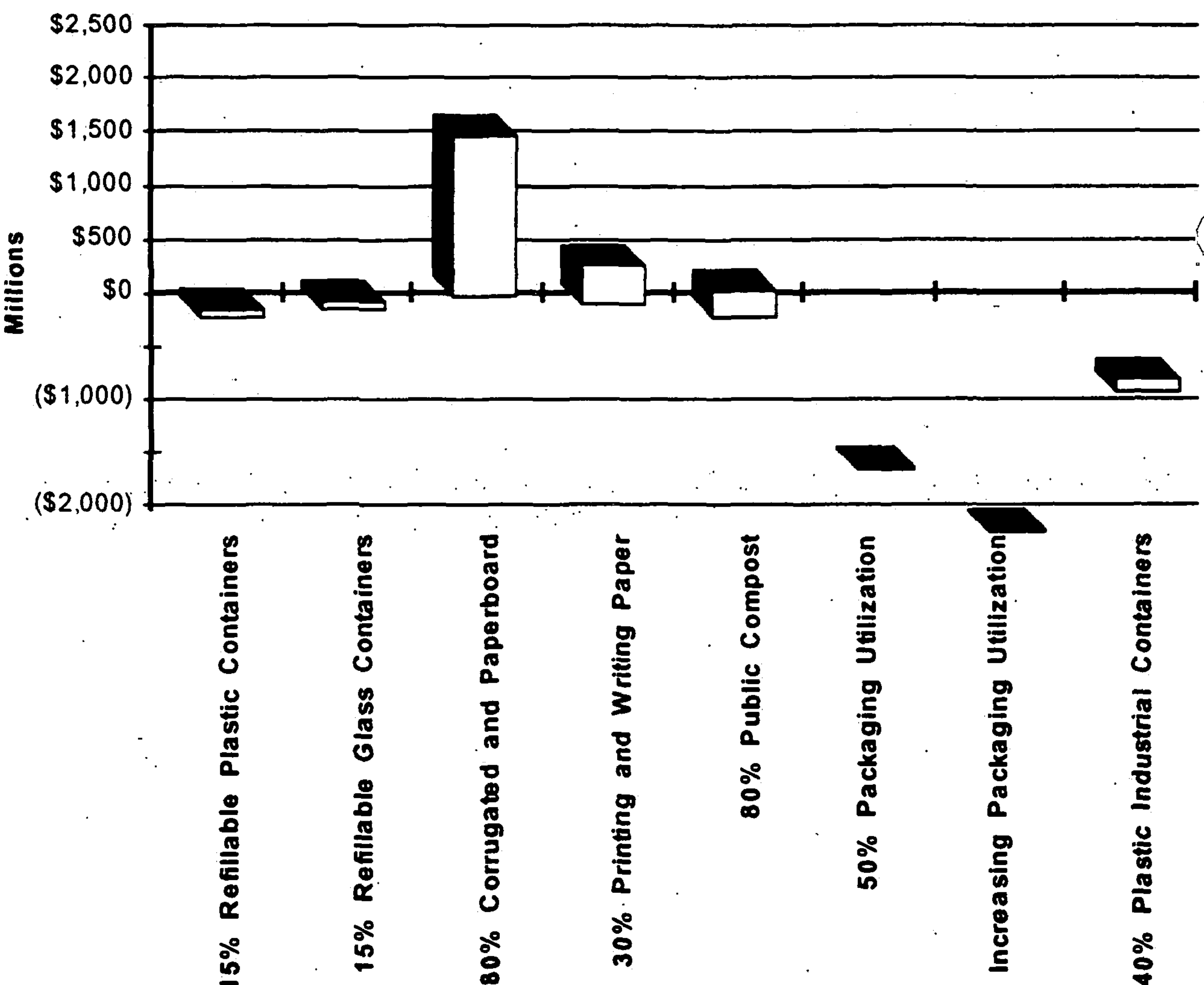
The 15% refillable policy, which results in large benefits for the value of the material, is ranked first in this analysis. The plastic refilling policy could result in a benefit of over $1,000 per ton, while the glass refilling could result in a benefit of over $400 per ton refilled. The corrugated and boxboard policy results in a benefit of between $13 and $115 per ton diverted. The benefit of the printing and writing paper policy at about the same level, ranging from $53 to $101 per ton.[3] Public agency compost use is the fifth ranked policy, with a net benefit of up to $28 per ton. However, at the lower usage levels that exist today, the policy results in a net cost of $32 per ton. Each of the manufacturer utilization policies[4] result in net costs of about $40 per ton. As the following two tables will illustrate, the utilization policies have a high net cost, but also a high level of diversion. This is in contrast to the lowest ranked policy, 40% recycled content in industrial containers, which has a high cost and low diversion. The result is a cost of up to about $1000 per ton diverted.

Total Net Benefit or (Cost)

Table 1-2 and Chart 1-2 show the total net benefit or (cost) of each policy over the seven year period of the analysis. This figure represents the sum of all the costs and benefits that accrue as a result of the policy. When total benefit is used to rank the policies, the 80% recycled content in corrugated ranks highest, with a benefit of between $130 million and $1.7 billion over seven years. The 30% recycled content in printing and writing paper ranks second in this case, with a net benefit of between $136 million and $421 million. While these policies have a lower benefit per ton than the refilling options, the tonnage diverted, and thus the total net benefit, is greater.

Table 1.2 RANKING BY TOTAL BENEFIT OR (COST)				
Policy	Total Cost Rank	Low- $Mill.	Mid- $ Mill.	High- $ Mill.
15% Refillable Plastic Containers	5	($2)	$37	$42
15% Refillable Glass Containers	3	$43	$67	$80
80% Corrugated and Boxboard	1	$130	$861	$1,749
30% Printing and Writing Paper	2	$136	$226	$421
80% Public Compost	4	($9)	$78	$209
50% Packaging Utilization	7		($1,554)	
Increasing Packaging Utilization	8		($2,030)	
40% Plastic Industrial Containers	6	($527)	($584)	($609)

Chart 1.2 RANKING BY TOTAL BENEFIT OR (COST)



The glass refilling policy ranks third with a net benefit of between $43 million and $80 million. The plastic refilling policy, with its low diversion by weight, ranks fifth with a net benefit of up to $42 million. When lower value containers are used in the refilling mix, there may be a total cost of $2 million for this policy. The fourth ranked policy, by total net benefit, is the compost policy. The wide range, from a $9 million cost to a $209 million benefit, is due to different assumptions in the amount of compost utilized by public agencies. At low use levels the policy results in a net cost, while at high use levels there is a net benefit. The 40% recycled content in plastic industrial containers policy has a net cost of between $500 million and $600 million. The utilization policies result in the highest total net cost, due in large part to the high cost of the plastic packaging segment. The total cost for the 50% utilization policy is about $1.5 billion, and for the increasing utilization policy is $2 billion.

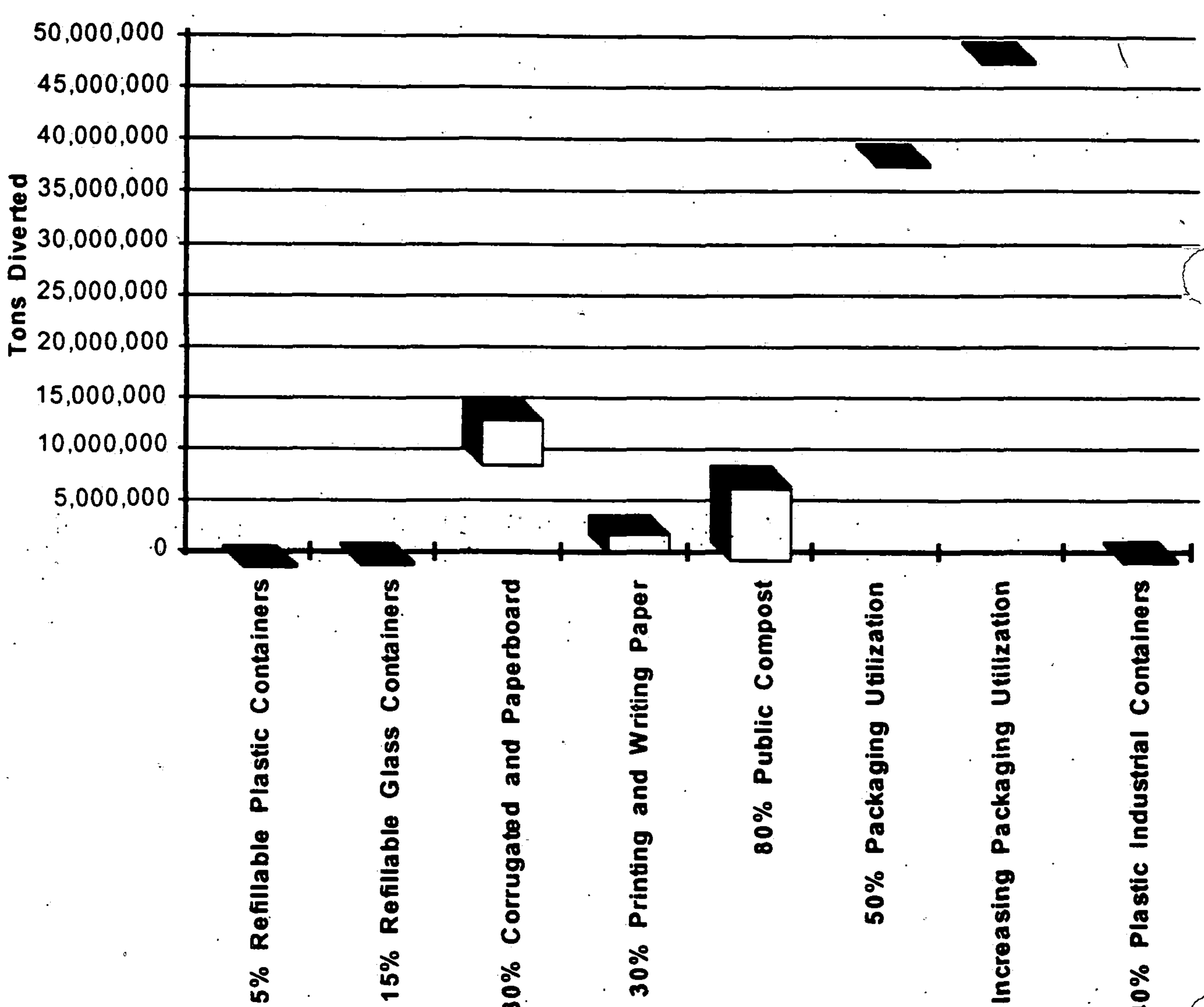
Diversion and Market Impacts

All of these policies, if implemented, would be operating within the larger framework of AB 939 diversion goals. Thus, it is useful to evaluate the potential impact on markets and diversion that will result. Table 1-3 and Chart 1-3 summarize the total diversion impact over the seven year period from 1994 to 2000. The model provides a range because a recycled content policy may not necessarily provide markets for, or divert, the specified percentage of the material sold in the state. A material that is manufactured primarily out of state, such as paper, may actually divert far less than the specified percentage.

Table 1.3 RANKING BY DIVERSION

Policy	Diversion Rank	Low- tons	Mid-tons	High- tons	% AB 939 Div.
15% Refillable Plastic Containers	8	36,000	36,000	36,000	0.01%
15% Refillable Glass Containers	7	165,000	165,000	165,000	0.05%
80% Corrugated and Boxboard	3	10,160,000	12,700,000	15,240,000	4 %
30% Printing and Writing Paper	5	2,560,000	3,200,000	4,160,000	1 %
80% Public Compost	4	295,000	3,743,000	7,485,000	1 %
50% Packaging Utilization	2		38,349,000		11 %
Increasing Packaging Utilization	1		48,453,000		14 %
40% Plastic Industrial Containers	6	554,000	693,000	831,000	0.22%

Chart 1.3 RANKING BY DIVERSION



The manufacturer utilization policies result in the greatest diversion, and would have the greatest impact on market demand for secondary material. California generates an estimated 10 million tons of packaging waste annually, so a utilization policy of at least 50% will, if successful, create markets for up to 5 million tons a year of secondary materials. Within the utilization policy, corrugated and paperboard packaging, and glass containers contribute the largest share of the packaging weight -- about 75% of the total. The corrugated and paperboard policy also results in significant demand -- 12.7 million tons over the seven year period. The compost policy creates the next highest *potential* demand for a material. The actual impact on volume of use of compost by public agencies is questionable. While public agencies *could* easily use this volume of compost, it is doubtful that they *will* use this much compost given current economic conditions. The printing and writing policy will create a demand for 3.2 million tons of material. The remaining policies, for plastic industrial containers and 15% refillables have substantially lower impact on the demand for secondary materials. The low number for the plastic policy does not show, however, the relatively high demand for HDPE containers that this policy will create.

As emphasized in the first volume of our report to the Board, the recycled content policies we developed were explicitly not intended to calibrate recycled content to market supply, and hence consume an overwhelming share of the secondary materials expected to be generated through AB 939. Such an approach is vulnerable to the vagaries of supply projections, and even if accurate would lead to the inefficient and high-cost use of secondary materials, since it would force them to be diverted from local, inexpensive markets to mandated, less accessible ones, and since it could produce a shortage of supply of secondary materials, potentially leading to price spikes (good for collectors, but bad for end-users), cheating, and barriers to marketing. Some of these impacts are discussed in another California Futures report, on the impact of processing fees and market development payments in the glass market.[5]

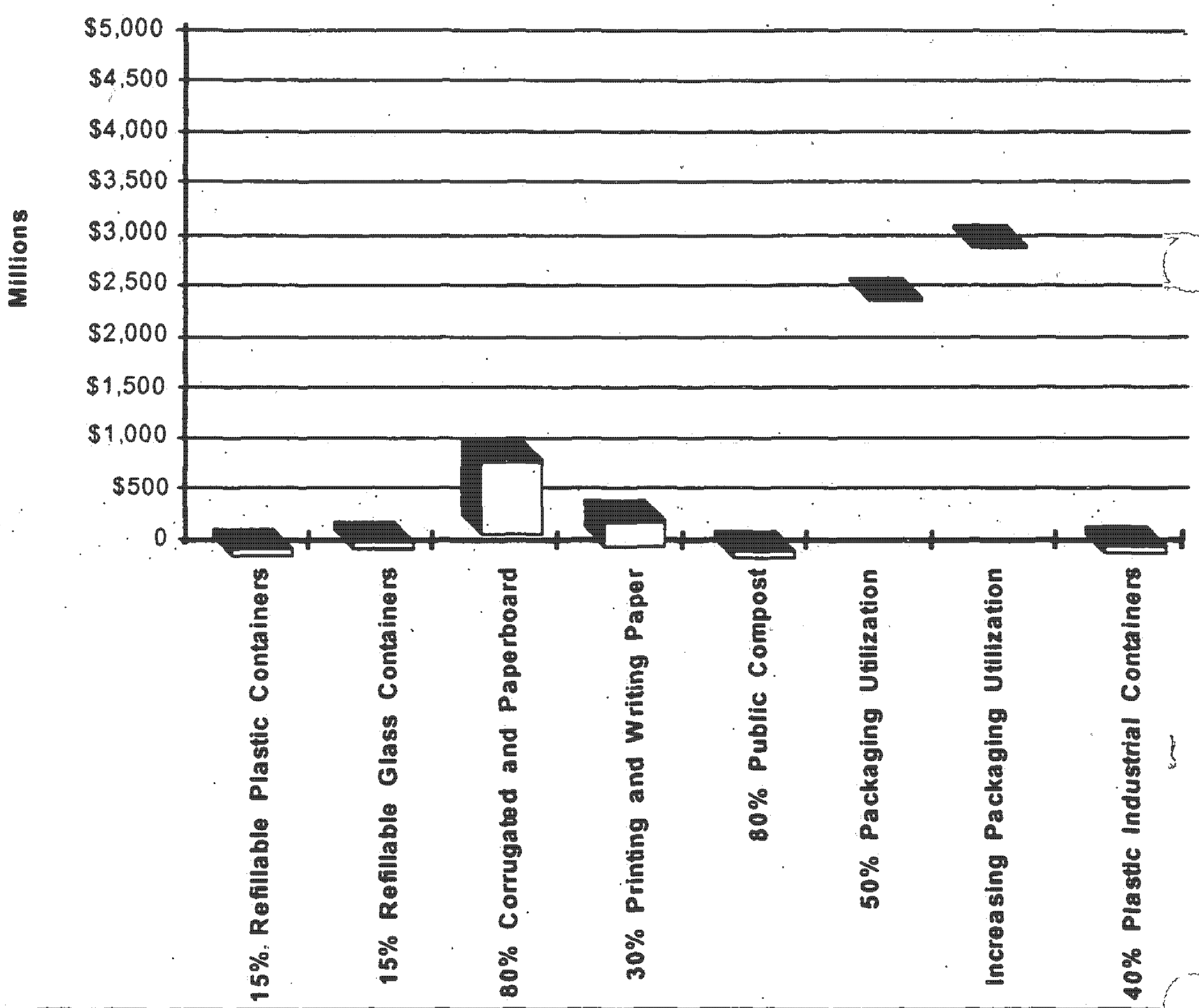
Rather than calibrating recycled content to match projected market supply, we selected levels of recycled content which we believed would be sufficient to stimulate investments in secondary materials end-use facilities and applications, based on the "critical mass" of demand needed to stimulate such investments. Therefore, the relatively low direct market impacts produced by these policies is not necessarily a sign that the selected content mandates are too low. Because the policies may provide a jump-start to secondary material applications which are cost-effective enough to grow in volume, the estimates above may understate the impacts of the policies on market development in the long-term.

Value of Material Diverted

The market value of the material diverted contributes to the net benefit of each policy. In the case of the commodity materials, such as glass, plastic, corrugated, and paper, this value is the market price of the material. For the refilling policy, the market value is the price of containers that are being replaced by refilling. For compost, the market value is the price of other organic materials that compost will be replacing. The mid-range value represents the current market price, with a range provided to account for possible price fluctuations.[6]

Table 1.4 COMPARISON OF POLICIES BY MARKET VALUE OF MATERIAL DIVERTED				
Policy	Value Rank	Low- $Mill.	Mid- $ Mill.	High- $ Mill.
15% Refillable Plastic	7	$29	$72	$82
15% Refillable Glass Containers	5	$92	$117	$129
80% Corrugated and Boxboard	3	$254	$699	$991
30% Printing and Writing Paper	4	$205	$272	$374
80% Public Compost	8	$1	$26	$75
50% Packaging Utilization	2		$2,579	
Increasing Packaging Utilization	1		$3,271	
40% Plastic Industrial Containers	6	$67	$97	$133

Chart 1.4 COMPARISON OF POLICIES BY MARKET VALUE OF MATERIAL DIVERTED



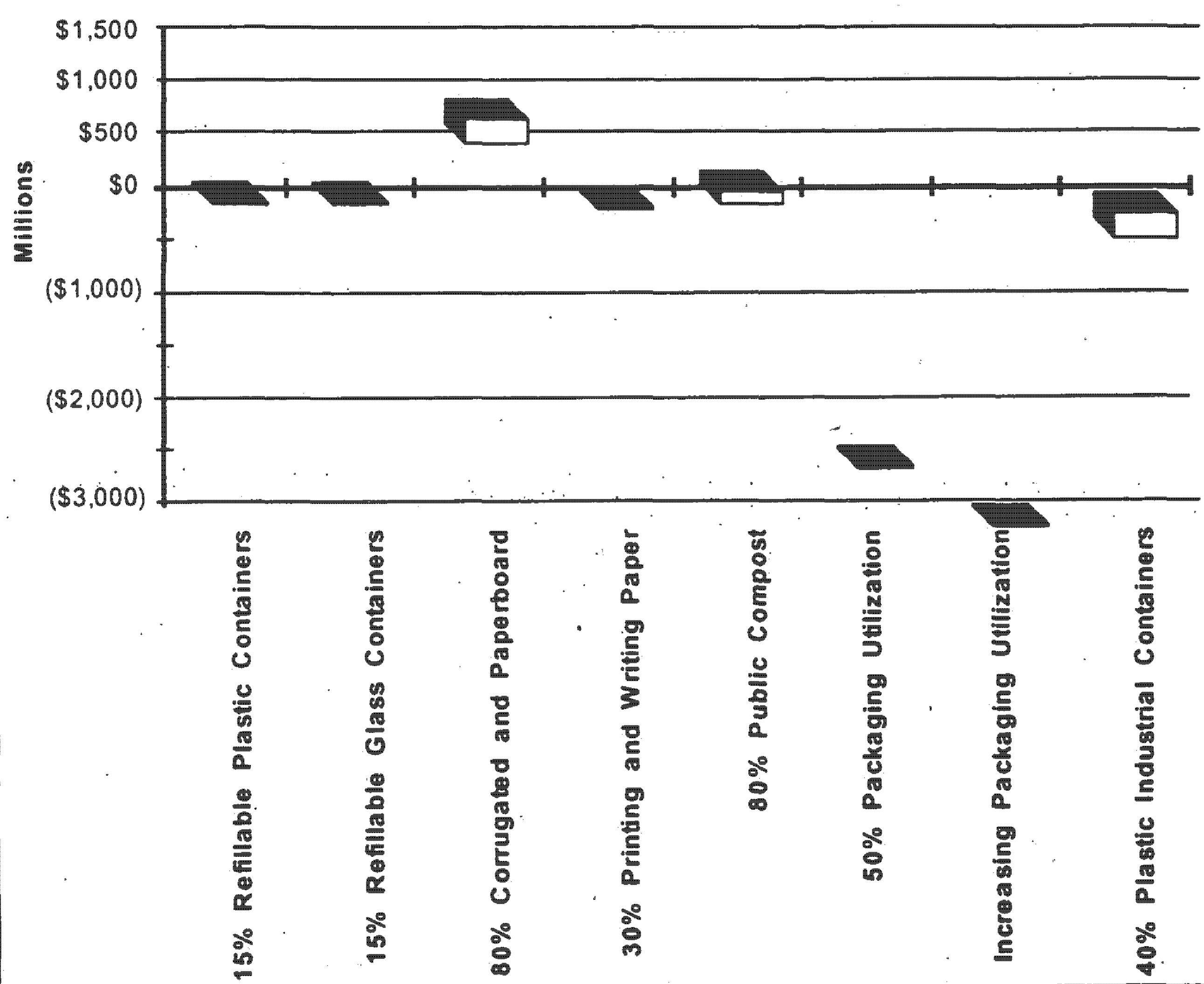
The manufacturer utilization policies divert the greatest value of material, in part because the volume of material diverted is so high. The corrugated policy also results in a high market value diverted. While the value per ton of printing and writing paper is higher than corrugated, the total value is less because fewer tons are diverted. The glass refilling policy ranks fifth in this category. Here, the value is based on the cost of beer and wine bottles. If a larger proportion of wine bottles, which have a higher value, are refilled, the total value of the materials would increase. The plastic industrial container policy diverts material ranging in value from $67 million to $133 million. The value of the material diverted by the plastic refilling policy is somewhat lower, ranging from $29 million to $82 million. The material diverted by the compost policy has the lowest value, ranging from $1 million to $75 million, depending on the volume used and the price of the material.

Net Benefit or (Cost) of Recycling

The net benefit or (cost) of recycling represents the difference between the cost of collecting and recycling the material and the cost of collecting and disposing of the material in a landfill. Every ton of material that is diverted is one ton less that is landfilled. If the cost of recycling is less than the cost of landfilling, then there is a net benefit from recycling. If the cost of recycling is greater than the cost of landfilling, then there is a net cost for recycling. Because the cost of landfilling tends to increase over time, a policy may result in a net cost of recycling initially, but a net benefit in later years. Table 1.5 and Chart 1.5 below compare the total benefit or cost of recycling over the seven year period. These Charts do not take into account the value of the material.

Table 1.5 COMPARISON OF POLICIES BY NET (COST) OR BENEFIT OF RECYCLING				
Policy	Rank	Low- $Mill.	Mid- $ Mill.	High- $ Mill.
15% Refillable Plastic	3		$53	
15% Refillable Glass Containers	4	$38	$42	$47
80% Corrugated and Boxboard	1	$534	$668	$801
30% Printing and Writing Paper	5	$2	$3	$4
80% Public Compost	2	$6	$75	$149
50% Packaging Utilization	7		($2,477)	
Increasing Packaging Utilization	8		($3,070)	
40% Plastic Industrial Containers	6	($372)	($466)	($559)

Chart 1.5 COMPARISON OF POLICIES BY NET (COST) OR BENEFIT OF RECYCLING



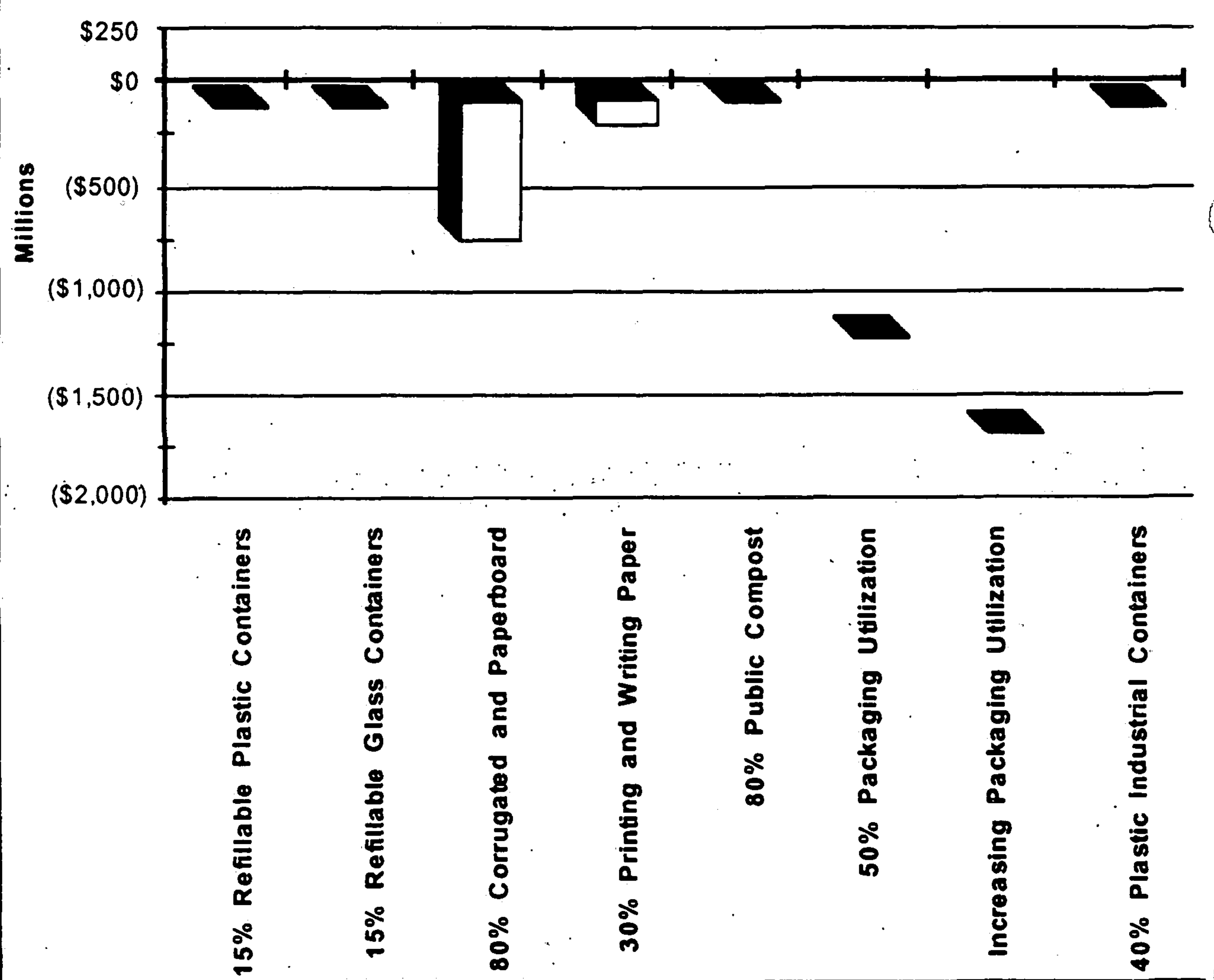
The corrugated policy results in the greatest net benefit in this category, ranging from $534 million to $800 million. Composting ranks second, with a benefit of between $6 million and $149 million. The wide range reflects the different assumptions on the quantity of material utilized. The refilling policies rank third and fourth, with benefits ranging from $38 million to $53 million. Here, the cost of recycling glass and plastic, rather than landfilling, is compared to the cost of refilling. For the printing and writing policy, the benefit is small, between $2 million and $4 million.The remaining policies result in a net cost of recycling. The high cost of recycling plastic is the determining factor for the plastic industrial container and utilization policies. The industrial container policy results in a net cost of between $372 million and $559 million, while the utilization policies result in net costs of $2.5 billion and $3 billion over the seven year period.

Cost to End-Users

Each of these policies may result in some additional cost to manufacturers in order to comply with the policy. For the paper policies and plastic industrial containers, these costs will occur primarily due to capital investment that may be necessary in order to utilize secondary materials. For the refilling policies, these numbers represent the net cost of collecting and refilling, since investment in washing equipment is already included in this cost. For the compost policy, this represents the cost to public agencies of applying compost. For the manufacturer utilization policies, this cost is based on our assumptions on the price of utilization credits and the quantities purchased at these prices. End-user costs are summarized in Table 1-6 and Chart 1-6.

Table 1.6 COMPARISON OF POLICIES BY COST TO END-USER				
Policy	Rank	Low- $Mill.	Mid- $ Mill.	High- $ Mill.
15% Refillable Plastic	2	($38)	($42)	($47)
15% Refillable Glass Containers	4		($53)	
80% Corrugated and Boxboard	6	$0	($462)	($616)
30% Printing and Writing Paper	5	$0	($92)	($114)
80% Public Compost	1	($2)	($15)	($15)
50% Packaging Utilization	7		($1,262)	
Increasing Packaging Utilization	8		($1,604)	
40% Plastic Industrial Containers	3	($14)	($46)	($52)

Chart 1.6 COMPARISON OF POLICIES BY COST TO END-USER



Job Creation and Economic Development

There is much confusion about the relationship between recycling and net economic development. All policies which require additional work can be shown to create jobs. However, overall economic development is a function of wealth creation, not job creation. If a policy imposes new costs on the private or public sector, it will divert financial resources away from present and potential uses, toward the fulfillment of the policy mandates. Thus, any new jobs created may be the result of jobs diminished in other areas. The result could be the depletion rather than development of the local economy. On the other hand, if a policy creates or liberates value-added activities which were stifled or misappropriated under the previous policy, such as by eliminating a barrier to the use of a cheaper raw material or more efficient production process, then it will unleash wealth which will be deployed throughout the economy, producing new jobs, increasing payrolls, and resulting in net economic growth.

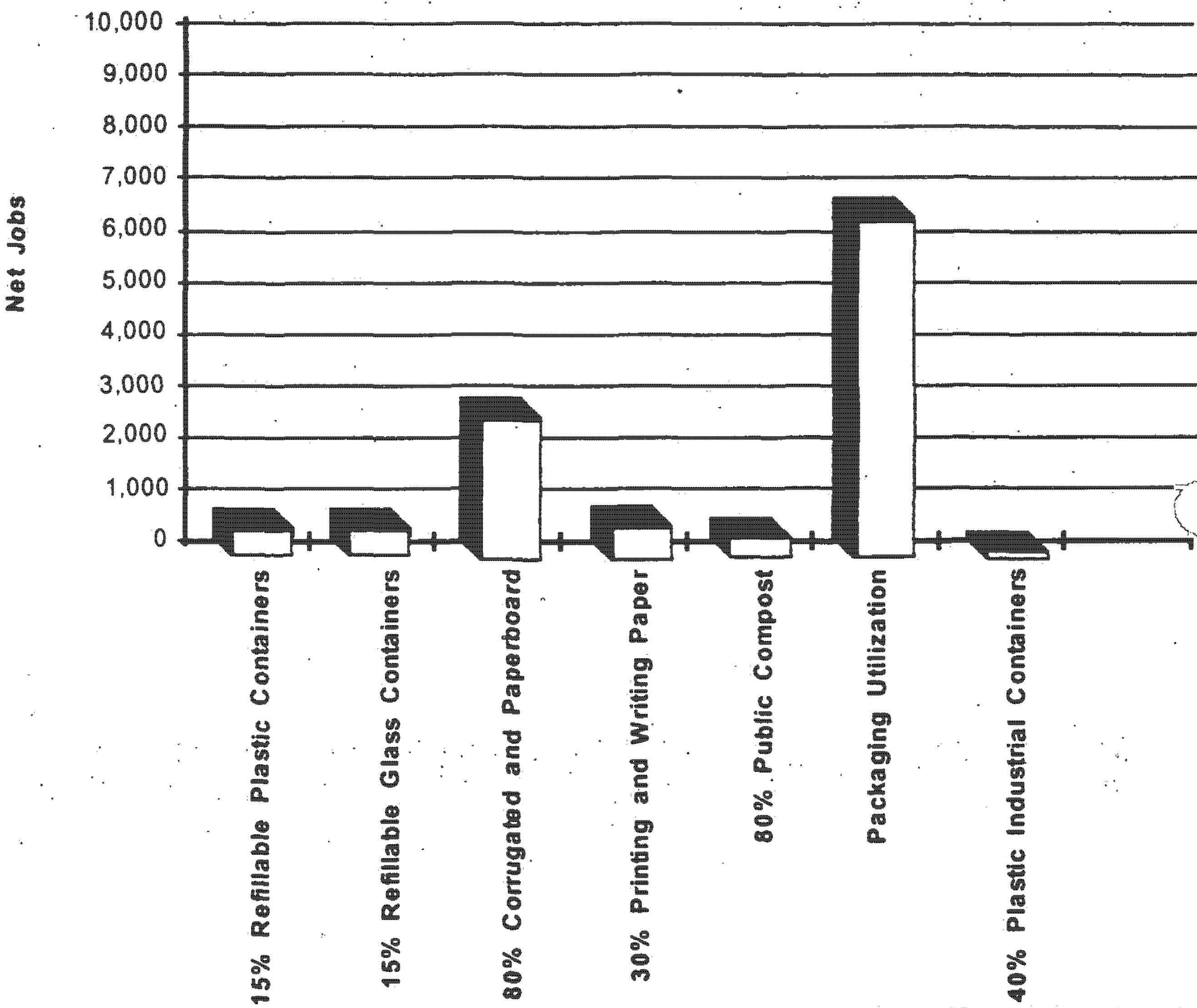
In order to distinguish between gross and net job creation and economic development, the California Futures model attempts to look to both halves of the equation: jobs and wealth created as a result of mandating recycled content, and jobs and wealth displaced as a result of such policies.

Our model provides the following estimates of net job creation and economic development resulting from each of the six policies:

Table 1.7 COMPARISON OF POLICIES BY JOB IMPACT -- 1994

Policy	Job Rank	Jobs Created	Jobs Lost	Net Jobs
15% Refillable Plastic	5	390	10	380
15% Refillable Glass Containers	4	618	207	411
80% Corrugated and Boxboard	2	2,856	0	2,856
30% Printing and Writing Paper	3	672	0	672
80% Public Compost	6	229	0	229
Packaging Utilization	1	11,281	4,644	6,637
40% Plastic Industrial Containers	7	1,077	1,003	74

Chart 1.7 COMPARISON OF POLICIES BY JOB IMPACT -- 1994



Jobs created represent those new jobs resulting from collecting and processing the material, as well as additional jobs from such activities as applying compost and washing bottles. Indirect jobs that are created as a result of these new jobs are also included. Jobs that are a direct result of the policy still represent a net cost, and as such are not included as a benefit of the policy in the cost-benefit model, but as a cost incorporated into the cost of recycling or processing the material, or in end-user costs. The indirect, or multiplier jobs created result in a net benefit to the economy. See Appendix D for more detail on jobs in collection and processing.

Jobs are lost due to a direct reduction such as fewer glass and plastic containers being manufactured due to refilling, or indirectly. Those policies that result in a net cost to the state willalso result in a loss of jobs due to ageneral decline in the economy. The plastic industrial container and manufacturer utilization policies result in job loss due to thier net cost.

Even with this job loss, the utilization policies will result in 3,000 to 6,000 new jobs. The corrugated policy, which also requires collection of large amounts of material, will result in almost 3,000 new jobs. A policy for printing and writing paper could result in about 670 new jobs.[6] While the two refilling policies will result in some job loss in container manufacturing, they will require about 800 new jobs to maintain and support the refilling infrastructure. The plastic industrial container policy will result in a large number of new jobs to collect and process the additional volume of plastic, however, the job loss will be almost equal.

Table 1-8 and Chart 1-8 provide a comparison of the benefit or cost of each job created. This comparison can help clarify the contention, made above, that all new jobs are not necessarily good jobs. The benefit or cost per job is the annual average benefit at the mid-level of the policy divided by the number of jobs created in the first year. The one-year figure is used because in most cases the number of jobs remains relatively constant. The compost policy results in the greatest annual benefit per job -- $49,000. This is, however, at the mid-usage level, which is more than ten times higher than the current level. The paper policy has a benefit per job of $48,000, followed in rank by the corrugated policy, at $43,000. The refilling policies result in a benefit per job of $23,000 for glass and $14,000 for plastic. The remaining policies, however, result in a net cost per job created. Because these policies result in a net cost to the state, the jobs that they create also come at a cost. For the utilization policies, each job costs $33,000 or $44,000 per year. For the plastic industrial container policy, the cost is tremendous. Because the policy results in a loss of jobs, and a high net cost, the cost per job created is over $1 million annually.

In most cases, gains in manufacturing of secondary materials may be offset by losses in primary industries, although this loss may occur out of California. Table 1-9 provides estimates on new manufacturing jobs that may result in California if facilities site in the state to utilize secondary materials collected as a result of these policies. These are best-case figures, based on a number of sources, and assume that new facilities would choose to site in the state.[7] Other factors, such as permitting, may make siting in California difficult for some manufacturing facilities. These jobs do not include those where there are already existing facilities using recycled materials, such as glass containers, aluminum, and some paper facilities. The wide ranges reflect differences in manufacturing facilities.

New facilities manufacturing products containing recycled paper have the potential to create a large number of jobs, either in the recycled content policies, or the packaging utilization. Whether these jobs occur in California depends heavily on permitting considerations. Manufacturing materials from secondary plastic also has the potential to create a large number of jobs. The composting and refilling policies are not likely to result in additional jobs beyond those shown in Table 1-7.

Table 1.8 COMPARISON OF POLICIES
BENEFIT OR (COST) PER JOB CREATED

Policy	Job Cost Rank	Ann. Ben. (Cost)$	Net Jobs	$ Per Job
15% Refillable Plastic	5	$5,285,714	380	$13,9[illegible]
15% Refillable Glass Containers	4	$9,571,429	411	$23,2[illegible]
80% Corrugated and Boxboard	3	$123,000,000	2,856	$43,067
30% Printing and Writing Paper	2	$32,285,714	672	$48,044
80% Public Compost	1	$11,142,857	229	$48,659
50% Packaging Utilization	6	($222,000,000)	6,637	($33,449)
Increasing Packaging Utilization	7	($290,000,000)	6,637	($43,694)
40% Plastic Industrial Containers	8	($83,428,571)	74	($1,127,413)

Chart 1.8 COMPARISON OF POLICIES BENEFIT OR (COST) PER JOB CREATED

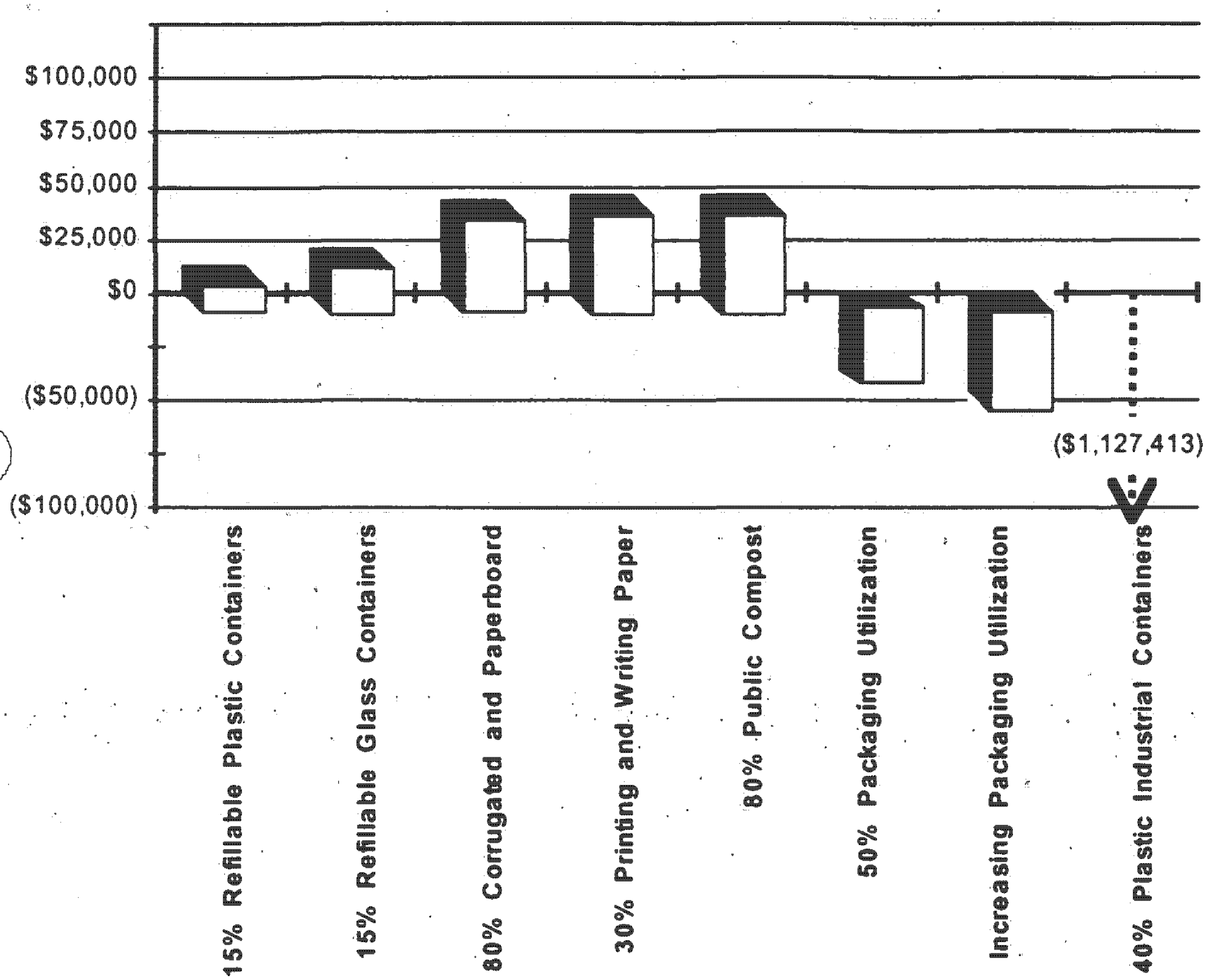


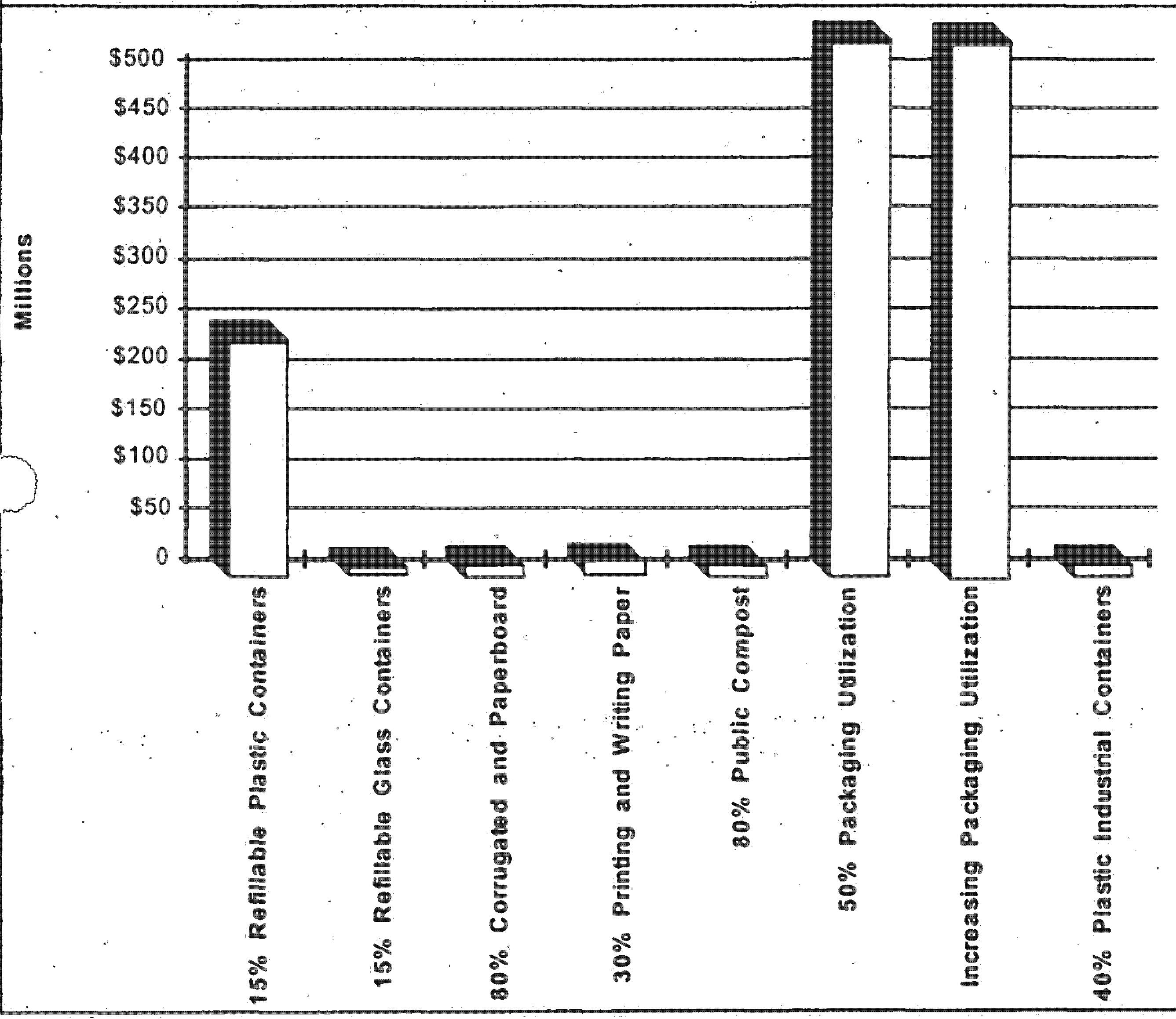
Table 1.9 COMPARISON OF POLICIES POTENTIAL MANUFACTURING JOBS CREATED				
Policy	Tons Utilized	Low Tons/Job	High Tons per Job	Range in Jobs
80% Corrugated and Boxboard	1,270,000	300	1300	1,000 to 4,200
30% Printing and Writing Paper	457,000	250	2700	170 to 1,800
40% Plastic Industrial Container	99,000	100	250	400 to 1,000
50% Packaging Utilization				
Plastic	731,400	100	250	3,000 to 7,300
Alternative Glass	211,400	230	450	500 to 900
Paper and Paperboard Products	2,145,000	250	2700	800 to 8,600
Alternative Paper Products	300,000	105	370	800 to 2,900
Total for Utilization				5,000 to 19,700

Administrative Costs

The estimates of administrative costs for each policy are based on staffing levels and costs of existing recycled content policies, the number of industries impacted, and the assumption that each impacted industry will spend one person-day per month, on average, administering the policy. We use the same cost per employee level for private industry as the state, $70,000 per year. Based on these assumptions, the total administrative cost, over the seven year period, for the printing and writing paper is the lowest, at $8 million. The plastic industrial container, refilling, and compost policies also have relatively low administrative costs, ranging from $11 million to $15 million. The corrugated policy, which would impact about 9,000 firms, has substantially higher costs of $242 million. For the utilization policies we assume that 20,000 firms will be impacted, resulting in an administrative cost of $540 million.

Table 1.10 COMPARISON OF POLICIES BY ADMINISTRATIVE COSTS				
Policy	Admin. Rank	Public (Mill $)	Private (Mill $)	Total (Mill $)
15% Refillable Plastic	3	$1	$12	$13
15% Refillable Glass Containers	3	$1	$12	$13
80% Corrugated and Boxboard	6	$2	$240	$242
30% Printing and Writing Paper	1	$1	$7	$8
80% Public Compost	5	$15	$0	$15
50% Packaging Utilization	7	$5	$535	$540
Increasing Packaging Utilization	7	$5	$535	$540
40% Plastic Industrial Containers	2	$8	$3	$11

Chart 1.10 COMPARISON OF POLICIES BY ADMINISTRATIVE COSTS



COST SAVINGS FROM USE OF TRADABLE CREDITS

The model provides an indication of the cost savings which would result from the use of tradable credits, as compared to implementing the same policy without such credits. The accuracy of these savings estimates is dependent on the implementation of a trading system which minimizes the transaction costs of trading. If transaction costs are high, then credits may not be used, and the costs of the system will be closer to the high estimate.

The savings from trading are primarily related to capital investment. The overall capital expenditures will be less if only some manufacturers are required to make the capital investment necessary to use secondary materials. The difference is most apparent in the refilling policies, where we assume that only a few beverage manufacturers make the investment to refill, while a policy without trading would require all beverage manufacturers to invest. For the corrugated policy, trading means that firms can manufacture or purchase credits for the secondary paper use, whichever is cheaper. Then, when a manufacturer that is using virgin feedstock is ready to purchase new equipment, the policy might induce them to purchase equipment that will allow use of secondary pulp. Since compost is not an essential commodity for public agencies, they are more likely to simply not use it, and avoid the policy, than to conduct trades.

The potential savings through trading credits varies with each policy, and depends on the level of existing and future investment necessary to meet the standard. Table 1-11 and Chart 1-11 illustrate potential savings through trading. The savings achieved through trading could range in value up to the figures illustrated in Chart 1-11. These figures are based on industry averages and typical investments necessary to meet the requirements. The refilling policies will require some initial investment in washing equipment, particularly for plastic refilling. The number of firms that would need to invest in equipment, and thus the level of investment, is substantially less without trading.

For plastic containers, the savings potential is about $77 million, or over $2,000 per ton of plastic diverted. For glass, the savings is about $15 million, or $90 per ton. The corrugated and printing and writing policies could potentially be met with no additional investment, at least in California. The more likely level of investment with trading would be somewhere between zero and the mid-range figures, which assumes that half of the appropriate manufacturers invest in new equipment. The high end figure, with trading, assumes that all manufacturers must invest in new equipment. The maximum potential savings for the corrugated policy is over $600 million, however actual savings are likely to be somewhat lower. For the printing and writing policy, the maximum savings are almost $140 million, or $43 per ton. Again, actual savings may be less.

Our estimates of capital investment for the packaging utilization policy includes investments in paper utilization and plastic processing and manufacturing. We assume that no additional investment would be necessary for aluminum, steel, or glass in order to meet the utilization requirement. Trading will result in savings of about $1 billion, or $24 per ton diverted. The 40% utilization in plastic industrial containers policy will require investment in plastic processing with or without trading. If trading is included, potential savings could reach up to $48 million, or $69 per ton.

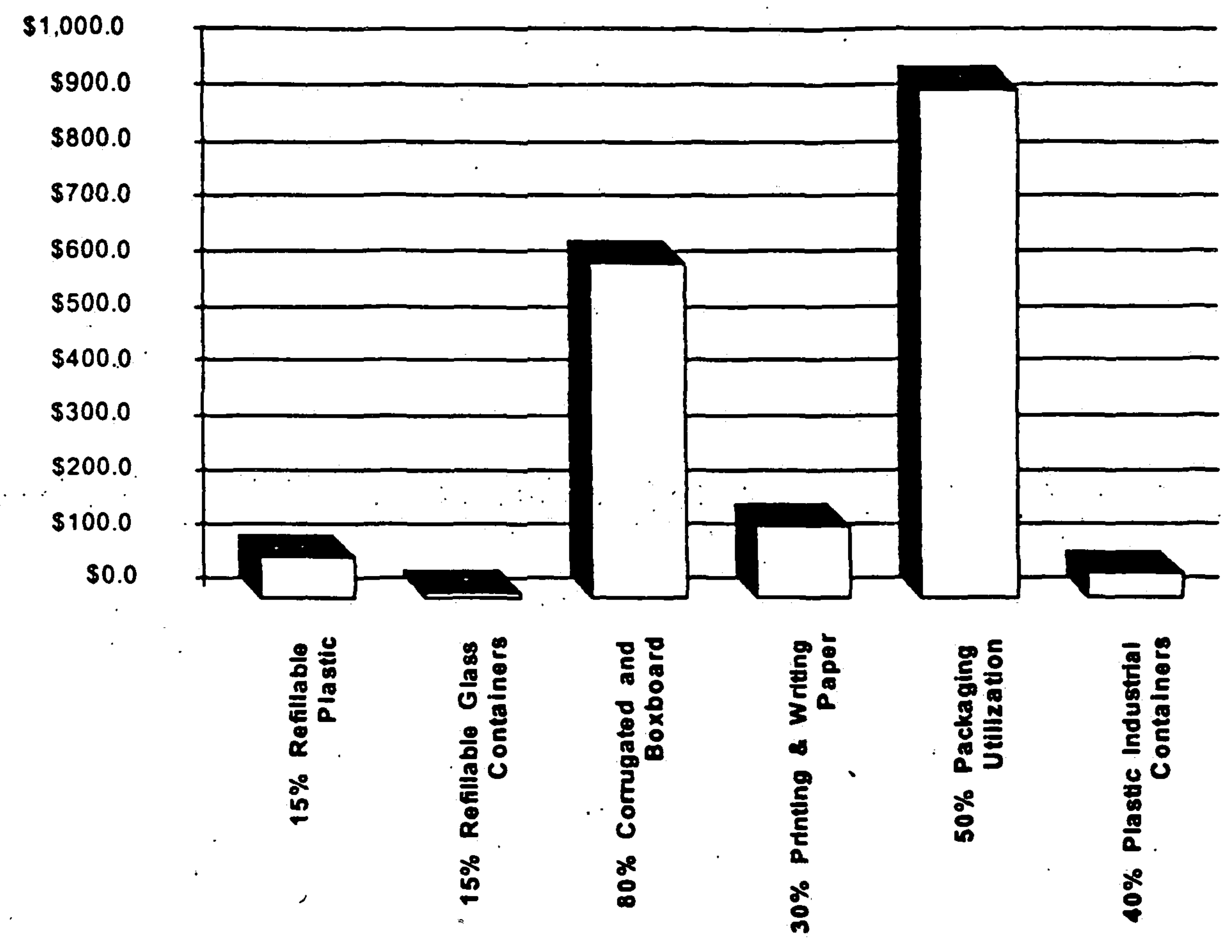
While trading can potentially add overall efficiency to the program, it may also change the appropriate recycled content level. As illustrated in the examples in Appendix B, a market player with high production and recycled content levels can meet the entire standard alone. The result would be no new diversion through the policy. The content level should achieve the increased investment in recycling infrastructure that the policy is intended to stimulate. For any given policy, the content level that will achieve this investment with trading is higher than the content level without. It does not appear that any of these policies will result in a single dominant firm trading credits.

In the chapters that follow we provide a detailed analysis of six market development policies involving recycled content, trading, and utilization. The appendices to this report provide a detailed description of the cost-benefit model, and in depth discussions of recycled content and tradable credits, agriculture compost development, and jobs created in recycling.

Table 1.11 COMPARISON OF POLICIES
CAPITAL INVESTMENT WITH AND WITHOUT TRADING CREDITS

Policy	Capital Investment - Million $ With Trading	Mid-Range	Without Trading	Mid- Range Tons diverted	Maximum Savings per Ton
15% Refillable Plastic	$3.99		$81.00	36,000	$2,139
15% Refillable Glass Containers	$5.23		$19.88	165,000	$89
80% Corrugated and Boxboard	$0.00	$462.02	$616.03	12,700,000	$49
30% Printing and Writing Paper	$0.00	$68.73	$137.45	3,200,000	$43
50% Packaging Utilization	$91.53	$556.36	$1,021.17	38,349,000	$24
40% Plastic Industrial Containers	$10.63	$34.38	$58.12	693,000	$69

Chart 1.11 COMPARISON OF POLICIES, SAVINGS WITH TRADING CREDITS



ENDNOTES

1. *Community Environmental Council, et al, Sonoma County Secondary Materials Markets Study, June 1991.*

2. *Policy Option numbers refer to the California Futures report* ***Developing Sustainable Markets for California's Waste: Market-Based Policy Alternatives.***

3. *Even though the mid-range benefit for the printing and writing policy is higher than for corrugated, we rank the corrugated policy ahead. This relatively small difference is indistinguishable given the assumptions in the models, and we feel that given the overall impacts, the corrugated policy merits a higher rank.*

4. *We analyze two utilization policies in this report. One requires 50% utilization of packaging weight by manufacturers, and the other requires an increasing rate of utilization. The second policy starts at 50% in 1994 and 1995, is 60% in 1996 and 1997, 70% in 1998 and 1999, and 80% in 2000 and thereafter.*

5. *California's Glass Markets: The Impacts of Recycled Content, Processing Fees, and Market Development Payments, by Wendy Pratt and William Shireman, for California Department of Conservation, May 1992.*

6. *Except in the case of the refilling and compost policies, where the range represents the value of different materials or containers.*

7. *References for these estimates include: Brenda Platt and David Morris,* ***The Economic Benefits of Recycling****, Institute for Local Self Reliance, Washington DC, January 1993; Robin F. Ingenthron,* ***Value Added by Recycling Industries in Massachusetts****, Massachusetts Department of Environmental Protection, Boston, July 1992; Meg Lynch, "Creating Jobs from Recycling,"* ***Resource Recycling****, December 1992, p.60; Samuel I. Doctors, "Integrated Waste Management Project Phase II Interim Report,"* ***California State Hayward for CIWMB****, November 1992; Western States Glass Recycling Fact Sheet, June 1992; "U.S. Bureau of the Census,"* ***Statistical Abstract of the United States: 1992****, Washington DC, 1992; and personal communications with Jeff Walch, Green Bay Packaging, June 10, 1993 and Caroline McGreevy, James River, June 11, 1993.*

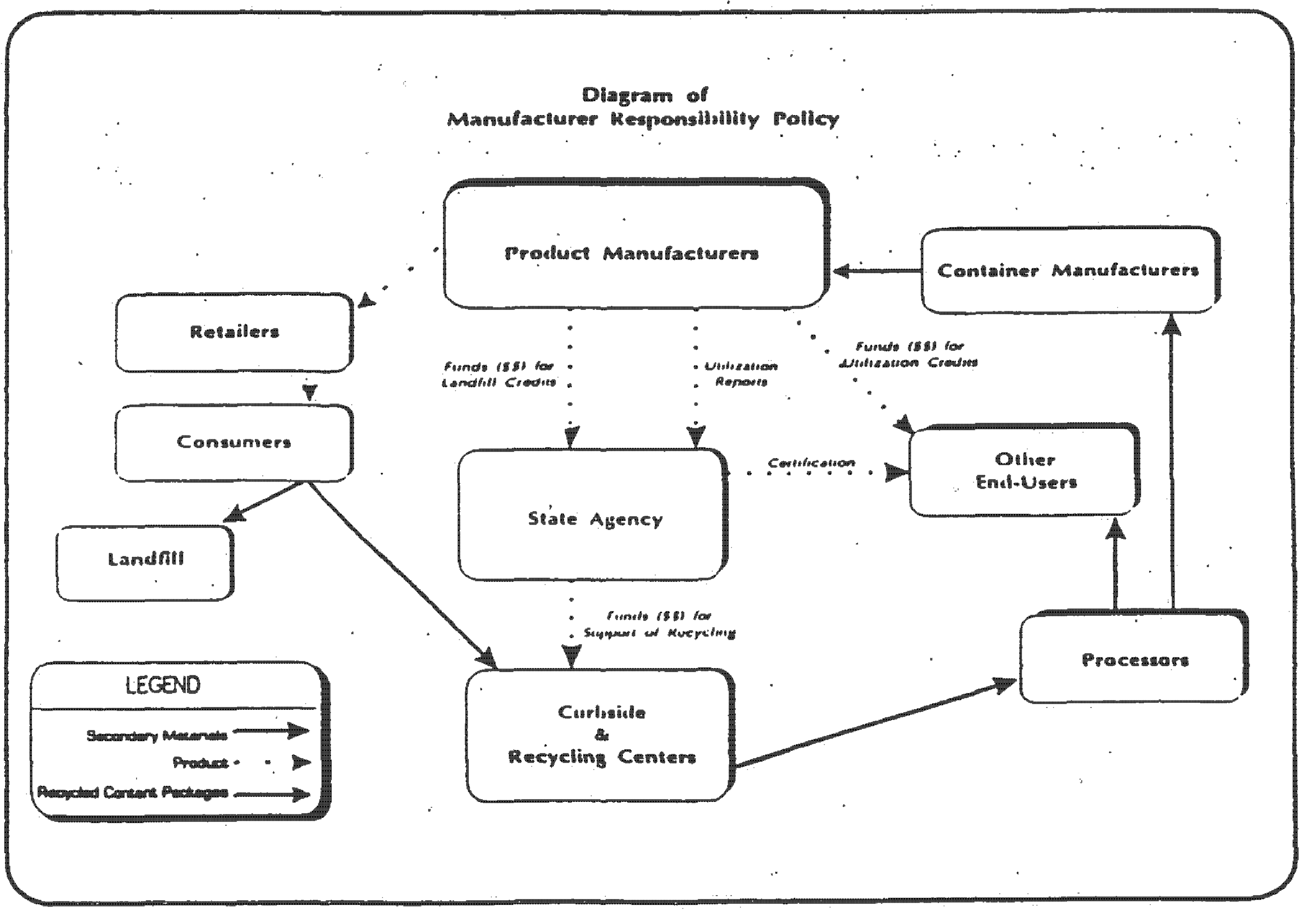
CHAPTER 2
MANUFACTURING RESPONSIBILITY FOR 50% OF THEIR WASTESTREAM

INTRODUCTION

In the wake of Germany's "green dot" packaging requirements, a movement has begun to establish a similar program of manufacturer responsibility for packages sold in the United States. This movement has taken the form of legislation (federal S 976 as part of the 1992 proposed Resource Conservation and Recovery Act (RCRA) amendments) and serious policy discussions at such forums as the Recycling Advisory Committee's (RAC) Market Development Committee, and the Board's Emerging Market Development Options Workshop. This process is expected to result in the introduction of new packaging legislation at both the federal and state levels.

The movement represents a step beyond specific packaging mandates, and is intended to merely assign legal responsibility for packaging to its manufacturer. How this responsibility is assigned is the primary focus of policy discussions relating to manufacturer responsibility. The RAC committee has been discussing and evaluating eight "manufacturer responsibility" options: virgin materials tax, packaging tax, minimum content standards, utilization requirements, manufacturer responsibility, shared responsibility, packaging stewardship, and a national secondary materials utilization trust fund.[1]

This analysis does not attempt to further discuss and evaluate the merits and demerits of the manufacturer responsibility options that have been proposed. Our approach, instead, is to analyze, in depth, the impacts of one manufacturer utilization policy. While the analysis must be based on a number of assumptions on the design and implementation of the policy, such an analysis can provide insight into the impacts of this and similar policies.



In order to conduct a detailed analysis of the manufacturer utilization approach, we first had to define what that approach was. We chose to examine a policy similar to that proposed in S 976 and being discussed by Californians Against Waste for introduction into the 1993 legislative session. Within the framework of manufacturer responsibility options, this policy allows manufacturers maximum flexibility in meeting the utilization rates, and minimizes involvement at the state level. The policy transfers a portion of waste management costs to industry, and allows manufacturers to choose the least cost method of doing so. It also creates strong incentives to source reduce. With a 50% utilization requirement, every ton of packaging that is source reduced is a half ton less that the firm is responsible for. In addition, the policy can stimulate markets for secondary materials. Under this policy:

- Manufacturers would be responsible for utilizing, or showing that someone utilized, an amount of material equivalent to 50% or more of the primary and secondary packaging they sell in the state. Utilization would be material-specific: aluminum must be utilized for aluminum, glass for glass, etc. Paper and plastic utilization would be material specific, not resin or grade specific.

- We analyze two different scenarios: one that set the utilization rate at 50%, and one that increases the rate, starting at 50% for 1994 and 1995, 60% in 1996 and 1997, 70% in 1998 and 1999, and finally 80% in 2000 and thereafter.

- Six packaging materials are included in the analysis: aluminum, glass, plastic, corrugated and paperboard, other paper packaging, and steel. A utilization rate policy could also be applied to wood packaging and non-durable goods such as newspaper and printing and writing paper.

- Manufacturers could utilize the material in a number of ways, including recycled content, refilling or reuse, alternative uses, or purchasing utilization credits from another end-user. Manufacturers would report their credit trades to the state. However, the state would not be directly involved in the trades, except possibly to provide information on potential trades.

- End-users would certify with the state. Once certified, they would be able to earn or sell utilization credits to manufacturers. In order to simplify reporting and to increase the impact on secondary markets in the state, only end-users in the state would be allowed to sell credits. For example, a paper manufacturer with 80 percent recycled content in Canada could not sell credits to manufacturers in California. A fiberglass manufacturer in California could sell credits to a glass container manufacturer.

- Out-of-state manufacturers that utilized recycled content in their packaging could count that toward their own utilization requirement, but they could not trade excess credits for any amount above 50 percent. In-state manufacturers could trade their excess credits. This would stimulate markets for secondary materials in California, and create an incentive for manufacturers using secondary materials to site in the state.

- If utilization credits were not available, manufacturers could purchase disposal credits from the state, at the estimated avoided cost of disposal. While in our cost benefit models we use an estimate of total avoided disposal cost of $78-$124 from 1994 to 2000, we use $160 per ton as the estimated state fee for utilization credits, since this number, derived from estimates in a report of the World Resources Institute, more closely reflects anticipated legislative language. Thus, if it cost more than $160 a ton to recycle and utilize a material, landfill credits would be purchased instead. The revenues from state sale of credits would be used for economic development programs.

HIGHLIGHTS OF THE ANALYSIS

- *The utilization policies analyzed have a cost per ton of $41 for the 50% policy and $42 for the increasing utilization policy.*
- *The total net cost, over the seven years of the analysis, is $1.5 billion for the 50% policy and $2 billion for the increasing utilization policy.*
- *These policies result in significant diversion. The 50% policy would divert 38 million tons of packaging waste over seven years, while the increasing rate policy would divert 48 million tons. The policies would divert 11% and 14% of the state's waste stream.*
- *Over 75% of the diversion impact of this policy results from the diversion of corrugated and paperboard and glass packaging.*
- *Collecting and processing this volume of packaging will create approximately 11,000 jobs. Because the policy results in a net cost to the state, there will also be a loss of about 4,500 jobs.*
- *The 6,600 net jobs resulting from the 50% policy have an annual cost to the state of $33,000. The jobs created by the increasing rate policy have a cost to the state of $44,000.*
- *The net cost of this policy is driven by the high cost of recycling plastic. If plastic was removed from the utilization requirement, the policy would result in a net benefit of $68 per ton for the 50% policy and $70 per ton for the increasing utilization policy.*

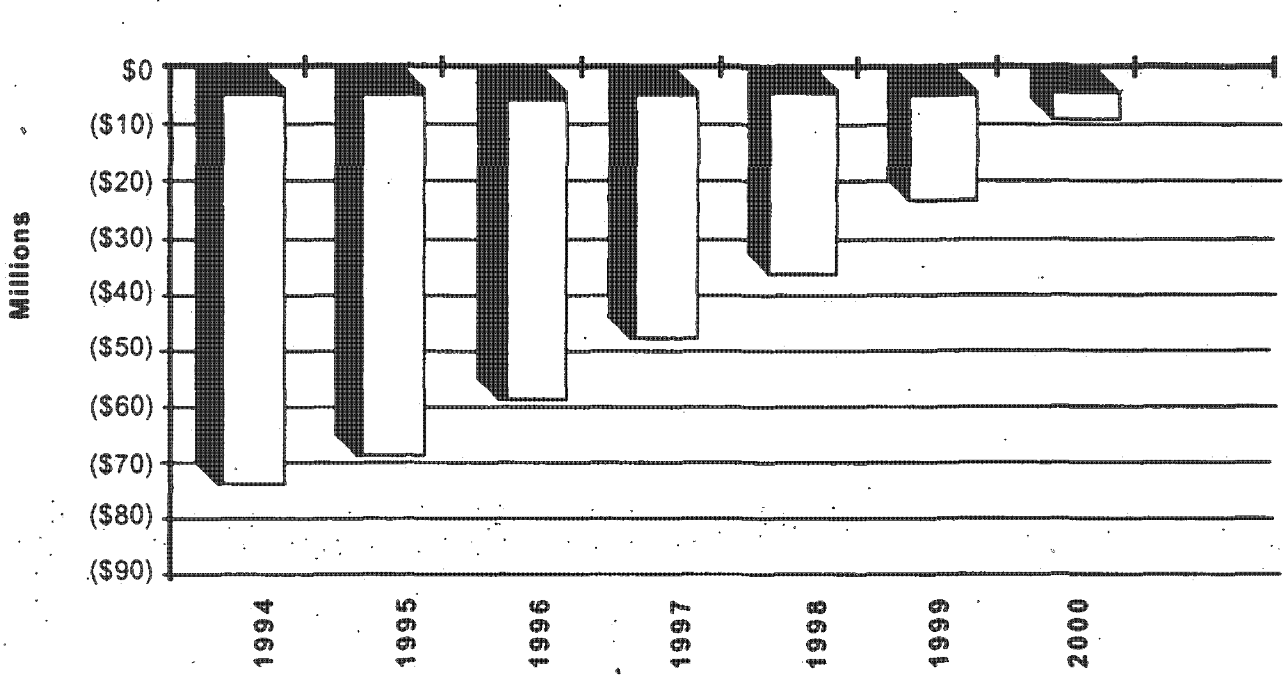
GENERATION AND DIVERSION OF PACKAGING WASTE

Packaging waste accounts for about one-quarter to one-third of the municipal waste stream. Table 2-1 summarizes packaging generation from the EPA Waste Characterization Update for 1990. California's share, based on GDP, is 8.5 million tons.

Table 2.1 Generation of Packaging Waste			
Material	US (Mill. Tons)	California Tons	50% Utilization
Glass	11.9	1,570,800	785,400
Beer, Soda	5.7	752,400	376,200
Wine, Liquor	2.1	277,200	138,600
Food, Other	4.1	541,200	270,600
Steel	2.9	382,800	191,400
Beer, Soda	0.1	13,200	6,600
Food, other Cans	2.5	330,000	165,000
Other	0.2	26,400	13,200
Aluminum	1.9	250,800	125,400
Beer, Soda	1.6	211,200	105,600
Other Cans	Negligible		
Foil, Closures	0.3	39,600	19,800
Paper and Paperboard	32.6	4,303,200	2,151,600
Corrugated	23.9	3,154,800	1,577,400
Milk Cartons	0.5	66,000	33,000
Folding Cartons	4.3	567,600	283,800
Other Paperboard	0.3	39,600	19,800
Bags and Sacks	2.4	316,800	158,400
Wrapping Papers	0.1	13,200	6,600
Other Paper Packaging	1.0	132,000	66,000
Plastics	7.0	924,000	462,000
Soft Drink Bottles	0.4	52,800	26,400
Milk Bottles	0.4	52,800	26,400
Other Containers	1.8	237,600	118,800
Bags and Sacks	0.9	118,800	59,400
Wraps	1.5	198,000	99,000
Other Plastic Packaging	1.9	250,800	125,400
Plastic recycling	0.3	39,600	
Wood Packaging	7.9	1,042,800	521,400
Other Packaging	0.2	26,400	13,200
Total Container Packaging	19.2	2,534,400	1,267,200
Total Non-Container	45.2	5,966,400	2,983,200
Total Packaging	64.4	8,500,800	4,250,400
Source: 1990 Waste Generation Update, Franklin Associates for EPA			5/3/93

California generation and diversion estimates for each of the six packaging categories are in Table 2-2. These figures are based on material specific sales and industry trends, and are more representative of generation in California than Table 2-1. Over 75% of the packaging generated by weight is corrugated and paperboard and glass. The other four categories each contribute between 2% and 13% to the total. Total packaging generation is estimated to be between 10 million and 12 million tons annually between 1994 and 2000. Assuming that the utilization requirements were met, the 50% policy would divert 11% of the state's waste, and the increasing policy would divert up to 18% of the total wastestream by 2000.

Chart 2.2 ANNUAL BENEFIT OR (COST) PER TON FOR 50% UTILIZATION



Summary Table for 50% and Increasing Utilization in Packaging

	1994	1995	1996	1997	1998	1999	2000	Total
Aluminum Packaging								
Tons Diverted/Utilized								
50% Utilization	124,750	127,245	129,790	132,388	135,034	137,734	140,489	927,429
Increasing Utilization	124,750	127,245	155,748	158,883	189,047	192,828	224,783	1,173,265
Total Net (Cost) or Benefit								
50% Utilization Only	$67,664,566	$69,834,467	$72,195,480	$74,624,609	$77,258,811	$80,108,083	$83,042,329	$524,728,325
Increasing Utilization Only	$67,664,566	$69,834,467	$86,238,762	$89,134,117	$107,290,315	$111,236,061	$131,428,778	$662,825,066
Net (Cost) or Benefit per ton diverted								
50% Utilization Only	$542	$549	$556	$564	$572	$582	$591	$566
Increasing Utilization Only	$542	$549	$554	$561	$568	$577	$585	$565
Glass Containers								
Tons Diverted/Utilized								
50% Utilization	1,030,301	1,040,804	1,051,010	1,061,520	1,072,135	1,082,857	1,093,685	7,432,113
Increasing Utilization	1,030,301	1,040,804	1,261,212	1,273,824	1,500,989	1,515,999	1,749,896	9,372,827
Total Net (Cost) or Benefit								
50% Utilization	($5,821,201)	$798,768	$8,615,456	$16,601,626	$25,832,541	$36,343,559	$47,077,084	$129,447,613
Increasing Utilization	($5,821,201)	$798,768	$7,133,531	$16,591,011	$29,241,931	$43,685,328	$64,105,744	$155,735,112
Net (Cost) or Benefit per ton diverted								
50% Utilization	($6)	$1	$8	$16	$24	$34	$43	$17
Increasing Utilization	($6)	$1	$6	$13	$19	$29	$37	$17
Plastic Packaging								
Tons Diverted/Utilized								
50% Utilization	612,500	648,638	686,907	727,435	770,353	815,804	863,937	5,125,573
Increasing Utilization	612,500	648,638	824,289	872,922	1,078,495	1,142,128	1,382,298	6,561,266
Total Net (Cost) or Benefit								
50% Utilization	($394,725,625)	($413,129,418)	($431,613,410)	($450,807,171)	($469,956,776)	($488,941,501)	($508,487,493)	($3,157,881,394)
Increasing Utilization	($394,725,625)	($413,129,418)	($525,616,648)	($549,338,192)	($676,180,348)	($704,395,368)	($846,070,705)	($4,109,456,304)
Net (Cost) or Benefit per ton diverted								
50% Utilization	($644)	($637)	($628)	($620)	($610)	($599)	($589)	($616)
Increasing Utilization	($644)	($637)	($638)	($629)	($627)	($617)	($612)	($626)
Corrugated and Paperboard Packaging								
Tons Diverted/Utilized								
50% Utilization	2,850,000	2,900,000	2,950,000	3,100,000	3,150,000	3,250,000	3,250,000	21,450,000
Increasing Utilization	2,850,000	2,900,000	3,540,000	3,720,000	4,410,000	4,550,000	5,200,000	27,170,000
Total Net (Cost) or Benefit								
50% Utilization	$192,336,275	$214,784,815	$249,856,754	$287,248,650	$329,398,421	$372,073,911	$414,627,335	$2,060,326,162
Increasing Utilization	$192,336,275	$214,784,815	$289,033,009	$333,025,405	$432,678,931	$490,668,421	$610,069,100	$2,562,595,958
Net (Cost) or Benefit per ton diverted								
50% Utilization	$67	$74	$85	$93	$105	$114	$128	$96
Increasing Utilization	$67	$74	$82	$90	$98	$108	$117	$94
Other Paper Packaging								
Tons Diverted/Utilized								
50% Utilization	291,902	293,653	295,415	297,188	298,971	300,765	302,569	2,080,462
Increasing Utilization	291,902	293,653	354,498	356,625	418,559	421,070	484,111	2,620,418
Total Net (Cost) or Benefit								
50% Utilization	($5,823,441)	($3,973,833)	($901,970)	$1,330,622	$4,858,953	$7,792,129	$11,800,529	$15,082,989
Increasing Utilization	($5,823,441)	($3,973,833)	($2,163,392)	$477,693	$4,099,567	$8,110,939	$13,915,487	$14,643,021
Net (Cost) or Benefit per ton diverted								
50% Utilization	($20)	($14)	($3)	$4	$16	$26	$39	$7
Increasing Utilization	($20)	($14)	($6)	$1	$10	$19	$29	$6
Steel Cans/Packaging								
Tons Diverted/Utilized								
50% Utilization	172,064	173,441	174,828	176,227	177,637	179,058	180,490	1,233,746
Increasing Utilization	172,064	173,441	209,794	211,472	248,692	250,681	288,785	1,554,929
Total Net (Cost) or Benefit								
50% Utilization	$2,735,823	$3,870,784	$5,200,674	$6,553,791	$8,108,140	$9,868,360	$11,658,674	$47,996,246
Increasing Utilization	$2,735,823	$3,870,784	$5,707,677	$7,311,567	$10,204,255	$12,625,852	$16,802,650	$59,258,607
Net (Cost) or Benefit per ton diverted								
50% Utilization	$16	$22	$30	$37	$46	$55	$65	$39
Increasing Utilization	$16	$22	$27	$35	$41	$50	$58	$38
Jobs Lost, All Industries								
50% Utilization	4,644	4,346	3,716	3,066	2,246	1,394	525	
Increasing Utilization	4,644	4,346	4,648	3,897	3,725	2,592	2,030	
Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Cost of Jobs Lost								
50% Utilization	$139,326,283	$134,156,803	$118,047,183	$100,202,950	$75,623,084	$48,234,860	$18,682,654	$634,273,816
Increasing Utilization	$139,326,283	$134,156,803	$147,657,578	$127,364,855	$125,301,589	$89,715,666	$72,290,515	$835,813,291
Administrative Costs								
Public	$700,000	$720,300	$741,189	$762,683	$784,801	$807,560	$830,979	$5,347,513
Private	$70,000,000	$72,030,000	$74,118,870	$76,268,317	$78,480,098	$80,756,021	$83,097,946	$534,751,253
Packaging Totals								
Tons Diverted/Utilized								
50% Utilization	5,081,517	5,183,581	5,287,951	5,494,755	5,604,130	5,766,218	5,831,170	38,249,323
Increasing Utilization	5,081,517	5,183,581	6,345,541	6,593,707	7,845,782	8,072,705	9,329,873	48,452,706
Total Net (Cost) or Benefit								
50% Utilization	($353,659,885)	($334,721,520)	($289,554,277)	($241,881,824)	($179,387,893)	($112,553,701)	($42,893,140)	($1,554,452,241)
Increasing Utilization	($353,659,885)	($334,721,520)	($382,184,699)	($307,194,254)	($297,231,836)	($209,348,016)	($165,970,386)	($2,030,310,597)
Net(Cost) or Benefit per ton diverted								
50% Utilization	($70)	($65)	($55)	($44)	($32)	($20)	($7)	($41)
Increasing Utilization	($70)	($65)	($57)	($47)	($38)	($26)	($18)	($42)
Diversion Summary								
Total Waste Generation	48,136,918	48,957,280	49,789,553	50,635,976	51,496,787	52,372,233	53,262,561	354,653,308
Diversion at 50% Utilization	11%	11%	11%	11%	11%	11%	11%	11%
Diversion at Increasing Utl	11%	11%	13%	13%	15%	15%	18%	14%

THE COST-BENEFIT MODEL

Table 2-2 summarizes the results of the cost-benefit models of the six packaging types included in the analyses. For each material type, the table shows the quantity diverted at each of the two policies, the net benefit or (cost) for that material type, and the benefit or (cost) per ton. Annual costs are summarized in Chart 2-2. Table 2-3 summarizes the results of three cost categories in the models as well as the job impacts. The complete models are in the appendix to this chapter. Table 2-2 includes job loss and administrative costs for the utilization policies as a whole. These values are summed to determine the total diversion and total cost of the policy, as well as the benefit or (cost) per ton.

Table 2.3 Summary of Utilization Policies									
	Value of Material-Mill $		Cost of Recycling-Mill $		Cost to End User- Mill $		1994	1994	1994
Material	50%	Increasing	50%	Increasing	50%	Increasing	Direct Jobs	Total Jobs	Multiplier Jobs
Aluminum	$742	$939	($231)	($290)	$0	$0	150	210	60
Glass	$282	$356	($91)	($92)	($178)	($225)	1,236	1,731	495
Plastic	$465	$595	($3,326)	($4,241)	($595)	($761)	2,695	3,773	1,078
Corrugated	$1,026	$1,300	$1,130	$1,498	($528)	($667)	3,420	4,788	1,368
Other Paper	$3	$4	$41	$58	$71	$89	350	490	140
Steel	$61	$77	$0.40	($3)	($32)	($40)	206	289	83
Total	$2,579	$3,271	($2,477)	($3,070)	($1,262)	($1,604)	8,057	11,281	3,224

The results of the cost-benefit model show a cost of $41 and $42 per ton for the 50% and increasing utilization policies, respectively. The cost per ton ranges from a high of $70 in 1994 to a low of $7 in 2000. The reduced cost is a result of the increased benefit of avoided landfill disposal as the cost of landfills increases. Job loss is another factor that reduces the cost in later years, since, as the policy becomes more cost-effective, fewer jobs are lost, resulting in a reduction in cost.

Because this policy impacts a large volume of material, the overall cost over the seven years of the analysis is high. The 50% utilization policy has a total net cost of $1.5 billion, ranging from $43 million to $350 million a year. The increasing utilization policy has a total net cost of $2 billion, ranging from $166 million to $350 million annually. The cost of the increasing utilization policy is higher in the later years, even after landfill prices increase, due to the greater volume of material that is diverted.

The utilization policies result in the creation of a large number of jobs due to the collection and processing of 5 million to 6 million tons of material annually.[2] About 8,000 direct jobs could be created in the first year of the policy. These jobs will, in turn, result in the creation of over 3,000 indirect jobs. Because the policy results in a net cost to the state, there will also be a loss of jobs in the economy. For the 50% utilization policy, this loss ranges from about 4,500 in the first year, to 500 in 2000. The net jobs created in 1994 is 6,600. These jobs occur at an annual cost to the state of $33,000.

Based on the assumptions made in the cost-benefit model, administrative costs of the policy are substantial. The average annual cost of about $75 million, contributes to 20% of the total net cost of the 50% policy in the first year, and all of the net cost in 2000. Administrative costs are about $14 per ton of material diverted.

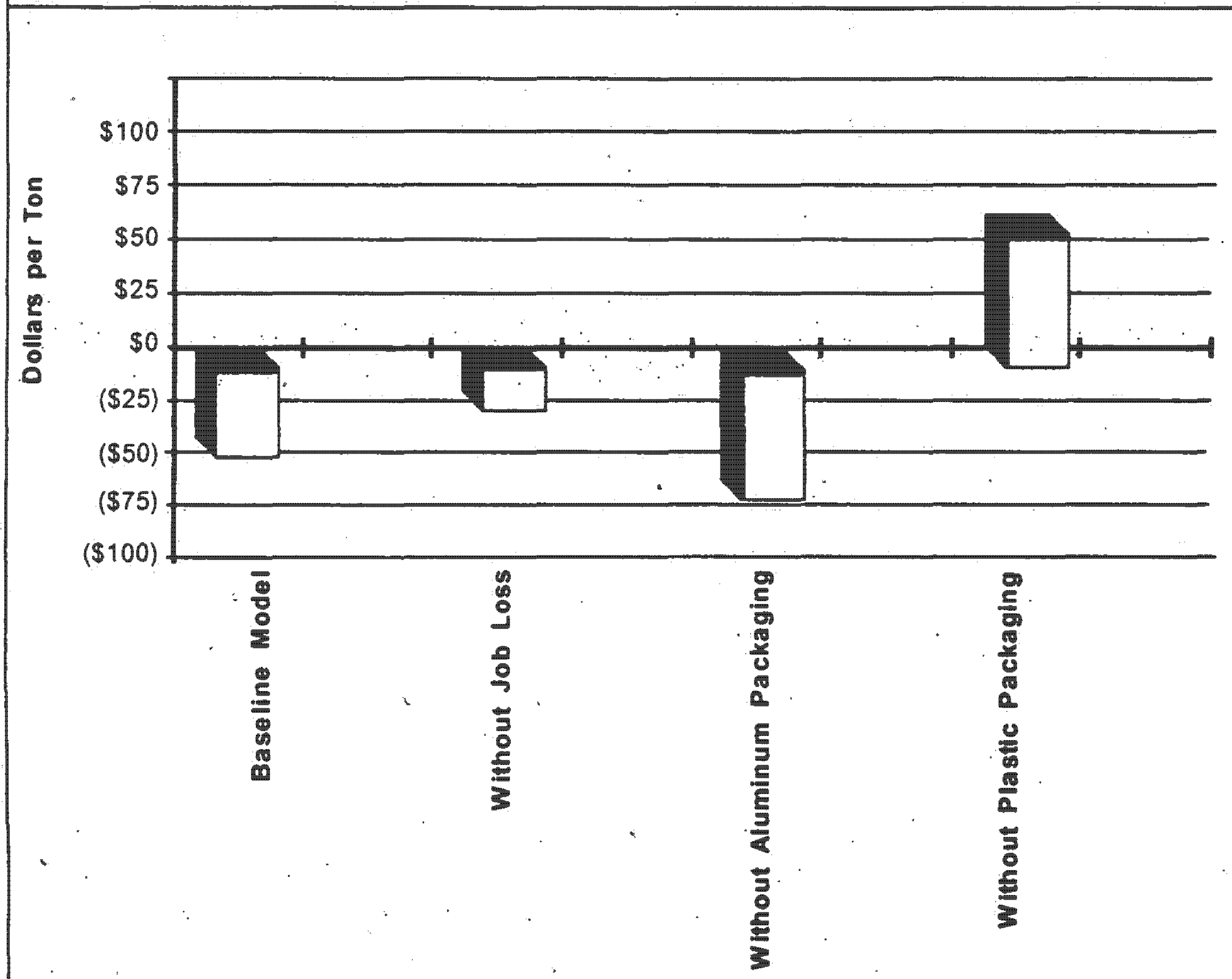
SENSITIVITY ANALYSIS

We ran three variations of the packaging cost-benefit model to test the impacts on the cost-effectiveness of the policy. The results of these analyses are summarized in Table 2-4 and Chart 2-4.

Table 2.4 Manu[illegible]
Sensitivity Analysis

	50% Utilization	Increasing Util.
Baseline Model (Table 2.2)		
Total Net Benefit (Cost) (Million $)	($1,554)	($2,030)
1996 Net Benefit (Cost) (Million $)	($290)	($362)
Benefit (Cost) per ton ($/ton)	($41)	($42)
Without Job Loss (Table 2-A.7)		
Total Net Benefit (Cost) (Million $)	($920)	($1,194)
1996 Net Benefit (Cost) (Million $)	($172)	($214)
Benefit (Cost) per ton ($/ton)	($24)	($25)
Without Aluminum Packaging (Table 2-A.8)		
Total Net Benefit (Cost) (Million $)	($2,244)	($2,960)
1996 Net Benefit (Cost) (Million $)	($383)	($480)
Benefit (Cost) per ton ($/ton)	($60)	($63)
Without Plastic Packaging (Table 2-A.9)		
Total Net Benefit (Cost) (Million $)	$2,237	$2,915
1996 Net Benefit (Cost) (Million $)	$260	$311
Benefit (Cost) per ton ($/ton)	$68	$70

Chart 2.4 MANUFACTURER UTILIZATION POLICY SENSITIVITY ANALYSIS



Impact Without Job Loss

The job loss to the state results from the net cost of this policy. This job loss will occur across all sectors of the economy. We did an additional run of the model without job loss factored in to determine the extent of its impact. The policy still results in a net cost, although not as high as the baseline model. The cost per ton for the two policies drops to about $25.

Without Aluminum

Aluminum is already recycled and utilized at a high rate, and its high recyclability and scrap value often "carries the weight" of recycling other materials. As a result, it is conceivable that the aluminum industry could argue to exempt themselves from the policy. If aluminum is exempt, it would eliminate a material with a net benefit, and thus would increase the net cost of the program. This analysis shows an increased cost per ton of about $60 without aluminum.

Without Plastic

Plastic contributes about 13% by weight to the packaging generated in the state. Because of the high cost of recycling plastic -- about $750 per ton -- the entire cost of the policy can be attributed to plastic. We ran the model without plastic to determine the impact of eliminating plastic from the policy. While this concept may be unappealing environmentally, it has some merit if diversion and economic impacts are considered. Eliminating plastic from the utilization policies results in a net benefit rather than a net cost. This change is dramatic -- switching from a cost of $40 per ton to diverted to a benefit of $70 per ton diverted. The net benefit is over $2 billion over the seven year period. Diversion drops from 11% to 9% for the 50% policy and 14% to 12% for the increasing rate option.

DATA AND ASSUMPTIONS

THE COST-BENEFIT MODEL

The analysis of the utilization policies represent the sum of individual analyses for the six packaging categories included in the policy: aluminum, glass, plastic, corrugated and paperboard, other paper packaging, and steel. The models for each of these six materials are in the appendix to Chapter 2.

Consumption and Diversion

Packaging data was based on the EPA Waste Characterization for 1990 and industry sales statistics for each material. Historical trends for each material were used to estimate generation to 2000. For this analysis we assume that the utilization rates are being met. Thus, it should be understood that even though there is only one result for each of the policies, the actual cost could fall within a range above or below that figure.

Value of Materials

The mid-value of the materials was set at current market prices. High and lows were established at levels that would account for potential fluctuations in price. Because of the potential for price variation under these policies, given a wide range of quality of materials and the increased supply that would result, we assume that 1/3 of the material diverted under each policy will be at each price. For example, glass cullet has values of $20, $45, and $55 per ton. The value of the material for the 50% policy is (.33 x 1 million tons x $20) +(.33 x 1 million tons x $40) +(.33 x 1 million tons x $65), or $39 million.

Collection and recycling costs

Material specific costs from DOC, NSWMA, and other studies were used where possible (see sources in Appendix A).

Net Cost to End-User

The net cost to the end user is the additional cost to manufacturers to comply with the policy. This depends on the existing level of utilization and the availability of utilization credits. Because it is difficult to predict how manufacturers will meet the utilization requirements, we made a number of assumptions for this portion of the model:

***Aluminum** -- No additional cost to end-users, since aluminum cans are at close to 50% recycled content at this time.*
***Glass** -- 50% of the utilization will be at no cost (existing recycled content), 40% at a $20 (½ existing scrap value), and 10% at the cost of landfill credits, $160 per ton.*
Plastic -- 15% of the credits will be at no cost, 25% at $80 per ton, about ½ the scrap value of HDPE, and the remaining 60% of the credits at the avoided landfill cost of $160 per ton.
***Corrugated and Boxboard** -- 50% of the utilization at no additional cost, 40% at $20 to $23 per ton (proportional share of capital investment), and 10% at the landfill credit cost of $160.*
Other paper packaging -- 50% of the utilization at no additional cost, 40% at $45 per ton, a mid-range price for high quality mixed paper, and 10% at $160.

Steel -- 50% of the utilization at no cost (steel cans are currently at 25% recycled content), 40% at $25 per ton (½ the scrap value), and 10% at $160. Steel credits would be available from foundries and mills that utilize secondary steel at up to 100%.

Job Impacts

We assess jobs created for each material based on our preliminary survey figure of 920 tons per job for California recycling programs. This policy also will result in a net loss of jobs in the state due to the cost of compliance with the policy. The job loss is calculated by using the Total Final-Demand Multiplier for Employment. We used the multiplier for Miscellaneous Manufacturing Industries, which is 23.8. This means that for every $1,000,000 loss in output in this industry, a total of 23.8 jobs are lost in all industries in the state. To determine the job loss, we used the net cost of the policy for each year, before the impact of the job loss was calculated.

Capital Investment

Where we had data on capital investment, such as for corrugated and paperboard, that was used in the model. Aluminum and steel would not need additional capital investment to meet the utilization requirement. Data was not available for glass, plastic, and other paper packaging. This does not change the results of the analysis, however better information on capital investment would allow us to more accurately assess the cost to end-users.

Administration

Administrative costs are determined for the policy as a whole in Table 2-2. We assume that ten state staff people would be required to implement the program, and that 20,000 firms would be regulated.

ASSESSMENT OF IMPACTS OF THE MANUFACTURER UTILIZATION POLICY

In this section we highlight some of the critical issues that should be addressed if this policy was to be implemented.

ADMINISTRATIVE REQUIREMENTS AND FEASIBILITY

Even if they are minimized, the administrative costs of this policy are significant simply because the policy impacts such a large number of firms. The administration requirements of the credit-trading aspects of this program are difficult to determine. (See Appendix B for a discussion of administration of tradable credit policies). In order to maximize trading of credits, and minimize the costs of the program, the states' role in trading should be kept to a minimum. Manufacturers could be required to report utilization levels and trades to the state annually, however they should not need to have trades approved or certified by the state. Trading of recycled content or utilization credits should, ideally, be similar to trading of stocks rather than the more complicated process of trading air pollution credits.

The administrative requirements of the policy could be further reduced by exempting manufacturers with annual revenue below $50 million or some other threshold.

INCENTIVES TO SUBSTITUTE MATERIALS OR SOURCE REDUCE

Because this policy covers essentially all packaging, it should not create incentives to switch from one material type to another simply in order to avoid regulation. It may, however, create incentives to switch to a material type that is more cost-effective under the policy. This could mean switching to a lighter material, or to one that is more easily recycled or utilized. The policy creates a direct incentive to source-reduce, as every ton less of packaging waste generated means one-half ton less that the manufacturer is responsible for.

This may create some interesting trade-offs. Plastic is substantially lighter than glass, however it is less recyclable, and in fact is utilized at far below the 50% level. As a result, manufacturers using plastic containers are likely to end up purchasing landfill cost credits from the state. If the cost of these credits is high enough, this may create an incentive for some manufacturers to switch from plastic to glass or aluminum. However, if the cost is not high enough, it may be cheaper for the manufacturer to comply with the policy by using more plastic than they do currently, and paying the state the land disposal cost. Manufacturers will balance the trade-offs of the weight of their packaging and the cost of credits or utilization into their packaging material choice, along with factors that they already consider. The policy should be designed so that it does not encourage the "wrong" choices.

If the policy was designed to eliminate one or more material types, such as aluminum or plastic, the substitution effects could be high. Where possible, manufacturers would switch to the non-regulated material. This could mean a large increase in the amount of plastic packaging.

EQUITY CONCERNS

One of the compelling reasons to implement a manufacturer responsibility policy in the state is that local governments are already "responsible" for diverting and managing waste, and that manufacturers should share in this responsibility. The issue of who is responsible and who pays must be evaluated in further detail. Both local governments and manufacturers pass costs on to consumers, who will ultimately pay for the policy in one form or another. It is also important to evaluate whether the policy is regressive, placing a greater burden on consumers or firms with fewer resources.

Additional equity concerns relate to the impacts among industry types and among other products. Should other products be included? Does the policy favor one industry at the expense of another?

MARKET IMPACTS

This policy will have substantial impacts on markets for secondary materials. It should result in a more favorable climate for businesses, including small entrepreneurs, that can benefit from the sale of credits by utilizing secondary materials. The impact on price of secondary materials is difficult to predict. The increased demand for these materials would tend to drive prices up, however the increased supply will tend to drive prices downward.

IMPACT WITHIN EXISTING RECYCLING INFRASTRUCTURE

A manufacturer responsibility policy in California would, by default, be implemented within a framework of many other existing laws impacting packaging and solid waste. The implications of this need to be carefully evaluated. If a utilization policy was implemented, it would be essential to coordinate and possibly eliminate some existing laws. For example, the glass recycled content law requires 65% recycled content by 2005. If a manufacturer responsibility law was passed, it seems reasonable to eliminate the recycled content law, and allow for utilization, rather than recycled content at the specified percentage. Changing laws, essentially in mid-stream, may impose unreasonable costs on industries, who gear up to comply with one policy, only to have it changed a few years later. It would appear that now is a good time to establish a timeline and framework for recycled content and utilization policies, so that the state, local governments, and industry can better understand what to expect in the next few years.

UNCERTAINTY

There a many uncertainties related to the impact of a manufacturer utilization policy. Several have been addressed above. A few specific areas are:

- How will the market for tradable credits operate?
- What prices will credits sell for?
- Will strong markets for secondary materials develop as a result of the policy?
- What will the impact be on California business? Will it result in an exodus of firms from the state?
- How will international trade agreements such as GATT and NAFTA impact the policies?

POLITICAL FEASIBILITY

Manufacturer responsibility is being widely and seriously discussed in solid waste policy circles in California and the U.S., largely in response to Germany's green dot system. Several other countries, including France and Canada are in the process of implementing manufacturer responsibility policies based loosely on the German model. While manufacturer responsibility policies are gaining momentum, industry opposition and California's poor economy may be difficult to surmount.

SUMMARY

This particular version of the manufacturer responsibility concept is appealing for several reasons: it allows manufacturers flexibility in choosing their method of utilization, it minimizes state involvement, it does not require a broad fee on all packaging, it creates a strong incentive for source reduction, and it will divert over 10% of the state's waste from landfills. It also has many drawbacks and uncertainties, in particular: it has a net cost of almost $50 per ton, it may have a negative impact on California manufacturers, administration will be costly, and it focusses on only one segment of the waste stream. The advantages and disadvantages of utilization policies may become more clear in the policy and political discussions relating to manufacturer responsibility that are sure to occur over the next several months

ENDNOTES

1. Memorandum from the RAC Market Development Committee meetings, January 14, 1993 and February 12, 1993.

2. Job creation is based on the 50% utilization policy.

Chapter 2

APPENDICES

California FUTURES

Table 2-A.1 Cost-Benefit Analysis for Market Development Policies
50% Utilization in Aluminum Packaging

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	249.501	254.491	259.580	264.772	270.067	275.469	280.978	
Diversion resulting from Policy (tons)								
Baseline Diversion	190.000	195.700	201.571	207.618	213.847	220.262	226.870	1.455 868
50% Utilization	124.750	127.245	129.790	132.386	135.034	137.734	140.489	927 429
Increasing Utilization	124.750	127.245	155.748	158.863	189.047	192.828	224.783	1.173.265
(at these rates)	50%	50%	60%	60%	70%	70%	80%	
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$700	$700	$700	$700	$700	$700	$700	
Mid	$800	$800	$800	$800	$800	$800	$800	
High	$900	$900	$900	$900	$900	$900	$900	
Value of Material Diverted -- $								
All Material	$152.000,000	$156.560.000	$161.256.800	$166.094.504	$171.077.339	$176.209.659	$181.495.949	$1.164.694.251
50% Utilization Only	$99.800.245	$101.796.250	$103.832.175	$105.908.819	$108.026.995	$110.187.535	$112.391.286	$741.943.304
Increasing Utilization Only	$99.800.245	$101.796.250	$124.598.610	$127.090.582	$151.237.793	$154.262.549	$179.826.057	$938.612.086
Costs								
Collection and Recycling Costs								
Cost per ton	$350	$350	$350	$350	$350	$350	$350	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$116	$124	
Net collection and recycling costs	$272	$266	$259	$252	$244	$235	$226	
Net Cost for colln./recy.								
All Material	$51.680.000	$52.056.200	$52.206.889	$52.319.769	$52.178.588	$51.761.587	$51.272.606	$363.475.639
50% Utilization Only	$33.932.083	$33.847.253	$33.615.667	$33.361.278	$32.948.233	$32.367.588	$31.750.538	$231.822.641
Increasing Utilization Only	$33.932.083	$33.847.253	$40.338.800	$40.033.533	$46.127.527	$45.314.624	$50.800.861	$290.394.682
st of Use by End-User $/ton								
All Utilization Levels	$0	$0	$0	$0	$0	$0	$0	
Total addit. Cost to end-user								
All Utilization Levels	$0	$0	$0	$0	$0	$0	$0	$0
Job Impacts								
Jobs Created	150	153	156	159	162	165	189	
CA Multiplier	1 4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	210	214	218	222	227	231	236	
Jobs Lost	0	0	0	0	0	0	0	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Lost	0	0	0	0	0	0	0	
Multiplier Jobs Created	60	61	62	64	65	66	67	
Average Value of Jobs	$30.000	$30.870	$31.765	$32.686	$33.634	$34.610	$35.613	
Net Value of Jobs Created	$1.796.404	$1.885.470	$1.978.952	$2.077.068	$2.180.049	$2.288.136	$2.401.582	$14.607.662
Capital Investment								
Capital Investment by Industry								
No additional investment	$0	$0	$0	$0	$0	$0	$0	$0
Net Benefit or (Cost)								
50% Utilization Only	$67.664.566	$69.834.467	$72.195.460	$74.624.609	$77.258.811	$80.108.083	$83.042.329	$524.728.325
Increasing Utilization Only	$67.664.566	$69.834.467	$86.238.762	$89.134.117	$107.290.315	$111.236.061	$131.426.778	$662.825.066
Benefit or (Cost) per ton diverted								
50% Utilization Only	$542	$549	$556	$564	$572	$582	$591	$566
Increasing Utilization Only	$542	$549	$554	$561	$568	$577	$585	$565

14-Apr-93

Table 2-A.2 Cost-Benefit Analysis for Market Development Policies
50% Utilization of glass containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	2 060.602	2.081.208	2.102.020	2.123.040	2.144.271	2.165.713	2.187.371	
Diversion resulting from Policy (tons)								
50% Utilization	1.030.301	1.040.604	1.051.010	1.061.520	1.072.135	1.082.857	1.093.685	7.432 113
Increasing Utilization	1.030.301	1.040.604	1.261.212	1.273.824	1.500.989	1.515.999	1.749.896	9.372.827
(at these rates)	50%	50%	60%	60%	70%	70%	80%	
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$20	$20	$20	$20	$20	$20	$20	
Mid	$40	$40	$40	$40	$40	$40	$40	
High	$55	$55	$55	$55	$55	$55	$55	
Value of Material Diverted -- $ (assume 33% of the material diverted at each value)								
50% Utilization	$39.099.923	$39.490.922	$39.885.831	$40.284.690	$40.687.537	$41.094.412	$41.505.356	$282.048.671
Increasing Utilization	$39.099.923	$39.490.922	$47.862.998	$48.341.628	$56.962.551	$57.532.177	$66.408.570	$355.698.768
Costs								
Collection and Recycling Costs								
Cost per ton	$112	$112	$112	$112	$112	$112	$112	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	$34	$28	$21	$14	$6	($3)	($12)	
Net Cost for colln./recy.								
50% Utilization	$35.030.234	$29.136.912	$22.071.211	$14.861.282	$6.432.812	($3.248,570)	($13.124.223)	$91.159.658
Increasing Utilization	$35.030.234	$29.136.912	$26.485.453	$17.833.539	$9.005.937	($4.547.998)	($20.998.757)	$91.945.320
Cost of Use by End-User $/ton								
Low- No additional costs	$0	$0	$0	$0	$0	$0	$0	
Mid - Cost of credits = 1/2 scrap	$20	$20	$20	$20	$20	$20	$20	
High - avoided landfill credits	$160	$160	$160	$160	$160	$160	$160	
Total addit. Cost to end-user (assume 10% of credits from avoided landfill, 50% low cost, 40% mid cost)								
50% Utilization	$24.727.224	$24 974.496	$25.224.241	$25.476.484	$25.731.248	$25.988.561	$26.248.447	$178.370.701
Increasing Utilization	$24.727.224	$24.974.496	$30.269.089	$30.571.780	$36.023.748	$36.383.985	$41.997.514	$224.947.838
Job Impacts								
Jobs Created (920 tons/job)	1.236	1.249	1.261	1.274	1.287	1.299	1.312	
CA Multiplier	1 4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	1.731	1.748	1.766	1.783	1.801	1.819	1.837	
Jobs Lost	0	0	0	0	0	0	0	
CA Multiplier	1 4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Lost	0	0	0	0	0	0	0	
Multiplier Jobs Created	495	499	504	510	515	520	525	
Average Value of Jobs	$30.000	$30.870	$31.765	$32.686	$33.634	$34.610	$35.613	
Net Value of Jobs Created	$14.836.334	$15.419.254	$16.025.076	$16.654.702	$17.309.065	$17.989.138	$18.695.931	$116.929.501
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$0	$0	$0	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0	$0	$0	$0
Net Benefit or (Cost)								
50% Utilization	($5.821.201)	$798.768	$8 615.456	$16.601.626	$25.832.541	$36.343.559	$47.077.064	$129.447.813
Increasing Utilization	($5.821.201)	$798.768	$7.133.531	$16.591.011	$29.241.931	$43.685.328	$64.105.744	$155.735.112
Benefit or (Cost) per ton diverted								
50% Utilization	($6)	$1	$8	$16	$24	$34	$43	$17
Increasing Utilization	($6)	$1	$6	$13	$19	$29	$37	$17

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Table 2-A.3 Cost-Benefit Analysis for Market Development Policies
50% Utilization of Plastic Packaging

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons) Containers	609,000	646,149	685,584	727,383	771,754	818,831	868,780	
Other Packaging	616,000	651,112	688,225	727,454	768,919	812,748	859,074	
Total Plastic Packaging	1,225,000	1,297,275	1,373,814	1,454,869	1,540,707	1,631,608	1,727,873	
Diversion resulting from Policy (tons)								
50% Utilization	612,600	648,638	686,907	727,435	770,353	815,804	863,937	5,125,573
Increasing Utilization	612,500	648,638	824,289	872,922	1,078,495	1,142,126	1,382,298	6,561,266
(at these rates)	50%	50%	60%	60%	70%	70%	80%	
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$75	$75	$75	$75	$75	$75	$75	
High	$200	$200	$200	$200	$200	$200	$200	
Value of Material Diverted -- $ (assume 33% of the material utilized at each value)								
50% Utilization	$55,584,375	$58,863,853	$62,336,820	$66,014,693	$69,909,560	$74,034,224	$78,402,243	$465,145,788
Increasing Utilization	$55,584,375	$58,863,853	$74,804,185	$79,217,631	$97,873,384	$103,847,913	$125,443,589	$595,434,930
Costs								
Collection and Recycling Costs								
Cost per ton	$750	$750	$750	$750	$750	$750	$750	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	$672	$666	$659	$652	$644	$635	$626	
Net Cost for colln./recy.								
50% Utilization	$411,600,000	$431,992,575	$452,671,787	$474,287,380	$496,107,509	$518,035,615	$540,824,288	$3,325,519,155
Increasing Utilization	$411,600,000	$431,992,575	$543,206,145	$569,144,856	$694,550,513	$725,249,862	$865,318,880	$4,241,062,811
Cost of Use by End-User $/ton								
Low Cost Utilization	$0	$0	$0	$0	$0	$0	$0	
Mid-Cost Utilization	$80	$80	$80	$80	$80	$80	$80	
Utilization Landfill Credits	$160	$160	$160	$160	$160	$160	$160	
Total addit. Cost to end-user (Assumes 15% at zero, 25% at $80 and remaining 60% at $160)								
50% Utilization	$71,050,000	$75,241,950	$79,681,225	$84,382,417	$89,360,980	$94,633,278	$100,216,641	$594,566,491
Increasing Utilization	$71,050,000	$75,241,950	$95,617,470	$101,258,901	$125,105,372	$132,486,589	$160,346,626	$761,106,908
Job Impacts								
Jobs Created	2,695	2,854	3,022	3,201	3,390	3,590	3,801	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	3,773	3,996	4,231	4,481	4,745	5,025	5,322	
Jobs Lost	0	0	0	0	0	0	0	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Lost	0	0	0	0	0	0	0	
Multiplier Jobs Created	1,078	1,142	1,209	1,280	1,358	1,436	1,521	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$32,340,000	$35,241,254	$38,402,782	$41,847,934	$45,602,154	$49,693,169	$54,151,192	$297,278,484
Capital Investment								
Capital Investment by Industry								
Low	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$91,528,093
Mid	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$91,528,093
High	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$17,580,021	$91,528,093
Net Benefit or (Cost)								
50% Utilization	($394,725,625)	($413,129,418)	($431,613,410)	($450,807,171)	($469,956,776)	($488,941,501)	($508,487,493)	($3,157,661,394)
Increasing Utilization	($394,725,625)	($413,129,418)	($525,618,648)	($549,338,192)	($676,180,348)	($704,395,388)	($846,070,705)	($4,109,456,304)
Benefit or (Cost) per ton diverted								
50% Utilization	($644)	($637)	($628)	($620)	($610)	($599)	($589)	($616)
Increasing Utilization	($644)	($637)	($638)	($629)	($627)	($617)	($612)	($626)

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Table 2-A.4 Cost-Benefit Analysis for Market Development Policies
50% Utilization in Corrugated and Paperboard Packaging

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	5,700,000	5,800,000	5,900,000	6,200,000	6,300,000	6,500,000	6,500,000	
Diversion resulting from Policy (tons)								
50% Utilization	2,850,000	2,900,000	2,950,000	3,100,000	3,150,000	3,250,000	3,250,000	21,450,000
Increasing Utilization	2,850,000	2,900,000	3,540,000	3,720,000	4,410,000	4,550,000	5,200,000	27,170,000
(at these rates)	50%	50%	60%	60%	70%	70%	80%	
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$25	$25	$25	$25	$25	$25	$25	
Mid	$55	$55	$55	$55	$55	$55	$55	
High	$65	$65	$65	$65	$65	$65	$65	
Value of Material Diverted -- $ (assume 33% of the material diverted at each value)								
50% Utilization	$136,372,500	$138,765,000	$141,157,500	$148,335,000	$150,727,500	$155,512,500	$155,512,500	$1,026,382,500
Increasing Utilization	$136,372,500	$138,765,000	$169,389,000	$178,002,000	$211,018,500	$217,717,500	$248,820,000	$1,300,084,500
Costs								
Collection and Recycling Costs								
Cost per ton	$48	$48	$48	$48	$48	$48	$48	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	($31)	($37)	($44)	($51)	($59)	($68)	($77)	
Net Cost for colln./recy.								
50% Utilization	($86,925,000)	($105,850,000)	($128,325,000)	($156,550,000)	($184,275,000)	($219,375,000)	($248,625,000)	($1,129,925,000)
Increasing Utilization	($86,925,000)	($105,850,000)	($153,990,000)	($187,860,000)	($257,985,000)	($307,125,000)	($397,800,000)	($1,497,535,000)
Cost of Use by End-User $/ton								
Low No additional cost	$0	$0	$0	$0	$0	$0	$0	
Mid - Cost of credits/use	$23	$23	$22	$21	$21	$20	$20	
High - Avoided landfill credits	$160	$160	$160	$160	$160	$160	$160	
Total addit. Cost to end-user (assume 10% of credits from avoided landfill, 50% low cost, 40% mid cost)								
50% Utilization	$72,001,225	$72,801,225	$73,601,225	$76,001,225	$76,801,225	$78,401,225	$78,401,225	$528,008,572
Increasing Utilization	$72,001,225	$72,801,225	$88,321,470	$91,201,470	$107,521,714	$109,761,714	$125,441,959	$667,050,777
Job Impacts								
Jobs Created	3,420	3,480	4,248	4,464	5,292	5,460	6,240	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	4,788	4,872	5,947	6,250	7,409	7,644	8,736	
Jobs Lost	0	0	0	0	0	0	0	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Lost	0	0	0	0	0	0	0	
Multiplier Jobs Created	1,368	1,392	1,699	1,786	2,117	2,184	2,496	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$41,040,000	$42,971,040	$53,975,479	$58,364,875	$71,197,145	$75,567,636	$88,891,060	$432,027,234
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$343,636,364
High	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$687,272,727
Net Benefit or (Cost)								
50% Utilization	$192,336,275	$214,784,815	$249,856,754	$287,248,650	$329,398,421	$372,073,911	$414,627,335	$2,060,326,162
Increasing Utilization	$192,336,275	$214,784,815	$289,033,009	$333,025,405	$432,678,931	$490,666,421	$610,069,100	$2,582,595,958
Benefit or (Cost) per ton diverted								
50% Utilization	$67	$74	$85	$93	$105	$114	$128	$96
Increasing Utilization	$67	$74	$82	$90	$98	$108	$117	$94

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Table 2-A.5 Cost-Benefit Analysis for Market Development Policies
50% Utilization in Other Paper Packaging

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	583,804	587,306	590,830	594,375	597,942	601,529	605,138	
Diversion resulting from Policy (tons)								
50% Utilization	291,902	293,653	295,415	297 188	298,971	300 765	302,569	2,080 462
Increasing Utilization	291,902	293,653	354,498	356,625	418,559	421 070	484,111	2,620,418
(at these rates)	50%	50%	60%	60%	70%	70%	80%	
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	($5)	($5)	($5)	($5)	($5)	($5)	($5)	
Mid	$0	$0	$0	$0	$0	$0	$0	
High	$10	$10	$10	$10	$10	$10	$10	
Value of Material Diverted -- $ (assume 33% of the material diverted at each value)								
50% Utilization	$481,638	$484,528	$487,435	$490,360	$493,302	$496,262	$499,239	$3,432,763
Increasing Utilization	$481,638	$484,528	$584,922	$588,432	$690,622	$694,766	$798,783	$4,323,690
Costs								
Collection and Recycling Costs								
Cost per ton	*$80*	*$80*	*$80*	*$80*	*$80*	*$80*	*$80*	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	$2	($4)	($11)	($18)	($26)	($35)	($44)	
Net Cost for colln./recy.								
50% Utilization	$583,804	($1,174,613)	($3,249,567)	($5,349,377)	($7,773,240)	($10,526,760)	($13,313,043)	($40,802,796)
Increasing Utilization	$583,804	($1,174,613)	($3,699,480)	($6,419,253)	($10,882,535)	($14,737,464)	($21,300,869)	($57,830,411)
Cost of Use by End-User $/ton								
Low No additional cost	$0	$0	$0	$0	$0	$0	$0	
Mid - Cost of credits/use	$45	$45	$45	$45	$45	$46	$45	
High - Avoided landfill credits	$160	$160	$160	$160	$160	$160	$160	
Total addit. Cost to end-user (assume 10% of credits from avoided landfill, 50% low cost, 40% mid cost)								
50% Utilization	$9,924,661	$9,984,209	$10,044,115	$10,104,379	$10,165,006	$10,225,996	$10,287,352	$70,735,718
Increasing Utilization	$9,924,661	$9,984,209	$12,052,938	$12,125,255	$14,231,008	$14,316,394	$16,459,763	$89,094,228
Job Impacts								
Jobs Created	350	352	425	428	502	505	581	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	490	493	596	599	703	707	813	
Jobs Lost	0	0	0	0	0	0	0	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Lost	0	0	0	0	0	0	0	
Multiplier Jobs Created	140	141	170	171	201	202	232	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$4,203,386	$4,351,236	$5,405,144	$5,595,264	$6,757,417	$6,995,103	$8,275,598	$41,583,147
Capital Investment								
Capital Investment by Industry								
Low								
Mid								
High								
Net Benefit or (Cost)								
50% Utilization	($5,823,441)	($3,973,833)	($901,970)	$1,330,622	$4,858,953	$7,792,129	$11,800,529	$15,082,989
Increasing Utilization	($5,823,441)	($3,973,833)	($2,163,392)	$477,693	$4,099,567	$8,110,939	$13,915,487	$14,643,021
Benefit or (Cost) per ton diverted								
50% Utilization	($20)	($14)	($3)	$4	$16	$26	$39	$7
Increasing Utilization	($20)	($14)	($6)	$1	$10	$19	$29	$6

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Table 2-A.6 Cost-Benefit Analysis for Market Development Policies
50% Utilization of Steel Cans and Packaging

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	344,129	346,882	349,657	352,454	355,274	358,116	360,981	2,467,491
Diversion resulting from Policy (tons)								
50% Utilization	172,064	173,441	174,828	176,227	177,637	179,058	180,490	1,233,746
Increasing Utilization	172,064	173,441	209,794	211,472	248,692	250,681	288,785	1,554,929
(at these rates)	50%	50%	60%	60%	70%	70%	80%	
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$40	$40	$40	$40	$40	$40	$40	
Mid	$50	$50	$50	$50	$50	$50	$50	
High	$60	$60	$60	$60	$60	$60	$60	
Value of Material Diverted -- $ (assume 33% of the material diverted at each value)								
50% Utilization	$8,517,185	$8,585,322	$8,654,005	$8,723,237	$8,793,023	$8,863,367	$8,934,274	$61,070,413
Increasing Utilization	$8,517,185	$8,585,322	$10,384,806	$10,467,884	$12,310,232	$12,408,714	$14,294,838	$76,968,982
Costs								
Collection and Recycling Costs								
Cost per ton	$100	$100	$100	$100	$100	$100	$100	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling cos	$22	$16	$9	$2	($6)	($15)	($24)	
Net Cost for colln./recy								
50% Utilization	$3,785,416	$2,775,054	$1,573,455	$352,454	($1,065,821)	($2,685,869)	($4,331,769)	$402,920
Increasing Utilization	$3,785,416	$2,775,054	$1,888,147	$422,945	($1,492,149)	($3,760,216)	($6,930,831)	($3,311,636)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$25	$25	$25	$25	$25	$25	$25	
High	$160	$160	$160	$160	$160	$160	$160	
Total addit. Cost to end-user (assume 10% of credits from avoided landfill, 50% low cost, 40% mid cost)								
50% Utilization	$4,473,673	$4,509,462	$4,545,538	$4,581,902	$4,618,557	$4,655,506	$4,692,750	$32,077,389
Increasing Utilization	$4,473,673	$4,509,462	$5,454,646	$5,498,283	$6,465,980	$6,517,708	$7,508,400	$40,428,152
Job Impacts								
Jobs Created	206	208	210	211	213	215	217	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	289	291	294	296	298	301	303	
Jobs Lost								
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Lost								
Multiplier Jobs Created	83	83	84	85	85	86	87	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$2,477,727	$2,569,977	$2,665,663	$2,764,911	$2,867,854	$2,974,630	$3,085,381	$19,406,141
Capital Investment								
Capital Investment by Industry								
None Needed	$0	$0	$0	$0	$0	$0	$0	
Net Benefit or (Cost)								
50% Utilization	$2,735,823	$3,870,784	$5,200,674	$6,553,791	$8,108,140	$9,868,360	$11,658,674	$47,996,246
Increasing Utilization	$2,735,823	$3,870,784	$5,707,677	$7,311,567	$10,204,255	$12,625,852	$16,802,650	$59,258,607
Benefit or (Cost)per ton diverted								
50% Utilization	$16	$22	$30	$37	$46	$55	$65	$39
Increasing Utilization	$16	$22	$27	$35	$41	$50	$58	$38

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Table 2-A.7 Cost-Benefit Analysis for Market Development Policies
Summary Table for 50% and Increasing Utilization in Packaging - Without Job Loss

	1994	1995	1996	1997	1998	1999	2000	Total
Aluminum Packaging								
Tons Diverted/Utilized								
50% Utilization	124,750	127,245	129,790	132,388	135,034	137,734	140,489	927,429
Increasing Utilization	124,750	127,245	155,748	158,863	189,047	192,828	224,783	1,173,265
Total Net (Cost) or Benefit								
50% Utilization Only	$67,664,566	$69,834,467	$72,195,460	$74,624,609	$77,258,811	$80,108,083	$83,042,329	$524,728,325
Increasing Utilization Only	$67,664,566	$69,834,467	$86,238,762	$89,134,117	$107,290,315	$111,236,061	$131,426,776	$662,825,066
Net (Cost) or Benefit per ton diverted								
50% Utilization Only	$542	$549	$556	$564	$572	$582	$591	$566
Increasing Utilization Only	$542	$549	$554	$561	$568	$577	$585	$565
Glass Containers								
Tons Diverted/Utilized								
50% Utilization	1,030,301	1,040,604	1,051,010	1,061,520	1,072,135	1,082,857	1,093,685	7,432,113
Increasing Utilization	1,030,301	1,040,604	1,261,212	1,273,824	1,500,989	1,515,999	1,749,896	9,372,827
Total Net (Cost) or Benefit								
50% Utilization	($5,821,201)	$798,768	$8,615,456	$16,601,626	$25,632,541	$36,343,559	$47,077,064	$129,447,813
Increasing Utilization	($5,821,201)	$798,768	$7,133,531	$16,591,011	$29,241,931	$43,885,328	$64,105,744	$155,735,112
Net (Cost) or Benefit per ton diverted								
50% Utilization	($6)	$1	$8	$16	$24	$34	$43	$17
Increasing Utilization	($6)	$1	$6	$13	$19	$29	$37	$17
Plastic Packaging								
Tons Diverted/Utilized								
50% Utilization	612,500	648,638	686,907	727,435	770,353	815,804	863,937	5,125,573
Increasing Utilization	612,500	648,638	824,289	872,922	1,078,495	1,142,126	1,382,298	6,561,266
Total Net (Cost) or Benefit								
50% Utilization	($394,725,625)	($413,129,418)	($431,813,410)	($450,607,171)	($469,958,776)	($488,941,501)	($508,487,493)	($3,157,661,394)
Increasing Utilization	($394,725,625)	($413,129,418)	($525,616,648)	($549,338,192)	($676,180,348)	($704,395,368)	($846,070,705)	($4,109,456,304)
Net (Cost) or Benefit per ton diverted								
50% Utilization	($644)	($637)	($628)	($620)	($610)	($599)	($589)	($616)
Increasing Utilization	($644)	($637)	($638)	($629)	($627)	($617)	($612)	($626)
Corrugated and Paperboard Packaging								
Tons Diverted/Utilized								
50% Utilization	2,850,000	2,900,000	2,950,000	3,100,000	3,150,000	3,250,000	3,250,000	21,450,000
Increasing Utilization	2,850,000	2,900,000	3,540,000	3,720,000	4,410,000	4,550,000	5,200,000	27,170,000
Total Net (Cost) or Benefit								
50% Utilization	$192,336,275	$214,784,815	$249,856,754	$287,248,650	$329,398,421	$372,073,911	$414,627,335	$2,060,326,162
Increasing Utilization	$192,336,275	$214,784,815	$289,033,009	$333,025,405	$432,678,931	$490,668,421	$610,069,100	$2,562,595,958
Net (Cost) or Benefit per ton diverted								
50% Utilization	$67	$74	$85	$93	$105	$114	$128	$96
Increasing Utilization	$67	$74	$82	$90	$98	$108	$117	$94
Other Paper Packaging								
Tons Diverted/Utilized								
50% Utilization	291,902	293,653	295,415	297,188	298,971	300,765	302,569	2,080,462
Increasing Utilization	291,902	293,653	354,498	356,625	418,559	421,070	484,111	2,620,418
Total Net (Cost) or Benefit								
50% Utilization	($5,823,441)	($3,973,833)	($901,970)	$1,330,622	$4,858,953	$7,792,129	$11,800,529	$15,082,989
Increasing Utilization	($5,823,441)	($3,973,833)	($2,163,392)	$477,693	$4,099,567	$8,110,939	$13,915,487	$14,643,021
Net (Cost) or Benefit per ton diverted								
50% Utilization	($20)	($14)	($3)	$4	$16	$26	$39	$7
Increasing Utilization	($20)	($14)	($6)	$1	$10	$19	$29	$6
Steel Cans/Packaging								
Tons Diverted/Utilized								
50% Utilization	172,084	173,441	174,828	176,227	177,637	179,058	180,490	1,233,746
Increasing Utilization	172,084	173,441	209,794	211,472	248,692	250,681	288,785	1,554,929
Total Net (Cost) or Benefit								
50% Utilization	$2,735,823	$3,870,784	$5,200,674	$6,553,791	$8,108,140	$9,668,360	$11,658,674	$47,996,246
Increasing Utilization	$2,735,823	$3,870,784	$5,707,677	$7,311,567	$10,204,255	$12,625,852	$16,802,650	$59,258,607
Net (Cost) or Benefit per ton diverted.								
50% Utilization	$16	$22	$30	$37	$46	$55	$65	$39
Increasing Utilization	$16	$22	$27	$35	$41	$50	$58	$38
Jobs Lost, All Industries								
50% Utilization	0	0	0	0	0	0	0	
Increasing Utilization	0	0	0	0	0	0	0	
Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Cost of Jobs Lost								
50% Utilization	$0	$0	$0	$0	$0	$0	$0	$0
Increasing Utilization	$0	$0	$0	$0	$0	$0	$0	$0
Administrative Costs								
Public	$700,000	$720,300	$741,189	$762,683	$784,801	$807,560	$830,979	$5,347,513
Private	$70,000,000	$72,030,000	$74,118,870	$76,268,317	$78,480,098	$80,756,021	$83,097,946	$534,751,253
Packaging Totals								
Tons Diverted/Utilized								
50% Utilization	5,081,517	5,183,581	5,287,951	5,494,755	5,604,130	5,766,218	5,831,170	38,249,323
Increasing Utilization	5,081,517	5,183,581	6,345,541	6,593,707	7,845,782	8,072,705	9,329,873	48,452,706
Total Net (Cost) or Benefit								
50% Utilization	($214,333,602)	($200,564,717)	($171,507,094)	($141,478,874)	($103,764,810)	($64,319,041)	($24,210,487)	($920,178,625)
Increasing Utilization	($214,333,602)	($200,564,717)	($214,527,120)	($179,829,399)	($171,930,248)	($119,632,349)	($93,679,871)	($1,194,497,306)
Net(Cost) or Benefit per ton diverted								
50% Utilization	($42)	($39)	($32)	($26)	($19)	($11)	($4)	($24)
Increasing Utilization	($42)	($39)	($34)	($27)	($22)	($15)	($10)	($25)
Diversion Summary								
Total Waste Generation	48,138,916	48,957,280	49,789,553	50,635,976	51,496,787	52,372,233	53,262,561	354,653,306
Diversion at 50% Utilization	11%	11%	11%	11%	11%	11%	11%	11%
Diversion at Increasing Util.	11%	11%	13%	13%	15%	15%	18%	14%

Table 2-A.8 Cost-Benefit Analysis for Market Development Policies
Summary Table for 50% and Increasing Utilization in Packaging - Without Aluminum

	1994	1995	1996	1997	1998	1999	2000	Total
Aluminum Packaging								
Tons Diverted/Utilized								
50% Utilization	124.750	127.245	129.790	132.388	135.034	137.734	140.489	927.429
Increasing Utilization	124.750	127.245	155.748	158.863	189.047	192.828	224.783	1.173.265
Total Net (Cost) or Benefit								
50% Utilization Only	$67.664.566	$69.834.467	$72.195.460	$74.624.609	$77.258.811	$80.108.083	$83.042.329	$524.728.325
Increasing Utilization Only	$67.664.566	$69.834.467	$86.238.762	$89.134.117	$107.290.315	$111.236.061	$131.428.778	$662.825.066
Net (Cost) or Benefit per ton diverted								
50% Utilization Only	$542	$549	$556	$564	$572	$582	$591	$566
Increasing Utilization Only	$542	$549	$554	$561	$568	$577	$585	$565
Glass Containers								
Tons Diverted/Utilized								
50% Utilization	1.030.301	1.040.604	1.051.010	1.061.520	1.072.135	1.082.857	1.093.685	7.432.113
Increasing Utilization	1.030.301	1.040.604	1.261.212	1.273.824	1.500.989	1.515.999	1.749.896	9.372.827
Total Net (Cost) or Benefit								
50% Utilization	($5.821.201)	$798.768	$8.615.456	$16.601.626	$25.832.541	$36.343.559	$47.077.064	$129.447.613
Increasing Utilization	($5.821.201)	$798.768	$7.133.531	$16.591.011	$29.241.931	$43.685.328	$64.105.744	$155.735.112
Net (Cost) or Benefit per ton diverted								
50% Utilization	($6)	$1	$8	$16	$24	$34	$43	$17
Increasing Utilization	($6)	$1	$6	$13	$19	$29	$37	$17
Plastic Packaging								
Tons Diverted/Utilized								
50% Utilization	612.500	648.638	686.907	727.435	770.353	815.604	863.937	5.125.573
Increasing Utilization	612.500	648.638	824.289	872.922	1.078.495	1.142.126	1.382.298	6.561.266
Total Net (Cost) or Benefit								
50% Utilization	($394.725.625)	($413.129.418)	($431.613.410)	($450.807.171)	($469.956.778)	($488.941.501)	($508.487.493)	($3.157.661.394)
Increasing Utilization	($394.725.625)	($413.129.418)	($525.616.648)	($549.336.192)	($676.160.348)	($704.395.368)	($846.070.705)	($4.109.456.304)
Net (Cost) or Benefit per ton diverted								
50% Utilization	($644)	($637)	($628)	($620)	($610)	($599)	($589)	($616)
Increasing Utilization	($644)	($637)	($638)	($629)	($627)	($617)	($612)	($626)
Corrugated and Paperboard Packaging								
Tons Diverted/Utilized								
50% Utilization	2.850.000	2.900.000	2.950.000	3.100.000	3.150.000	3.250.000	3.250.000	21.450.000
Increasing Utilization	2.850.000	2.900.000	3.540.000	3.720.000	4.410.000	4.550.000	5.200.000	27.170.000
Total Net (Cost) or Benefit								
50% Utilization	$192.336.275	$214.784.815	$249.856.754	$287.248.650	$329.396.421	$372.073.911	$414.627.335	$2.060.326.162
Increasing Utilization	$192.336.275	$214.784.815	$289.033.009	$333.025.405	$432.678.931	$490.868.421	$610.069.100	$2.562.595.958
Net (Cost) or Benefit per ton diverted								
50% Utilization	$67	$74	$85	$93	$105	$114	$128	$96
Increasing Utilization	$67	$74	$82	$90	$98	$108	$117	$94
Other Paper Packaging								
Tons Diverted/Utilized								
50% Utilization	291.902	293.653	295.415	297.188	298.971	300.765	302.569	2.080.462
Increasing Utilization	291.902	293.653	354.498	356.625	418.559	421.070	484.111	2.620.418
Total Net (Cost) or Benefit								
50% Utilization	($5.823.441)	($3.973.833)	($901.970)	$1.330.622	$4.858.953	$7.792.129	$11.800.529	$15.082.989
Increasing Utilization	($5.823.441)	($3.973.833)	($2.163.392)	$477.693	$4.099.567	$8.110.939	$13.915.487	$14.643.021
Net (Cost) or Benefit per ton diverted								
50% Utilization	($20)	($14)	($3)	$4	$16	$26	$39	$7
Increasing Utilization	($20)	($14)	($6)	$1	$10	$19	$29	$6
Steel Cans/Packaging								
Tons Diverted/Utilized								
50% Utilization	172.064	173.441	174.828	176.227	177.637	179.058	180.490	1.233.746
Increasing Utilization	172.064	173.441	209.794	211.472	248.692	250.681	288.785	1.554.929
Total Net (Cost) or Benefit								
50% Utilization	$2.735.823	$3.870.784	$5.200.674	$6.553.791	$8.108.140	$9.868.360	$11.658.674	$47.996.246
Increasing Utilization	$2.735.823	$3.870.784	$5.707.677	$7.311.567	$10.204.255	$12.625.852	$16.802.650	$59.258.607
Net (Cost) or Benefit per ton diverted								
50% Utilization	$16	$22	$30	$37	$46	$55	$65	$39
Increasing Utilization	$16	$22	$27	$35	$41	$50	$58	$38
Jobs Lost, All Industries								
50% Utilization	5.276	5.001	4.397	3.774	2.987	2.167	1.334	
Increasing Utilization	5.276	5.001	5.634	4.919	5.115	4.040	3.887	
Value of Jobs	$30.000	$30.870	$31.765	$32.686	$33.634	$34.610	$35.613	
Net Cost of Jobs Lost								
50% Utilization	$158.284.536	$154.369.460	$139.660.297	$123.346.584	$100.471.109	$75.001.299	$47.495.849	$798.649.135
Increasing Utilization	$158.284.536	$154.369.460	$178.956.603	$160.784.903	$172.036.369	$139.826.054	$138.440.832	$1.102.698.759
Administrative Costs								
Public	$700.000	$720.300	$741.189	$762.683	$784.801	$807.560	$830.979	$5.347.513
Private	$70.000.000	$72.030.000	$74.118.870	$76.266.317	$78.480.098	$80.756.021	$83.097.946	$534.751.253
Packaging Totals								
Tons Diverted/Utilized								
50% Utilization	4.956.767	5.056.336	5.158.161	5.362.369	5.469.096	5.628.483	5.690.681	37.321.894
Increasing Utilization	4.956.767	5.056.336	6.169.793	6.434.843	7.656.735	7.879.877	9.105.090	47.279.440
Total Net (Cost) or Benefit								
50% Utilization	($440.282.704)	($424.768.644)	($383.382.852)	($339.450.067)	($281.494.730)	($219.426.422)	($154.748.665)	($2.243.556.084)
Increasing Utilization	($440.282.704)	($424.768.644)	($479.722.465)	($429.748.419)	($451.256.932)	($370.694.464)	($363.547.480)	($2.960.021.130)
Net(Cost) or Benefit per ton diverted								
50% Utilization	($89)	($84)	($74)	($63)	($51)	($39)	($27)	($60)
Increasing Utilization	($89)	($84)	($78)	($67)	($59)	($47)	($40)	($63)
Diversion Summary								
Total Waste Generation	48.138.918	48.957.280	49.789.553	50.635.976	51.496.787	52.372.233	53.262.561	354.653.308
Diversion at 50% Utilization	10%	10%	10%	11%	11%	11%	11%	11%
Diversion at Increasing Util	10%	10%	12%	13%	15%	15%	17%	13%

Table 2-A.9 Cost-Benefit Analysis for Market Development Policies

Summary Table for 50% and Increasing Utilization in Packaging - Without Plastic

	1994	1995	1996	1997	1998	1999	2000	Total
Aluminum Packaging								
Tons Diverted/Utilized								
50% Utilization	124.750	127.245	129 790	132.386	135 034	137 734	140.489	927 429
Increasing Utilization	124.750	127.245	155.748	158 863	189 047	192.828	224 783	1 173.265
Total Net (Cost) or Benefit								
50% Utilization Only	$67 684.566	$69.834 467	$72.195.460	$74 624.609	$77.258.811	$80.108.083	$83.042 329	$524 728 325
Increasing Utilization Only	$67.684.566	$69 834.467	$86.238 762	$89 134.117	$107.290.315	$111.236.061	$131.426.778	$662 925 066
Net (Cost) or Benefit per ton diverted								
50% Utilization Only	$542	$549	$556	$564	$572	$582	$591	$566
Increasing Utilization Only	$542	$549	$554	$561	$568	$577	$585	$565
Glass Containers								
Tons Diverted/Utilized								
50% Utilization	1 030.301	1.040.604	1.051 010	1.061.520	1.072.135	1.082.857	1 093.885	7 432 113
Increasing Utilization	1 030.301	1 040.604	1.261.212	1.273 824	1.500 989	1.515.999	1.749.896	9 372 827
Total Net (Cost) or Benefit								
50% Utilization	($5.821.201)	$798.768	$8.615.456	$16.601.626	$25.832.541	$36.343.559	$47.077 064	$129 447.813
Increasing Utilization	($5.821.201)	$798.768	$7.133.531	$16.591.011	$29.241.931	$43.665.328	$64.105.744	$155 735 112
Net (Cost) or Benefit per ton diverted								
50% Utilization	($6)	$1	$8	$16	$24	$34	$43	$17
Increasing Utilization	($6)	$1	$6	$13	$19	$29	$37	$17
Plastic Packaging								
Tons Diverted/Utilized								
50% Utilization	612.500	648.638	686.907	727.435	770.353	815.804	863.937	5.125.573
Increasing Utilization	612.500	648.638	824.289	872.922	1.078.495	1.142.126	1,382.298	6.561.266
Total Net (Cost) or Benefit								
50% Utilization	($394.725.625)	($413.129 418)	($431 613 410)	($450.807.171)	($469.956.776)	($488.941.501)	($508.487.493)	($3.157.661.394)
Increasing Utilization	($394.725.625)	($413.129.418)	($525.616.648)	($549.338.192)	($676.180.348)	($704.395.368)	($846.070.705)	($4.109.456.304)
Net (Cost) or Benefit per ton diverted								
50% Utilization	($644)	($637)	($628)	($620)	($610)	($599)	($589)	($616)
Increasing Utilization	($644)	($637)	($638)	($629)	($627)	($617)	($612)	($626)
Corrugated and Paperboard Packaging								
Tons Diverted/Utilized								
50% Utilization	2 850.000	2.900.000	2.950.000	3.100.000	3.150.000	3.250.000	3.250.000	21.450.000
Increasing Utilization	2.850.000	2.900.000	3.540.000	3.720.000	4.410.000	4.550.000	5.200.000	27.170.000
Total Net (Cost) or Benefit								
50% Utilization	$192.336.275	$214.784.815	$249.856.754	$287.248 650	$329.398.421	$372.073.911	$414.627.335	$2.060.326.162
Increasing Utilization	$192.336.275	$214.784.815	$289.033.009	$333.025.405	$432.676.931	$490.668.421	$610.089.100	$2.562.595.958
Net (Cost) or Benefit per ton diverted								
50% Utilization	$67	$74	$85	$93	$105	$114	$128	$96
Increasing Utilization	$67	$74	$82	$90	$98	$108	$117	$94
Other Paper Packaging								
Tons Diverted/Utilized								
50% Utilization	291.902	293.653	295 415	297.188	298.971	300.765	302.569	2.080.462
Increasing Utilization	291.902	293.653	354 498	356.625	418.559	421.070	484.111	2.620.418
Total Net (Cost) or Benefit								
50% Utilization	($5.623.441)	($3.973.833)	($901.970)	$1.330.822	$4.858.953	$7.792.129	$11.800.529	$15.082.989
Increasing Utilization	($5.623.441)	($3.973.833)	($2.163.392)	$477.693	$4.099.567	$8.110.939	$13.915.487	$14.643.021
Net (Cost) or Benefit per ton diverted								
50% Utilization	($20)	($14)	($3)	$4	$16	$26	$39	$7
Increasing Utilization	($20)	($14)	($6)	$1	$10	$19	$29	$6
Steel Cans/Packaging								
Tons Diverted/Utilized								
50% Utilization	172.064	173.441	174.828	176.227	177.637	179.056	180.490	1.233.746
Increasing Utilization	172.064	173.441	209.794	211.472	248.892	250.661	288.765	1.554.929
Total Net (Cost) or Benefit								
50% Utilization	$2.735.823	$3.870.784	$5.200.674	$6.553.791	$8.108.140	$9.868.360	$11.658.674	$47.996.246
Increasing Utilization	$2.735.823	$3.870.784	$5.707.677	$7.311.567	$10.204.255	$12.625.852	$16.602.650	$59.258.607
Net (Cost) or Benefit per ton diverted								
50% Utilization	$16	$22	$30	$37	$46	$55	$65	$39
Increasing Utilization	$16	$22	$27	$35	$41	$50	$58	$38
Jobs Lost, All Industries								
50% Utilization								
Increasing Utilization								
Value of Jobs	$30.000	$30.870	$31.765	$32.686	$33.634	$34.610	$35.613	
Net Cost of Jobs Lost								
50% Utilization	$0	$0	$0	$0	$0	$0	$0	$0
Increasing Utilization	$0	$0	$0	$0	$0	$0	$0	$0
Administrative Costs								
Public	$700.000	$720.300	$741 189	$762.683	$784.801	$807.560	$830.979	$5.347.513
Private	$70.000.000	$72.030.000	$74.118.870	$76.268.317	$78.480.098	$80.756.021	$83.097.946	$534.751.253
Packaging Totals								
Tons Diverted/Utilized								
50% Utilization	4 469.017	4.534.943	4.601.044	4.767.321	4.833.777	4.950.414	4.967.234	33.123.750
Increasing Utilization	4.469.017	4.534.943	5.521.253	5.720.785	6.767.287	6.930.579	7.947.574	41.891.439
Total Net (Cost) or Benefit								
50% Utilization	$180.392.023	$212.564.701	$260.106.316	$309.328.297	$368.191.966	$424.622.460	$484.277.006	$2.237.482.769
Increasing Utilization	$180.392.023	$212.564.701	$311.089.528	$369.508.793	$504.250.100	$584.763.020	$752.390.834	$2.914.958.998
Net(Cost) or Benefit per ton diverted								
50% Utilization	$40	$47	$57	$65	$76	$86	$97	$68
Increasing Utilization	$40	$47	$56	$65	$75	$84	$95	$70
Diversion Summary								
Total Waste Generation	48.138.918	48.957.260	49.789.553	50.635.976	51.496.787	52.372.233	53.262.561	354.653.308
Diversion at 50% Utilization	9%	9%	9%	9%	9%	9%	9%	9%
Diversion at Increasing Utl.	9%	9%	11%	11%	13%	13%	15%	12%

CHAPTER 3
15% REFILLING OF PLASTIC AND GLASS BEVERAGE CONTAINERS WITH AND WITHOUT TRADING CREDITS

INTRODUCTION

This policy would require that 15% of the glass and plastic beverage containers sold in the state be refillable. The refilled containers could either be standard "throwaway" bottles (some of which are already being collected for refilling in some areas), or specially-designed refillables. The containers on which the 15% would be applied are "CRV" (California redemption value) containers regulated under the California Beverage Redemption and Litter Reduction Act. However, manufacturers that sold non-CRV refillable beverages could sell credits to CRV beverage manufacturers. The effect of this could be to draw other beverage markets, such as milk, into the refilling process.

In most situations, refilling has been shown to have the lowest energy requirement and cause the least amount of water and air pollution of the containers tested.[1] Yet, the refillable market share has dropped dramatically in the last 25 years. Refillable bottles held 40% of the national beer container market share in 1965, and only about 5% in 1989. The decline for refillable glass soft drink bottles in this period was even more dramatic, dropping from a 90% market share in 1965 to 15% in 1985.[2] Changes in supermarket structure, centralization of beverage distributorship, consolidation in the industry, and movement toward recycling have resulted in a dramatic decrease in refillable market share.

Recycling centers are presently reluctant to pursue the limited markets now available for refilling. So long as just a few small, distant brewers are interested in the process, there seems to be limited economic reason to sort all glass bottles in order to isolate the narrow group for which a refilling market exists.

However, major markets may be within reach. Large breweries such as Anheuser-Busch report that they have developed a new generation of glass bottles which could either be refilled or recycled. They have not chosen to bring these containers into the California market, however. In addition, Owens-Brockway has developed refillable soft drink bottles for European markets, but the container has not been used in the U.S.

Many barriers-to-entry contribute to the lack of a large market for bottle refilling in the state. For example, large breweries indicate a reluctance to introduce more durable bottles because their regional competitors may be in a better position to refill them than they are. Large glass and plastic bottle manufacturers have little interest in introducing refilling, because every time a bottle is refilled, a new bottle is displaced. High sewer charges and increased water use from washing are also cited as barriers to refilling. Finally, recycling centers are discouraged from sorting bottles when just a tiny percentage are of the brand and type for which refill markets exist.

Until a larger infrastructure is in place, it is unlikely that recycling programs or centers will be able to incur the sorting and transportation expense required to market empty bottles for refilling.

This policy could serve to jump-start the development of such an infrastructure. If the economics of refilling prove out once such a structure is in place, the market could expand beyond the mandated fifteen percent.

<u>*HIGHLIGHTS OF THE ANALYSIS*</u>

- *The refilling policy results in the highest per ton benefit of the six policies analyzed. The plastic refilling benefit ranges from -$44 per ton to $1,171 per ton, and the glass benefit per ton ranges from $261 to $458. The per container benefit is in the range of 7-cents to 12-cents, mostly due to reduced container, processing and disposal costs.*

- *The combined overall net benefit of these policies ranges from $40 million to $112 million over the seven year period of the analysis.*

- *The direct diversion impacts of this policy are minimal. However, the policy will reduce the oversupply of cullet, provide a high-value use of secondary plastic, and may lay the foundation for broader reuse and refilling efforts.*

- *One of the primary benefits of this policy is the creation of new jobs related to the refilling infrastructure. The total number of jobs created will be about 800, with an annual benefit per job of $14,000 for the plastic policy and $23,000 for glass.*

- *Refilling of glass and plastic bottles, a source reducing option, results in a high net benefit. Refilling can become even more cost-effective once an infrastructure is established.*

Table 3.1 Waste Generation Data for Glass and Plastic Beverage Containers

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Glass Containers Sold	3,253,000,000	2,838,000,000	2,596,000,000	2,336,400,000	2,102,760,000	1,892,484,000	1,703,235,600	1,532,912,040	1,379,620,836	1,241,658,752	1,117,492,877
Glass Containers Recycled	1,645,000,000	1,803,000,000	1,774,000,000	1,612,116,000	1,450,904,400	1,305,813,960	1,175,232,564	1,057,709,308	951,938,377	856,744,539	771,070,085
Policy Glass Refilled	0	0	0	0	126,165,600	113,549,040	102,194,136	91,974,722	82,777,250	74,499,525	67,049,573
Ttl Glass Containers Refilled	242,000,000	265,000,000	226,000,000	216,960,000	315,414,000	283,872,600	255,485,340	229,936,806	206,943,125	186,248,813	167,623,932
Plastic Containers Sold	559,000,000	531,000,000	542,000,000	536,580,000	531,214,200	525,902,058	520,643,037	515,436,607	510,282,241	505,179,419	500,127,624
Plastic Containers Recycled	172,000,000	300,000,000	363,140,000	359,508,600	355,913,514	352,354,379	348,830,835	345,342,527	341,889,101	338,470,210	335,085,508
Plastic Containers Refilled	0	0	0	0	79,682,130	78,885,309	78,096,456	77,315,491	76,542,336	75,776,913	75,019,144
Tons Glass &Plastic Sold	850,517	744,900	685,133	619,872	561,104	508,181	460,518	417,590	378,924	344,093	312,715
Tons Glass & Plastic Recycled	422,717	470,750	467,709	426,996	386,454	349,944	317,064	287,450	260,777	236,751	215,107
Policy Tn Glass & Plastic Refilled	0	0	0	0	36,854	33,646	30,755	28,148	25,797	23,677	21,764
% Baseline Diversion	49.7%	63.2%	68.3%	68.9%	68.9%	68.9%	68.8%	68.8%	68.8%	68.8%	68.8%
Policy Diversion (Refilling)	0.0%	0.0%	0.0%	0.0%	6.6%	6.6%	6.7%	6.7%	6.8%	6.9%	7.0%
Total Diversion	49.7%	63.2%	68.3%	68.9%	75.4%	75.5%	75.5%	75.6%	75.6%	75.7%	75.7%
% AB 939 Diversion	0.94%	1.03%	1.00%	0.90%	0.88%	0.78%	0.70%	0.62%	0.56%	0.50%	0.44%

WASTE GENERATION AND DIVERSION

Table 3-1 illustrates the relatively modest diversion benefits of this policy. Glass and plastic CRV beverage containers account for only 2% of the total weight of waste generated annually in the state. Thus, even a high diversion rate of these commodities will have a small overall diversion impact. The total diversion impact of recycling and refilling in this model is just below 1%. However, overall diversion impacts of this policy are not the best measure of its potential success. A refilling policy has the potential to impact glass and plastic secondary material markets by diverting these materials from the marketplace. This can be important when the markets are already saturated for these materials. By essentially removing 15% of the glass and plastic from the supply of secondary materials, this policy can help to relieve the supply-heavy markets for these materials. Increasing the refillable market share to 15% will remove 24,000 tons annually of glass and 5,000 tons annually of plastic, or 5% and 7% respectively, of the glass and plastic recycled in the state from the marketplace.

THE COST-BENEFIT MODEL

RESULTS OF THE MODEL -- 15% REFILLABLES FOR GLASS CONTAINERS

The model shows a net annual benefit from the policy ranging from $3.8 to $15.9 million a year, and $43 million to $80 million over seven years. This is between 7-cents and 13-cents per container refilled. At least 6-cents of this savings is internal to the beverage industry; that is, it would accrue to manufacturers and consumers of beverages. This benefit increases as the value of the container increases. The balance would accrue either to local governments and ratepayers, or to the economy more generally. The model shows a substantial savings compared to the 1-cent per bottle cost of recycling a glass container, and the avoided land disposal cost of 3-cents a bottle. The benefits that accrue are a result of the avoided cost of bottles, and the creation of new economic activity and jobs. Refilling is a labor-intensive process, and refilling jobs also have a significant multiplier effect through the economy. Only the multiplier jobs are counted as a benefit to the policy; the remaining jobs are part of the cost of collecting and washing bottles. The benefits far outweigh the cost of refilling and administrative costs.

Table 3.2 Cost-Benefit Analysis for Market Development Policies
15% Refillable Glass Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (Glass Bev. Cont.	2,102,760,000	1,892,484,000	1,703,235,600	1,532,912,040	1,379,620,836	1,241,658,752	1,117,492,877	10,970,184,106
Diversion resulting from Policy (Containers)								
	126,165,600	113,549,040	102,194,136	91,974,722	82,777,250	74,499,525	67,049,573	658,209,846
Price and Value of Material								
Market Prices (Price of Glass Bottle)								
Beer - low	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	
Beer - high	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	
Wine - mid	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	
Value of Material Refilled -- $								
low (all low beer)	$17,663,184	$15,896,866	$14,307,179	$12,876,461	$11,588,815	$10,429,934	$9,386,940	$92,149,378
mid (10% wine, 90% beer)	$22,356,544	$20,120,890	$18,108,801	$16,297,921	$14,668,129	$13,201,316	$11,881,184	$116,634,785
high (20% wine, 80% beer)	$24,778,924	$22,301,031	$20,070,928	$18,063,835	$16,257,452	$14,631,707	$13,168,536	$129,272,414
Costs								
Collection and Washing Costs								
Cost per bottle	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	
Recycler Savings from Refilling	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	
Value of Avoided Recycling								
Per bottle	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	
Net collection and refilling costs	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Net Cost for colln./refilling								
	$10,093,248	$9,083,923	$8,175,531	$7,357,978	$6,622,180	$5,959,962	$5,363,966	$52,656,788
Additional investment w/o trading	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$14,670,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	442	397	358	322	290	261	235	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
To[illegible] Created	618	556	501	451	406	365	329	
[illegible]	129	116	105	94	85	76	69	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	207	186	168	151	136	122	110	
Multiplier Jobs	99	89	80	72	65	58	53	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$2,989,744	$2,750,280	$2,547,034	$2,358,809	$2,184,493	$2,023,059	$1,873,555	$16,706,973
Capital Investment								
Capital Investment by Industry								
With Trading	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$5,230,000
Without Trading	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$19,900,000
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	$1,069,503
Private	$1,596,000	$1,642,284	$1,689,910	$1,738,918	$1,789,346	$1,841,237	$1,894,633	$12,192,329
Net Benefit or (Cost)								
low	$8,803,680	$7,776,878	$6,840,535	$5,985,838	$5,204,821	$4,490,281	$3,835,700	$42,937,732
mid	$13,497,040	$12,000,903	$10,642,156	$9,407,297	$8,284,135	$7,261,663	$6,329,944	$67,423,139
high	$15,919,420	$14,181,044	$12,604,284	$11,173,212	$9,873,458	$8,692,054	$7,617,296	$80,060,768
Without trading (low)	$5,985,978	$4,959,176	$4,022,832	$3,168,135	$2,387,119	$1,672,579	$1,017,998	$23,213,817
Benefit (Cost) per bottle refilled								
low	$0.07	$0.07	$0.07	$0.07	$0.06	$0.06	$0.06	$0.07
mid	$0.11	$0.11	$0.10	$0.10	$0.10	$0.10	$0.09	$0.10
High	$0.13	$0.12	$0.12	$0.12	$0.12	$0.12	$0.11	$0.12
Without trading (low)	$0.05	$0.04	$0.04	$0.03	$0.03	$0.02	$0.02	$0.04
Benefit (Cost) per ton of bottles								
low	$279	$274	$268	$260	$252	$241	$229	$261
mid	$414	$409	$403	$396	$387	$377	$365	$397
High	$473	$468	$463	$456	$447	$438	$426	$456
Without trading (low)	$190	$175	$157	$138	$115	$90	$61	$141

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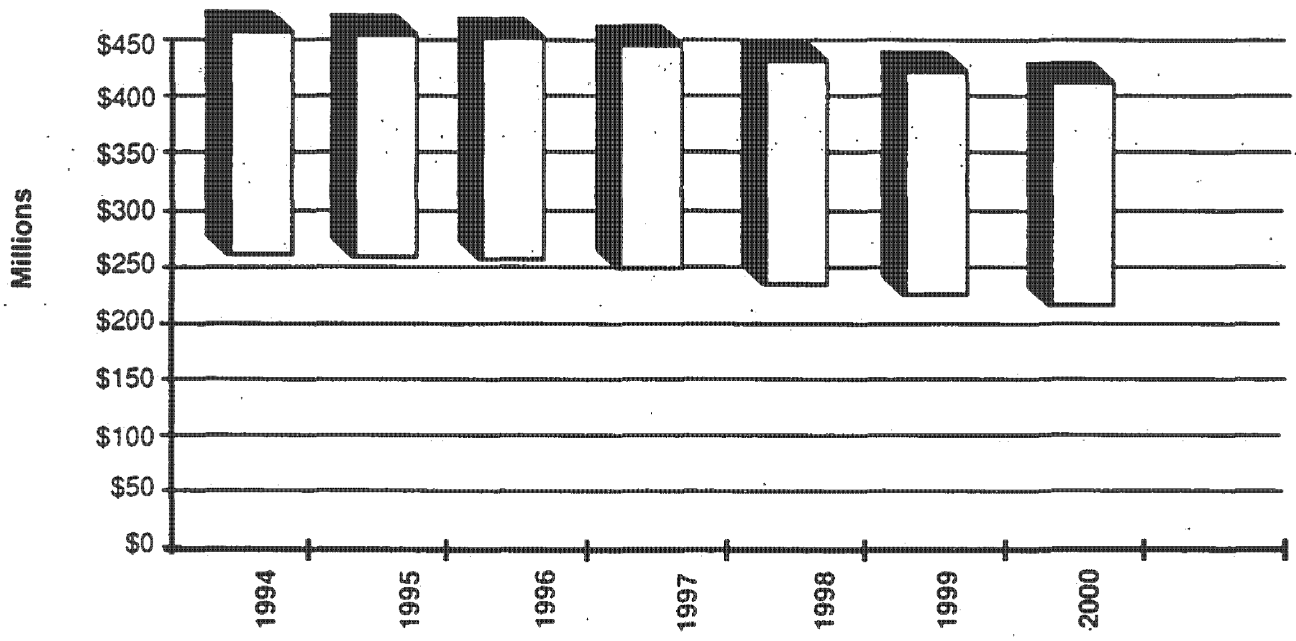
Chart 3.2 ANNUAL BENEFIT OR (COST) PER TON FOR 15% REFILLABLE GLASS



The positive result of the model is driven by the value of the materials (bottles) that are replaced by refilling. Every bottle refilled is one less bottle that must be purchased. This benefit ranges from $9 to $25 million annually, depending on the number and type of bottles refilled. Wine bottles have a value about two times greater than beer bottles. If the policy were to result in a greater number of wine bottles being refilled, either through trading, or inclusion of wine in the AB 2020 system, as proposed in AB 401 (Margolin, 1993), the benefit could be substantially greater than that presented here.

The net cost of washing and refilling is the primary cost category in the model. This cost is, however, in all cases lower than the cost of a new bottle. In addition, the policy reduces the costs associated with recycling plastic and glass beverage containers, which are a significant part of the costs of recycling programs.

The policy will result in a net gain in jobs. Jobs in refilling are related to sorting the containers, transportation, and washing. Job loss is related to reductions in glass manufacturing jobs in the state. There is strong evidence however, that glass industry job loss in California will occur due to increased glass container shipments from Mexico, with or without a refilling policy. A strong refilling market would rely heavily on California's glass industry to provide containers, and thus could be essential in maintaining the industry in light of serious competition with Mexico.

Capital investment is discussed as it relates to trading and non-trading issues, below.

TABLE 3-3 JOB IMPACT OF GLASS REFILLING POLICY -- 1994	
Direct Jobs Created	442
Multiplier Jobs Created	176
Direct Jobs Lost	129
Multiplier Jobs Lost	78
Net Direct Jobs Created	313
Net Multiplier Jobs Created	98
Total Jobs Created	411

SENSITIVITY ANALYSIS -- GLASS CONTAINERS

We conducted a sensitivity analysis of the policy to determine the impact of changing variables on the results of the model. Table 3-4 and Charts illustrate the results of this analysis. The complete models are in the Appendix to this chapter.

Chart 3.4 REFILLABLE GLASS CONTAINERS

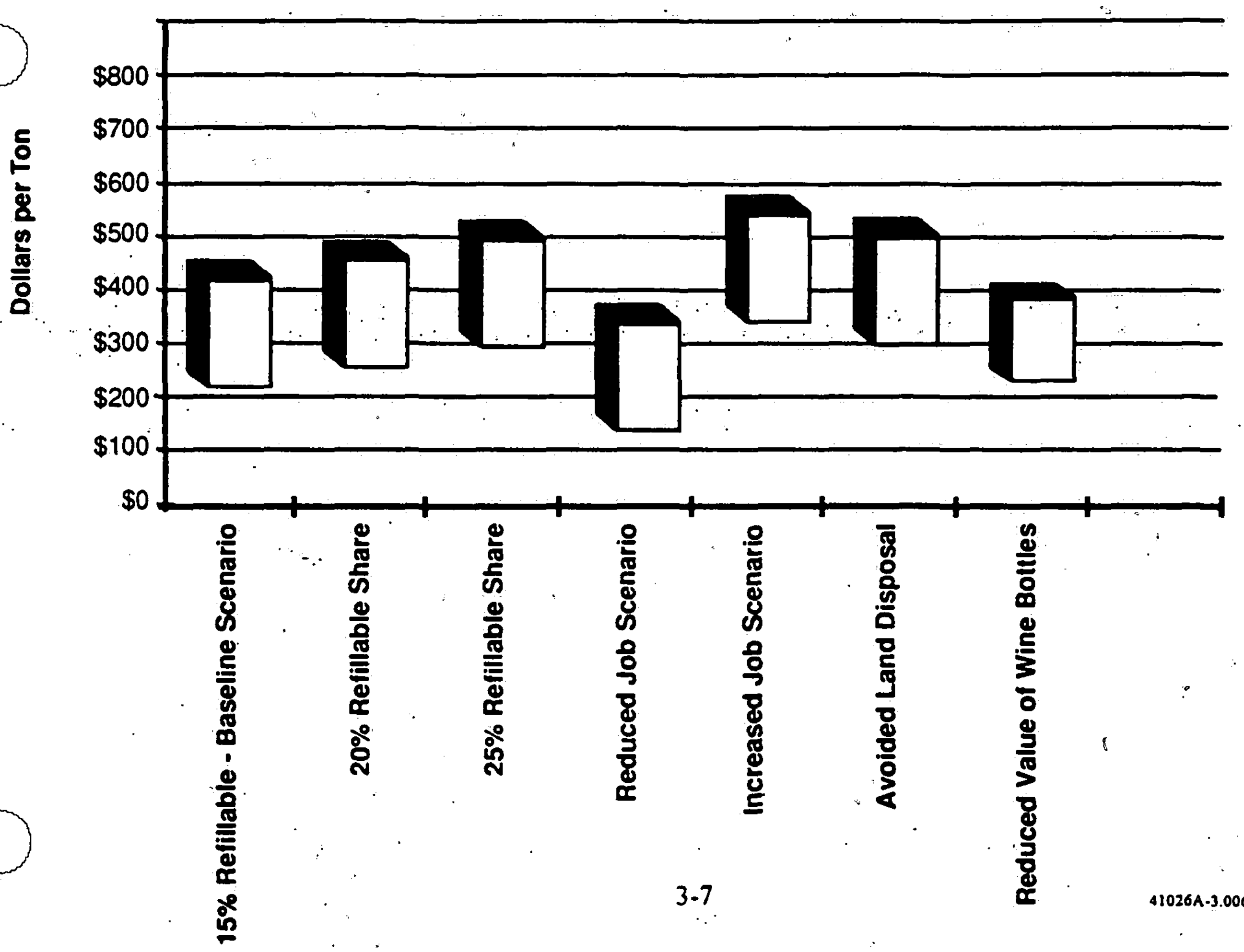


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Table 3.4 Refillable Glass Containers -- Sensitivity Analysis

	Low Value Mix	Mid Value Mix	High Value Mix	W/out trading
15% Refillable Market Share - Baseline Scenario (Table 3.2)				
Total Net Benefit (Cost) (million $)	$43	$67	$80	$23
1996 Net Benefit (Cost) (million $)	$7	$11	$13	$4
Benefit (cost) per ton ($/ton)	$261	$397	$456	$141
Total tons diverted (tons)	165,000	165,000	165,000	165,000
20% Refillable Market Share (Table 3-A.1)				
Total Net Benefit (Cost) (million $)	$90	$135	$158	$70
1996 Net Benefit (Cost) (million $)	$14	$21	$25	$11
Benefit (cost) per ton ($/ton)	$298	$432	$490	$232
Total tons diverted (tons)	302,000	302,000	302,000	302,000
25% Refillable Market Share (Table 3-A.2)				
Total Net Benefit (Cost) (million $)	$137	$202	$236	$117
1996 Net Benefit (Cost) (million $)	$21	$31	$37	$18
Benefit (cost) per ton ($/ton)	$311	$445	$503	$266
Total tons diverted (tons)	439,000	439,000	439,000	439,000
Reduced Job Scenario (Table 3-A.3)				
Total Net Benefit (Cost) (million $)	$30	$55	$67	$[illegible]
1996 Net Benefit (Cost) (million $)	$5	$9	$11	$2
Benefit (cost) per ton ($/ton)	$183	$321	$383	$63
Total tons diverted (tons)	165,000	165,000	165,000	165,000
Increased Job Scenario (Table 3-A.4)				
Total Net Benefit (Cost) (million $)	$58	$82	$95	$38
1996 Net Benefit (Cost) (million $)	$9	$13	$15	$6
Benefit (cost) per ton ($/ton)	$352	$484	$541	$232
Total tons diverted (tons)	165,000	165,000	165,000	165,000
Avoided Land Disposal (Table 3-A.5)				
Total Net Benefit (Cost) (million $)	$52	$77	$89	$32
1996 Net Benefit (Cost) (million $)	$8	$12	$14	$5
Benefit (cost) per ton ($/ton)	$317	$451	$509	$197
Total tons diverted (tons)	165,000	165,000	165,000	165,000
Reduced Value of wine bottles (Table 3-A.6)				
Total Net Benefit (Cost) (million $)	$43	$63	$71	$23
1996 Net Benefit (Cost) (million $)	$7	$10	$11	$4
Benefit (cost) per ton ($/ton)	$261	$369	$404	$141
Total tons diverted (tons)	165,000	165,000	165,000	165,0[illegible]

Changing the Percent Refilled

The first set of variables that were modified are the percent of containers that would be required to be refilled. Because the refilling rate for glass containers is already 9%, the model was not run for 10% refillable share. At 10%, there would be no additional costs or benefits, as the system would remain essentially at status quo.

The benefit of the policy increases as the market share increases. This relates to two features: 1) there is a net benefit for every bottle refilled, so that as more are refilled, the benefit is greater, and 2) even at the relatively low level of investment assumed in the model, there is room to increase refilling capacity without adding additional capital investment.

Change in Job Impacts

We also evaluated the impact of changing our assumptions on job-related benefits, to determine the impact on the overall cost-effectiveness of the policy. In this analysis we assume that the increase in jobs is only 2 per 1 million containers refilled, rather than 3.5. This results in a reduced overall benefit of the policy of 1- to 2-cents per container. In the increased job scenario we use a higher multiplier of 1.6 for the jobs created. This is still lower than the beverage industry multiplier of 3.1, however, given the uncertainties in the use of multipliers, conservative figures are more realistic. In this case, the net benefit of the policy increases by about 2-cents per container refilled.

Reduced Cost of Wine Bottles

To assess the impact of reduced costs of wine bottles, we ran the model using a 28¢ cost for wine bottles, rather than 35¢. This is closer to the prices that are being offered by Vitro glass of Mexico. This change results in a lower net benefit of 1-cent per container refilled. If more refilling occurred with wine bottles, the reduction would be greater, although the net benefit would still be large.

Avoided Land Disposal

The final analysis compares the results of the model using the avoided cost of landfilling rather than the avoided cost of recycling . For glass containers, this is about 3-cents each. The result is a greater net benefit of 2-cents per container.

DATA AND ASSUMPTIONS FOR THE COST-BENEFIT MODELS

WASTE GENERATION MODEL

Data on sales and recycling of plastic and glass beverage containers are taken from California Department of Conservation Biannual Reports. These documents provide figures on sales and recycling of beverage containers. Because 9% of glass beverage containers are already refilled,[3] the additional diversion from the policy represents only 6% of the market. Tons of containers are based on a 4,000 container/ton conversion for glass and a 15,000 container/ton conversion for plastic.

COST-BENEFIT MODEL: GLASS

Consumption Data

The DOC data is used for sales of beverage containers. The sales trends from 1988 to 1992 were averaged to provide a factor for growth or reduction to 2000. Diversion from the policy is 6% of the glass beverage container market.

Market Price

The market price represents the price for a new "throwaway" glass bottle. This is the cost that is avoided by refilling, and thus represents the savings from refilling. This number is based on figures from breweries that currently refill and a glass distributor.[4] We assume three different combinations of wine and beer bottles in the analysis. The low value scenario assumes that all bottles that are refilled replace beer bottles. The lower price beer bottles are used in this case. The mid-value mix assumes that with trading, 10% of the refilling requirement is met through wine bottles, and the remainder through refilling of beer bottles. The high-value mix assumes that 20% of the refilling that occurs is through wine bottles. This number actually could be substantially higher, given the potential for wine refilling in the state. The net benefit of the policy will increase as more wine bottles are refilled.

The prices of glass bottles have remained relatively stable over the last several years. This figure is not likely to change substantially over time. The inputs for glass containers are relatively stable, and the glass industry has little room to raise prices given the fierce competition between container types in the beverage market.

Costs

Collection and washing costs are based on current figures from brewers in the northwest, as surveyed by the consultants. The costs include the payment to the recycler for the containers and the cost of washing.

Recycler savings is the amount that a recycler saves by refilling, compared to recycling. This assumes a payment by the brewer of 5-cents per bottle, handling costs of 2.5-cents, and transportation costs of 0.5-cents. These cost estimates are based on current recycler costs and transport costs, within a 100 mile radius.

The avoided cost of recycling is the amount that would be spent to recycle the bottle, if it was not refilled. This is used instead of the avoided cost of landfilling because most beverage containers in the state are recycled. One cent represents the difference between the 2-cents per bottle collection

The additional investment without trading is the difference, in annualized payments, between the capital investment without trading, and the capital investment with trading. This represents an additional cost of the policy without trading.

Job Impacts

The increase in jobs required for refilling, as opposed to one-way containers is based on an analysis by Noel Desautels of Environmental Resources on "Refillable Containers and Jobs in Ontario". The figures from this study are applied to the beverage container sales in California under this policy. This number, 3.5 persons per 1 million bottles refilled, is consistent with anecdotal evidence of employment requirements.[5] The loss of jobs in the glass container manufacturing industry are based on figures from the Glass Packaging Institute on employment in the glass industry.[6] A multiplier of 1.4 for jobs created is used. The glass industry multiplier, for jobs lost, is 1.6.

Capital Investment

Capital investment requirements are based on industry figures on the cost of bottle-washing equipment and assumptions about the number of firms that would make the investment.[7] The number of firms that make the investment to refill will depend, in part, on how the policy is designed. As long as there is trading, only some percentage of the universe of beverage manufacturers that are directly impacted by the program will refill. The total of this group is 456; this includes beer and soda manufacturers in the state. Of these, according to ABC, there are 6 large breweries and 72 small ones. This leaves 378 soda, wine cooler, and mineral water manufacturers. In addition, some number of the 800 wineries and 50 dairy processors in the state might choose to invest in refilling, or sell credits for existing refilling. Without trading, all of the 456 beverage manufacturers would be required to make the investment, however none of the wineries or dairies would benefit. Some beverage manufacturers might close, rather than use refillables. For the glass analysis we assume that one of the six large breweries and 8 of the small breweries) make the investment, and 5 of the 800 wineries, a total of 14 firms and $5.2 million.

This level of investment for glass would provide capacity for up to 415 million bottles a year, an average of 270 bottles per minute if each firm operates their machine 7 hours per day, 260 days per year. This figure is quite reasonable given the equipment that is available on the market today. Bottle washers range from 25 per minute for a manual loaded machine to over 1,000 per minute for a fully automated machine for beer bottles. Investment by these fourteen firms would provide bottle washing capacity for up to 20% of the CRV containers.

Without trading, investment would be higher. In this model, we assume that four of the large breweries would invest in new equipment (two already have some equipment), and 60 small breweries, 20 each at three different investment levels. The total investment would be $19.9 million.

Administrative Costs

We assume that two state agency staff are required to implement the program. For private administrative costs we assume that each of the 456 regulated beverage manufacturers must have one employee dedicate 5% of their time (about 1 day a month) to the policy. In both cases, the base salary is $50,000 a year.

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We assume that two state agency staff are required to implement the program. For private administrative costs we assume that each of the 456 regulated beverage manufacturers must have one employee dedicate 5% of their time (about one day a month) to the policy. In both cases, the base salary is $50,000 a year.

RESULTS OF THE MODEL -- 15% REFILLABLES FOR PLASTIC CONTAINERS

Requiring 15% refillables in the plastic beverage container market results in a wide range of costs and benefits. The low value container mix results in a net cost of up to $510,000 annually, while the high value container mix results in a net benefit of up to $6.5 million annually. This is equivalent to between negative .7-cents to 8-cents per container refilled, depending on the size of the container. The range is dependent on the type and number of containers refilled. Like the glass policy, this allows for the development of a refilling structure. Unlike the glass policy, there is no existing infrastructure. The primary barrier plastic refilling faces is the lack of infrastructure. Because this policy provides an attractive alternative to the high cost of recycling plastic, plastic refilling may receive more attention as the recycling rate for plastic increases.

Table 3.5. Cost-Benefit Analysis for Market Development Policies
15% Refillable Plastic Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption	531,214,200	525,902,058	520,643,037	515,436,607	510,282,241	505,179,419	500,127,624	3,608,785,186
Diversion resulting from Policy (Containers)								
	79,682,130	78,885,309	78,096,456	77,315,491	76,542,336	75,776,913	75,019,144	541,317,778
Price and Value of Material								
Market Prices (Price of Plastic Bottle or Milk Container)								
Low (three half-pint cartons)	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Mid (half gallon milk)	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	
High (PET 2l Soda)	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	
Value of Material Refilled -- $								
Low (10% HG, 60% HP, 30% PET)	$4,302,835	$4,259,807	$4,217,209	$4,175,037	$4,133,286	$4,091,953	$4,051,034	$29,231,160
Mid(10%HG, 45% HP, 45% PET)	$10,577,603	$10,472,025	$10,367,304	$10,263,631	$10,160,995	$10,059,385	$9,958,791	$71,859,935
High(10% HG, 30%HP, 60%PET)	$12,071,843	$11,951,124	$11,831,613	$11,713,297	$11,596,164	$11,480,202	$11,365,400	$82,009,643
Costs								
Collection and Washing Costs - cost per bottle								
Low - three half pint cartons	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
High - half gallon or PET	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	
Value of Avoided Recycling								
Per bottle	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	
Net collection and recycling costs								
Half-Pint Cartons	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	
Large bottles	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	
Net Cost for colln./refilling								
Low Value Mix	$5,577,749	$5,521,972	$5,466,752	$5,412,084	$5,357,964	$5,304,384	$5,251,340	$37,892,244
Mid Value Mix	$6,235,127	$6,172,775	$6,111,048	$6,049,937	$5,989,438	$5,929,543	$5,870,248	$42,358,116
High Value Mix	$6,892,504	$6,823,579	$6,755,343	$6,687,790	$6,620,912	$6,554,703	$6,489,156	$46,823,988
Additional Investment Without Trading	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$76,980,000
Job Impacts								
[illegible],000,000 bottles refilled -- 3.5								
[illegible]	279	276	273	271	268	266	263	
[illegible]ir	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	390	387	383	379	375	371	368	
Jobs Lost (.08/million cont. refilled)	6	6	6	6	6	6	6	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	10	10	10	10	10	10	10	
Multiplier Jobs	101	100	99	98	97	96	95	
Average Value of Jobs	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
Net Value of Jobs Created	$3,040,670	$3,010,263	$2,980,161	$2,950,359	$2,920,856	$2,891,647	$2,862,731	$20,656,686
Capital Investment								
Capital Investment by Industry								
With trading	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$4,020,000
Without Trading	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$81,000,000
Administrative Costs								
Public	$140,000	$144,060	$149,822	$155,815	$162,046	$168,530	$175,271	$1,095,546
Private	$1,596,000	$1,642,284	$1,707,975	$1,776,294	$1,847,346	$1,921,240	$1,998,080	$12,489,229
Net Benefit or (Cost)								
Low	$29,756	($36,246)	($127,180)	($218,798)	($313,216)	($410,553)	($510,936)	($1,589,174)
Mid	$5,647,346	$5,523,169	$5,378,620	$5,231,944	$5,083,019	$4,931,719	$4,777,913	$36,573,729
High	$6,484,009	$6,351,464	$6,198,633	$6,043,756	$5,886,713	$5,727,377	$5,565,614	$42,257,566
Without trading (high)	($5,751,897)	($5,909,939)	($6,088,014)	($6,267,881)	($6,449,665)	($6,633,496)	($6,819,507)	($43,920,399)
Benefit or (Cost) per bottle refilled								
Low	$0.000	$0.000	($0.002)	($0.003)	($0.004)	($0.005)	($0.007)	($0.003)
Mid	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.06	$0.07
High	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.07	$0.08
Without trading (high)	($0.07)	($0.07)	($0.08)	($0.08)	($0.08)	($0.09)	($0.09)	($0.08)
Benefit or (Cost) per ton of bottles								
Low	$6	($7)	($24)	($42)	($61)	($81)	($102)	($44)
Mid	$1,063	$1,050	$1,033	$1,015	$996	$976	$955	$1,013
High	$1,221	$1,208	$1,191	$1,173	$1,154	$1,134	$1,113	$1,171
Without trading (high)	($1,083)	($1,124)	($1,169)	($1,216)	($1,264)	($1,313)	($1,364)	($1,217)

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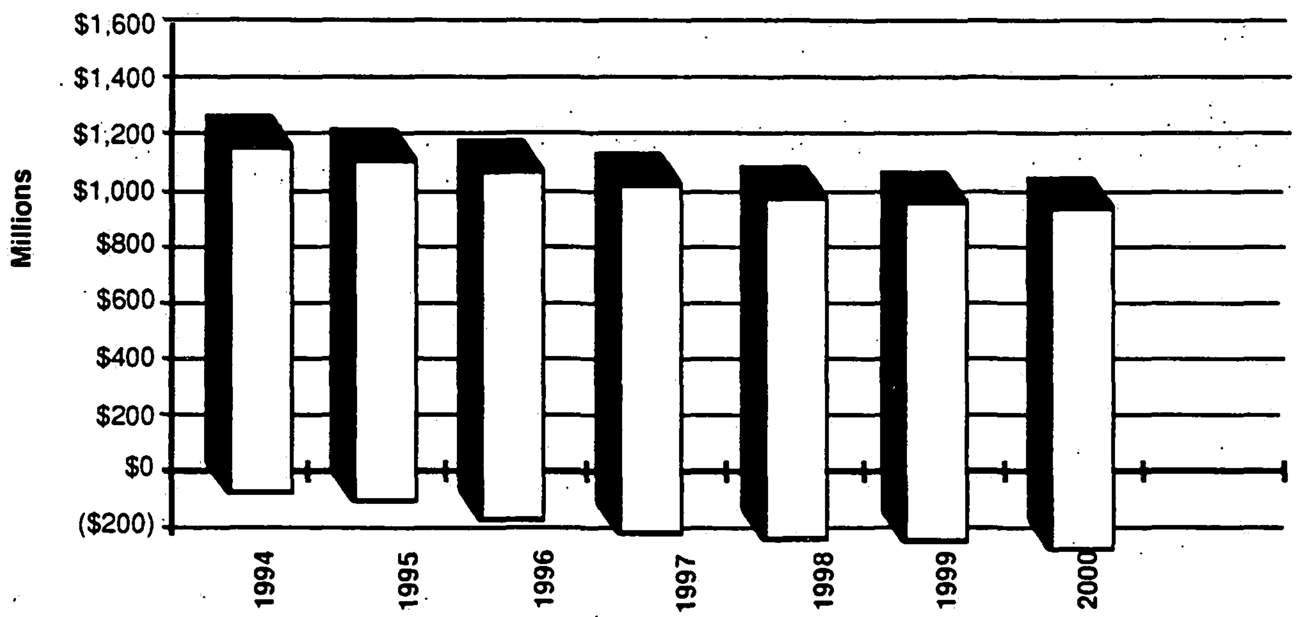
Chart 3.5 ANNUAL BENEFIT OR (COST) PER TON FOR 15% REFILLABLE PLASTIC



Like the glass model, the positive benefits of this model are driven by the value of the containers that are replaced by refillables. There is a wide range in value, depending on the container type. Half-pint milk cartons are inexpensive, and as a result, there is a lower net benefit when they are assumed to comprise a larger share of the container mix, as in the low value scenario. PET soda bottles have a high value, and thus as more PET bottles are replaced, the net benefit increases. While this range of costs results in variations in the net benefit, it reflects the variability and flexibility of plastic containers. There are a wide variety of applications in which plastic containers could be refilled.

The jobs created by refilling are based on calculations of job impacts for glass containers, which should be equivalent to plastic. Job loss, however, is based on broad assumptions and extrapolations on employment in the plastic industry. Because this results in a low number for job loss, the job benefit of the plastic policy is greater than for glass.

TABLE 3-6 JOB IMPACT OF PLASTIC REFILLING POLICY -- 1994	
Direct Jobs Created	279
Multiplier Jobs Created	111
Direct Jobs Lost	6
Multiplier Jobs Lost	4
Net Direct Jobs Created	273
Net Multiplier Jobs Created	107
Total Jobs Created	380

Capital investment is discussed below as it relates to trading and no-trading policies.

SENSITIVITY ANALYSIS FOR PLASTIC CONTAINERS

The results of the sensitivity analysis of the plastic refillable model, are illustrated in Table 3-7 and Charts . The complete models are in the Appendix of this chapter.

Chart 3.7 REFILLABLE PLASTIC CONTAINERS

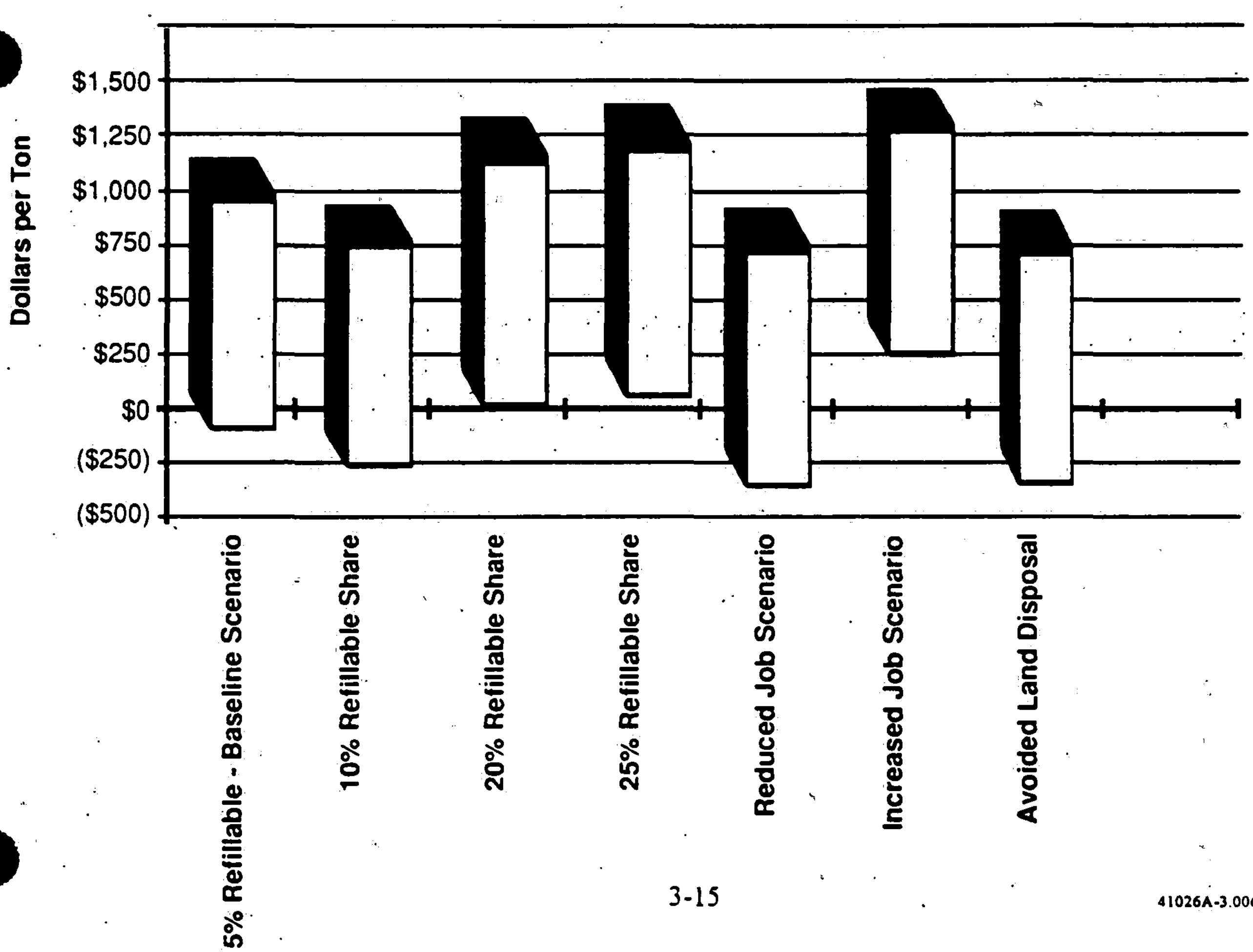


Table 3.7 Refillable Plastic Containers -- Sensitivity Analysis	Low Value Mix	Mid Value Mix	High Value Mix	W/out trading
15% Refillable Market Share - Baseline Scenario (Table 3.4)				
Total Net Benefit (Cost) (million $)	($2)	$37	$42	($44)
1996 Net Benefit (Cost) (million $)	($0.10)	$5	$6	($6)
Benefit (cost) per ton ($/ton)	($44)	$1,013	$1,171	($1,217)
Total tons diverted (tons)	36,000	36,000	36,000	36,000
10% Refillable Market Share (Table 3-A.7)				
Total Net Benefit (Cost) (million $)	($6)	$20	$24	($68)
1996 Net Benefit (Cost) (million $)	($0.70)	$3	$4	($10)
Benefit (cost) per ton ($/ton)	($232)	$825	$983	($2,839)
Total tons diverted (tons)	24,000	24,000	24,000	24,000
20% Refillable Market Share (Table 3-A.8)				
Total Net Benefit (Cost) (million $)	$2	$53	$61	($20)
1996 Net Benefit (Cost) (million $)	$0.45	$8	$9	($3)
Benefit (cost) per ton ($/ton)	$50	$1,108	$1,265	($406)
Total tons diverted (tons)	48,000	48,000	48,000	48,000
25% Refillable Market Share (Table 3-A.9)				
Total Net Benefit (Cost) (million $)	$6	$70	$79	$[illegible]
1996 Net Benefit (Cost) (million $)	$1	$10	$12	$1
Benefit (cost) per ton ($/ton)	$107	$1,164	$1,322	$81
Total tons diverted (tons)	60,000	60,000	60,000	60,000
Reduced Job Scenario (Table 3-A.10)				
Total Net Benefit (Cost) (million $)	($11)	$27	$33	($54)
1996 Net Benefit (Cost) (million $)	($2)	$4	$5	($7)
Benefit (cost) per ton ($/ton)	($314)	$743	$901	($1,487)
Total tons diverted (tons)	36,000	36,000	36,000	36,000
Increased Job Scenario (Table 3-A.11)				
Total Net Benefit (Cost) (million $)	$10	$48	$54	($33)
1996 Net Benefit (Cost) (million $)	$2	$7	$8	($5)
Benefit (cost) per ton ($/ton)	$271	$1,328	$1,486	($902)
Total tons diverted (tons)	36,000	36,000	36,000	36,000
Avoided land disposal (Table 3-A.12)				
Total Net Benefit (Cost) (million $)	($13)	$26	$31	($55)
1996 Net Benefit (Cost) (million $)	($2)	$4	$5	($8)
Benefit (cost) per ton ($/ton)	($350)	$708	$865	($1,523)
Total tons diverted (tons)	36,000	36,000	36,000	36,00[illegible]

Changing the Percent Refilled

For plastic, we ran the model at three additional refillable levels, 10%, 20%, and 25%. Because the policy results in a greater utilization of refilling capacity as the refillable level increases, and because each container refilled contributes to a net benefit, the overall benefit of the policy increases as the percentage increases. For the low value container mix, the policy results in a net cost at the 10% level. This is reversed at the 15% level.

Change in Job Impacts

We also ran the models using the reduced job impact and increased job impact scenarios described above. The reduced job impact scenario results in a net cost for the low-value container mix, and a reduced benefit of 2-cents per container as compared to baseline for the higher value container mixes. The increased job impact scenario improves the net benefit for all three container mixes.

Avoided Land Disposal

For plastic containers, using an avoided landfill cost instead of avoided recycling results in a reduced benefit for the model. This is because plastic, given its light weight and high recycling cost, is less expensive to landfill than to recycle. Under this scenario, the low-value container mix option has a net cost of $12.6 million over the seven year period. The net benefits of the higher value options are reduced by 1- to 2-cents per container refilled.

DATA AND ASSUMPTIONS

COST-BENEFIT MODEL: PLASTIC

Consumption Data

As noted above, these figures are from DOC Biannual Reports.

Diversion Resulting From The Policy

Because there is no existing refilling of CRV plastic, the diversion from the policy represents the full 15% of the containers sold .

Market Price

The market prices here are for alternative containers. They represent, at the low end, the price of a half-pint milk carton, and at the higher end, the price of an HDPE milk jug and PET soda bottle. For market prices and trading, we assume that three 8-ounce containers or 2-12-ounce containers are equivalent to one container of 24-ounces or larger. Half-pint paper milk cartons generally range in price form 1.75¢ to 2.5¢ each. Half gallon milk cartons, paper or HDPE, range from 7¢ to 10¢ each. PET soda bottles sell from 20¢ each.[8]

The total values are based on the above costs and the mix of containers. We have three scenarios. In all of them, only 10% of the refilling is for half-gallon milk jugs. In the low scenario, 60% of the refilling is from half pint milk cartons, and 30% from PET soda. In the mid scenario, there is a 45:45 split between half pint milk and PET, and in the high scenario, 30% if half pint milk and 60 percent PET.

Costs

There are two levels for washing costs. The first is for half-pint milk containers, and is based on information from GE plastic, multiplied by three to equal three container equivalents. The second is also from GE (in Wharton report[9]*), for half gallon or gallon containers. We assume that this is appropriate for 2 liter bottles also, and is not too different from the costs for glass. The total additional costs are based on the three scenarios above.*

The avoided cost of recycling is based on DOC data on the cost of recycling PET soda bottles.

Job Impacts

Job impacts are based on the Ontario study, noted above. We assume that employment to wash plastic bottles is similar to that to wash glass. Again, a conservative multiplier of 1.4 is used. Job loss is estimated from figures on total employment in the plastic industry and the percentage of total plastic consumption for containers.[10] *A multiplier of 1.6, for the plastics and rubber industry, is used for job loss.*

Capital Investment

Capital investment requirements are again based on industry figures. For the trading option , we assume that only 9 firms invest in bottle washing capacity, a total investment of $4 million. This level of investment would provide for an average capacity of 245 bottles per minute, and would provide three times more capacity than would be required by the policy. Without trading, all beverage manufacturers that use plastic containers would be required to invest -- here we assume that 300 firms make some investment for a total of $81 million.

Administrative Costs

The assumptions made for glass are also applied here.

TRADING VS. NON-TRADING

The without trading entry in the models illustrates the difference between the two scenarios. For glass, the without trading policy results in a minimum additional cost of 4-cents per bottle as compared to the trading scenarios. For plastic, the without trading scenario results in a net cost of 7- to 8-cents per bottle, or $44 million over the seven year period. This cost is a result of the high level of over-investment that would be required for every beverage manufacturer to meet the standard.

It is clear that the net benefit of this policy is substantially reduced if trading is not included. There are 456 beverage manufacturers in the state, plus some additional number of importers. If trading was not allowed, all of these firms would be required to make the investment for refilling, or to eliminate their glass and plastic beverage containers. Some manufacturers might choose the latter. In addition, without trading, the policy would not encourage alternative refillable markets such as milk and wine, which result in substantial benefits.

Trading allows those beverage manufacturers that want to refill the opportunity to do so. Those that do not want to make the investment to refilling may choose to purchase refilling credits. For example, large in-state brewers might be most able to establish refilling programs. Distant regional or foreign brewers might find it more cost effective to purchase credits from in-state firms. On the other hand, if in-state firms choose to maintain a non-refilling policy, then they would need to purchase credits, perhaps from regional brewers willing to implement the programs but for whom the economics are currently marginal.

One of the most important benefits of the policy, which is not quantified in the model, is that it provides a means to establish local and niche markets in refilling, ranging from tiny microbreweries to huge bottling and brewing plants who could buy back bottles redeemed locally, and ship them out to multiple states. Local markets are ideally suited to refilling, which often loses its economic benefits at a distance of much more than 150 miles. This is highly dependent on individual circumstances. For example, one brewery has access to low-cost back haul transportation that may make longer distances economically and environmentally advantageous. Others must incur full costs for return shipment. Trading enables companies with a comparative advantage to make full use of that advantage. Extending trading to markets outside the AB 2020 system will help establish markets in areas such as refillable school milk containers and local breweries.

Capital Investment

Tables 3-8 and 3-9 compare the bottle washing investment and capacity with and without trading for glass and plastic containers. These figures are based on existing technology and prices.[11] Under the trading scenario, investment by only 14 firms will provide sufficient capacity to refill 20% of the total glass beverage containers (this would bring the total up to 29%, since we are already at 9%). The investment is only 0.6¢ per bottle refilled over the seven year period of the analysis. If trading is not included, all beverage manufacturers that used glass containers would be required to invest in refilling and washing equipment, or to subscribe to a service that washed bottles independently.[12] In the model, we assume that 64 of the 78 breweries in the state invest in equipment. The others either have equipment already, switch to cans, or would close. Here, the difference in investment is substantial -- $19.9 million, rather than $5.2 million. Given the equipment on the market, the washing capacity is also high. In this case, this level of investment would provide for washing of 1.5 billion bottles a year, 70% of the glass beverage market. This would substantially over-invest in refilling capacity. The cost per required capacity to meet the policy is 2.3¢ per bottle over the seven year period, almost four times more than the trading policy.

For plastic, the difference between the two policies is more substantial. This is because there are a larger number of firms -- about 300 -- that would be required to invest in refilling capacity without trading. With trading, we assume in our model that only investment by only 9 firms can exceed the refilling capacity necessary to meet the requirement. This relatively modest investment of $4 million results in a cost of 0.7-cents per bottle refilled over the seven-year period. Without trading, the total investment level is $81 million. In this case, the refilling capacity is 8 times greater than needed to meet the requirement in the policy. This substantial over investment would result in a cost of 15-cents per bottle refilled over the seven year period.

Table 3.8 Glass Bottle Washing Capacity

Trading Scenario -- Glass			
Type of Firm	Number	Investment	Capacity (BPM)
Wineries	5	$1,500,000	1,000
Beer (large)	1	$770,000	1,000
Beer (small)	4	$1,960,000	1,000
Beer (small)	4	$1,000,000	800
Total	14	$5,230,000	3,800
Average Capacity			271
Capacity to Meet Requirement			126,000,000
Available Capacity (operating 260 days, 7 hour days)			414,960,000
% Refillables possible at capacity			20%
Investment per bottle capacity			$0.002
Investment per bottle, requirement level			$0.006
No Trading Scenario -- Glass			
Type of Firm	Number	Investment	Capacity (BPM)
Beer (large)	4	$3,080,000	4,000
Beer (small)	20	$9,800,000	5,000
Beer (small)	20	$5,000,000	4,000
Beer (small)	20	$2,000,000	500
Total	64	$19,880,000	13,500
Average capacity			211
Capacity at 260 days, 7 hours			1,474,200,000
% Refillables possible at capacity			70%
Times more than necessary			12
Investment ber bottle capacity			$0.002
Investment per bottle, requirement level			$0.023

Table 3.9 Plastic Bottle Washing Capacity

Trading Scenario -- Plastic

Type of Firm	Number	Investment	Capacity (BPM)
Soda	5	$2,300,000	2,000
Dairies (small)	2	$676,000	192
Dairies (large)	2	$1,010,000	420
Total	9	$3,986,000	2,204

Average Capacity	245
Capacity to Meet Requirement	79,000,000
Available Capacity (operating 260 days, 7 hour days)	240,676,800
% Refillables possible at capacity	45%
Investment per bottle capacity	$0.002
Investment per bottle, requirement level	$0.007

No Trading Scenario -- Plastic

Type of Firm	Number	Total investment	Capacity
Soda - mid size	100	$46,000,000	40,000
Soda - low size	100	$25,000,000	20,000
Soda - very low	100	$10,000,000	2,500
Total	300	$81,000,000	62,500

Average Capacity	208
Capacity to Meet Requirement	79,000,000
Available Capacity (operating 260 days, 7 hour days)	6,825,000,000
% Refillables possible at capacity	1285%
Investment per bottle capacity	$0.002
Investment per bottle, requirement level	$0.15

BACKGROUND -- EXISTING REFILLING AND BARRIERS

EXISTING REFILLING

Several reports and articles discuss current refilling programs.[13] Below, we discuss four refilling programs that may provide models for refilling opportunities in California.

Refilling Beer Bottles

Refillable bottles have declined from over 85% of the beer market in the late 1940's to less than 10% today. (cite CRI report) Recently, however, bottle refilling has re-emerged in other ways. Hundreds of tiny microbreweries have emerged locally, forming a potential market for whole "throwaway" bottles. Established microbreweries like Sierra-Nevada Brewery in Chico have in the past purchased whole throwaway bottles from local recycling centers, providing an economically and environmentally superior market.

Major regional breweries, such as Rainier, Blitz-Weinhard, Olympia, and General, have established throwaway buyback programs in the Pacific Northwest, and have indicated to the consultants an interest in expansion to California. Rainier and Blitz-Weinhard began refilling their full line of glass containers, including one-way containers, in 1990 after repairing and upgrading existing washing equipment. The breweries buy back containers from recyclers, wholesalers, and charity groups for $1.30 per case. This payment has more than doubled in the last three years to encourage better handling and higher return rates. While refilling is still more economical, at least within a 150 mile radius, the margin between refilling and one-way containers has been eroding as sewer charges increase and return rates are below par.[14]

Both Anheuser-Busch and Coors continue to refill, although in limited amounts. Coors is not enthusiastic with refilling, citing additional costs related to water, bottle loss, chemicals, and energy.[15] Anheuser-Busch likewise is not eager to expand refilling, citing low consumer interest in refilling, transportation costs, and water use as problems.[16]

Canada never stopped using refillables. Between 75% and 85% of the Canadian beer market is in glass refillable containers, the rest is in cans. In the last year and a half, Canadian brewers, led by the two major breweries, Molson and Labatts, have introduced a standard refillable bottle. The bottle is similar to the traditional long-neck bottle available in the US. Currently, between 50% and 75% of the market is in this container, and this is expected to rise to over 90% as the old bottles are gradually removed from the float. Beer in most of Canada is sold in a relatively small number of state owned beer stores, as opposed to the vast number of retail outlets in the US, and as a result the system is better designed for refillables.

While there have been no official studies released on the standard container, beer industry experts believe it can reduce sorting requirements, reduce breakage, reduce the size of the float (number of bottles), and generally increase the life of the bottles. Many brewers have accepted the bottle, and American beers that are brewed in Canada under agreement such as Miller, Coors, and Budweiser, are sold in the standard container. Whether or not other American beers use the container as they increase imports into Canada remains to be seen. Some, such as Rainier, have expressed an interest in the standard bottle, however many of the less expensive American beers sold in cans are not likely to switch to bottles.[17]

The traditional argument against the standard bottle, and the commonly cited cause of the demise of the "stubbie" in Oregon, is marketing. Brewers generally feel that with a standard bottle they lose their identity, and along with it, market share. This argument is being used by some brewers in Canada that are opposing the standard bottle. For the larger brewers though, it is a matter of balancing operational costs with marketing. Beer sales in Canada have been declining over the last several years, tipping the industry in favor of reducing costs According to the breweries, it is too early to tell exactly how much costs are reduced.[18]

Milk

The dairy industry is well suited to refilling, and has been refilling milk bottles for decades. Several dairies across the US. continue to refill, either glass or plastic containers. Castle Creamery in the bay area refills glass containers, and has return rates of over 95% for their quart and half-gallon containers. Both carry a deposit of $1, approximately the cost of the bottle.[19] No additional transportation is required to accommodate refilling containers because milk crates are picked up for return already.

One of the most well-publicized refilling efforts is for school milk programs. These programs use a refillable 8-ounce polycarbonate (Lexan) container. Several dairies in the east have successfully introduced this container, most notably Stewarts Dairy, who began their Lexan school milk program in 1991. These containers are competitively priced with traditional milk cartons, as long as they are used to their potential of 50 to 100 times. While long-term economics are favorable, an initial investment of close to $500,000 is required for washing and filling equipment and the bottle float.

According to Stewarts Dairy, return rates vary by school. Low return rates have been the largest problem. A deposit of 25¢ per bottle has helped increase return rates. The dairy was already refilling half-gallon milk and juice containers sold at their chain of retail stores. Currently, about 40% of their sales are in refillables. For Stewarts, refilling is economical, helps bring customers back, and fits in with their corporate philosophy to reduce waste and environmental impacts.[20]

Wine

Encore, a bottle refilling company in Richmond, CA has been refilling wine and other bottles since the 1970's. The company washes over 9 million bottles a year, and has grossed over $3 million annually.[21] Last year in California, 9 million wine bottles were refilled.[22] This is only a small percentage of the over 400 million bottles of wine California's consume annually. The AB 2020 program and increased curbside recycling (and crushing) have both reduced the amount and ease of refilling wine containers. Refilling may become more attractive as clear containers, which are preferred for marketing white wines, become more difficult to purchase.

Refillable PET Soda Bottles

Several countries in Europe, and South America, as well as Mexico are using refillable PET soda containers that were developed by Coke and Pepsi in the US. Bottle washer manufacturers in the US make a large number of their sales to these countries. These containers are made in a number of sizes, ranging from one-half to 1.5 liter, and are stronger than one-way PET containers. They are not available in the US, although there are some small soda bottlers that would use them if they were. Refillable PET is preferred over glass because it is lighter and does not break. The bottles may be used about 20 times. Because of these advantages, refillable PET bottles may effectively eliminate refillable glass soda bottles in the countries where it is introduced.[23]

ASSESSMENT OF IMPACTS OF THE 15% REFILLABLE POLICY

Administrative Feasibility

This policy appears to have relatively high administrative feasibility. Beverage manufacturers are already required to report to DOC under AB 2020, and requirements to comply with this policy could easily be added to existing reports. The dairy and wine industry are both regulated at a high level, so that additional reporting of trades would not need to create additional paperwork for them either. It would seem reasonable that this policy be implemented by DOC, in coordination between the Board and DOC.

Product Substitution

This policy could result in some substitution of glass and plastic containers with aluminum, steel, or aseptics in order to avoid refilling or the purchase of refilling credits. The degree of substitution will depend on whether or not the policy allows trading of credits. The potentially negative impacts of this policy on the beverage industry, in particular those using glass and plastic containers, are likely to be substantial if no trading is allowed. In this case, the resistance to refilling might result in a strong shift towards cans in some markets.

If trading can occur, the negative impact and amount of substitution should drop. By allowing trading, this policy encourages refilling only in those conditions where it will be most beneficial. This will limit the negative impacts on the industry, and limit substitution. As the cost of purchasing trading credits decreases and they are more widely available, the incentive to change container types away from glass and plastic will drop, and in fact, if refilling proves to be more economical, the market share of those containers may increase. The establishment of refilling operations, that would refill containers for a number of beverage manufacturers, such as Encore does now for wine, would also reduce substitution impacts.

Product Degradation

One of the benefits of this policy is that it can virtually eliminate land disposal of these containers. Both glass and plastic refillable containers can be recycled once they can no longer be refilled. Glass containers in Canada are refilled about 15 times. Some glass soda bottles that were made before World War II are still in use today, and dairies use their glass bottles at least 50 trips.[24] Lexan milk containers can be used up to 100 times. When it can no longer be refilled, a container in a refillable system can be easily sorted for recycling. Glass recycling is well established, and GE purchases back Lexan containers for use in non-food products such as bottle crates and building applications.[25]

Equity Concerns

Equity concerns in public policy relate to the extent to which a policy may favor or harm one industry, product, or group of firms at the expense of others. This policy could be considered inequitable for a number of reasons:

- The policy may hurt those without sufficient capital or credit to invest in refilling equipment. However, a loan program or the ability to purchase credits should alleviate this problem.
- The policy may be more difficult for firms that are located in regions with high sewer discharge fees. A sewer credit of some type could help alleviate this problem.
- The policy targets only those beverage manufacturers that are under the AB 2020 system. While administration of firms that are already regulated is easier, it may be more equitable to apply this policy to a broader range of beverage manufacturers.
- The policy targets glass and plastic, but not aluminum or steel, which also contribute to the waste stream, but are not refillable. These container types could be required to meet a recycled content level, or a certain recycling rate to "level the playing field".

Unintended Impacts

While this policy is intended to increase the market for refillables, it might also have a number of other impacts, some positive and some not. Many of these have been referred to and discussed in more detail in other sections.

- The market share of glass and plastic containers in the state may drop, while those for cans or paper containers increase. This impact may be temporary; if refilling is more economical, the market share of these containers may increase. The refilling policy may result in new niches for glass and plastic containers.
- The cost of glass and plastic containers may increase initially. Again, this impact may be temporary; if the policy has its intended impacts, the cost of these containers may drop.
- The demand for new glass and plastic beverage containers and half-pint paper milk cartons may drop, as more are being refilled.
- The scrap price for glass and PET might increase if the supply dropped. This could also result in a reduction in the processing fee, under AB 2020, for those materials.

Existing Infrastructure

While this policy could result in retail stores accepting back refillables, as they did in the past, this will not necessarily be the case. The return of refillables could be accommodated relatively easily within the existing recycling infrastructure of convenience zone recycling centers and curbside programs. These programs could sort and separate refillable containers as they were collected, and instead of sending them to a processor for crushing, they could be sent to a bottle-washer for washing. While this may add some additional costs, there is an additional benefit, as the bottles are worth more whole than as cullet. Refilling that occurs in institutional settings, such as schools, is relatively easy, since the containers never leave the facility.

AB 2020 was reportedly very hard on the bottle-washing and refilling industry, and DOC has not historically taken a positive view on refilling. The regulations require that a container be crushed in order to be canceled for the CRV, which essentially excludes refilling as an option. In addition, firms that wish to purchase bottles for washing must compete with the $58 per ton commingled rate that the state pays curbside and other recycling programs for glass.

As noted above, the policy could be implemented by DOC, or in coordination between DOC and the Board.

Refilling that occurs under this policy should be counted under AB 939 diversion, although it might be difficult for individual communities to account for refilling in their region.

Refilling of plastic containers would help in achieving SB 235 requirements to source reduce, reuse, recycle or use recycled content in rigid plastic containers. If a refilling infrastructure and ethic was established, the reuse option of SB 235 might be favored for a broader range of containers than it would currently.

Practical and Political Feasibility

This policy provides a visible source reduction option that could stimulate an industry with both environmental and economic benefits. As such, it should be very popular. At the same time, it counters an industry trend away from refilling, and will be opposed for that reason. Because this policy, with trading, allows flexibility, and because the mandate portion -- 15% -- is relatively low, it should be more feasible.

Uncertainty

The biggest questions relate to who will do the refilling under this policy, and how much the tradable credits will cost. It is likely that independent washing operations will start-up and the two existing ones in the state will expand. In addition, dairy processors and wineries may undertake refilling, as will some breweries. Large breweries, such as A-B, which is already equipped to refill, may expand those markets. New markets for refilling PET may also develop, however, if there are enough low-priced credits available, they may not.

The price of credits will depend on the capital expenditure that is necessary to refill, and the amount of financial assistance that will be available to those firms. It is likely that credits would be set at a level that will help firms pay back their capital investment in refilling and washing equipment in a shorter period than could be done otherwise. Once these investments have been paid back, the cost of credits might drop.

Another question is, will refilling increase to levels above 15%? This may occur is the infrastructure, economies of scale, and consumer demand favor refillables, however it cannot be answered with certainty at this time.

BARRIERS AND POTENTIAL SOLUTIONS TO REFILLING

While the quantitative analysis clearly illustrates the benefits of refilling, several concerns about the feasibility of refilling have been raised. This section identifies several of these concerns.

Sewer Discharge Costs

Many of those involved in refilling, or considering refilling, cited high sewer discharge fees as a major barrier. This problem appears to be regional: sewer fees are assessed locally, and are substantially higher in some regions than others. Increasingly stringent Clean Water Act requirements and the need for structural repairs on many municipal sewer system are likely to keep these costs rising. Gary Dake of Stewarts Dairy believes that high sewer costs and space for washing equipment are the only legitimate reasons for not refilling. Rising sewer discharge costs have reduced the economic benefit of refilling to about a penny a bottle for a northwest brewery, and is cited by one milk processor in California as a primary reason they are not interested in refilling.

Potential Solutions: Improving the design of bottle washing equipment to reduce the load on sewers and the discharge of caustic waste is one action that can reduce sewer costs. Manufacturer's have already taken many steps to reduce sewer loading,[26] however, an increase in demand for refilling equipment might drive R&D in the area. Another solution would be to reduce sewer fees for firms that refill. These firms contribute to a broader benefit to the community -- reducing waste -- thus it seems reasonable to give these firms a credit on their sewer charges. The amount could be calculated to be roughly equivalent to the savings resulting from less waste disposal or reduced recycling costs.

Sorting and the Loss of Bottles

One of the frequently cited problems with refilling is the difficulty in sorting and retrieving bottles. Refilling rapidly loses its economic benefit if the bottles are not refilled. While increased recycling has increased the potential pool of bottles, it has also increased crushing, and it is more difficult to sort out a few refillable containers from a large number overall. One-way bottles can and are refilled, although there may be some minor differences that distinguish bottles and make sorting difficult.

Potential solutions: Increasing the size of the deposit is a simple way to reduce loss. Moving towards a standard refillable bottle, such as in Canada, would make sorting refillables easier, although market conditions in the US do not favor this change. Simply making refillable containers more identifiable -- either through their similarity or differentiation -- would assist those sorting containers.[27] If refilling were done on a wider scale, consumer awareness, economies of scale and increased efficiency in sorting would help to reduce bottle loss.

Initial Cost of Washing Equipment

A few bottlers already have washing equipment and some used equipment is available at low cost, however, many would need to invest in new equipment in order to refill. For a brewer, winery, or dairy, the $200,000 to $500,000 in capital investment could present a serious barrier. While the economics almost always favor refillables within a 150 mile radius, this level of capital investment may be difficult or impossible for many firms.

Potential solutions: The recycling tax credit may offer help to some firms, and in addition, refilling equipment may be a good candidate for the Market Development Loan program. The sale of tradable credits may also provide a revenue stream to firms that refill, although it will not help with the initial investment.

State Redemption Payments to Curbside and Other Recycling Programs

Under the Beverage Redemption Act, recyclers receive a redemption payment based on the amount of CRV containers redeemed. A statewide "commingled rate" is calculated for curbside and drop-off programs to determine what percentage of containers are redemption value containers. Currently, the state pays a rate of $58 per ton for glass from collection programs. This rate assumes that 58% of the containers are redemption containers. In order to compete with the state for empty glass bottles, whether they are part of the redemption system or not, a bottle washer must pay at least $58 per ton. Then, they must also match the $10 per ton mixed cullet scrap payment, plus pay some additional amount to compensate the recycler for sorting the containers.

Potential Solution: Incorporating wine bottles into the redemption system, as is proposed in AB 401, would be a major step in encouraging refilling of containers. Even without AB 401, steps can be taken that would allow bottle washers to qualify as processors, and thus to receive the commingled CRV rate.

Consumer Demand for Refilling

Industry typically cites consumer demand for convenient one-way containers as a primary cause of the decline of refillable containers in the US. Refilling proponents, however, cite industry shifts and the desire to consolidate operations and inconvenience for retail operations as primary reasons for the decline of refilling. Several consumer surveys point out that consumers are willing to sacrifice some level of convenience for what they perceive to be environmental benefits. This policy does make the assumption that there would be sufficient consumer demand for 15% refillable markets for glass and wine containers.

SUMMARY

This policy results in a substantial benefit. While its overall diversion impacts are minimal, it has the potential to reduce the need for markets of 24,000 tons annually of glass and 5,000 tons annually of plastic, or 5% and 7% respectively, of the glass and plastic recycled in the state. The primary benefit may be related to establishment of an infrastructure for refilling. That infrastructure has not yet emerged, due to structural and philosophical barriers, especially the lack of a commitment to refilling by a market leader.

This analysis evaluates a refillable market share of 15%. This level was chosen because it represents a number significantly over the existing glass refillable market share of 9% to stimulate refillable markets. For plastic, a 15% rate is chosen in order to remain consistent with the glass policy. Refilling capacity above both of these levels can be achieved with relatively low levels of capital investment. As a result, higher refilling levels, either 20% or 25%, would result in greater net benefits for both container types. While it is tempting to recommend higher rates of refilling, given the lack of existing infrastructure and the changes in consumer behavior that this policy requires, we recommend the 15% level initially. The level could, however, be increased after the initial few years.

ENDNOTES

1. *Three such studies are: Franklin Associates, Ltd., "Comparative Energy and Environmental Impacts for Soft Drink Delivery Systems", for the National Association for Plastic Container Recovery, 1989; William K. Shireman,* ***Cans and Bottle Bills****, CALPIRG, 1980,; and H. Vogelpohl, "Beer bottles - ecological considerations",* ***Brauwelt International****, Vol IV, 1992, p. 385-394.*

2. GAO, ***Trade-Offs Involved in Beverage Container Legislation****, November 1990.*

3. *The 9% refilling market share, from DOC Biannual reports was thought to be high by several experts interviewed for this Chapter.*

4. *Personal communications with Don Grivoin and Kathy Chamberlain, California Glass, March 24, 1993.*

5. *Robert Stueteville, "Drink it Down, Take it Back,"* ***In Business****, September/October 1992, p. 48 and personal communications with David Sayre, April 22, 1993*

6. *"Everything you Always Wanted to Know about Glass..." Western States Glass Recycling Program, June 1992.*

7. *Personal communications with Bob Unke, D&L Manufacturing, March 5, 1993, and Chris Langmark, Niagara Manufacturing, March 8, 1993.*

8. *Personal communications with Mike Newell, Crystal Dairy, February 1993; Piper Alvey, R. W. Beck and Associates, December 1992; Johnson Controls, March 1993; and "An Analysis of the Market Potential for the Lexan Reusable Milk Bottle," Wharton School, Daniel Hallagan, Amy Hawman, Mike Newell, and Pat Walsh, April 1991.*

9. *"An Analysis of the Market Potential for the Lexan Reusable Milk Bottle," Wharton School, Daniel Hallagan, Amy Hawman, Mike Newell, and Pat Walsh, April 1991.*

10. ***Modern Plastics**, January 1993, Department of Commerce, **U.S. Industrial Outlook**, 1992.*

11. *Bob Unke, D&L, March 5, 1993, Chris Langmark, Niagara, March 8, 1993, and GE Plastics Informational Brochures.*

12. *It is likely that this policy, with our without trading, would result in the establishment of bottle-washing facilities. In this case, the capital investment assumptions used here might not apply, however, the total investment for washing capacity would probably be similar. Additional investment in high technology sorting equipment might also occur.*

13. *"Refillable Bottles: An Idea Whose Time Has Come, Again!" Container Recycling Institute, January 1993, Washington DC (CRI report); Scott Chaplin, "The Return of Refillable Bottles", **Resource Recycling**, March 1991, p.130; Robert Stueteville , "Drink it Down, Take it Back," **In Business**, September/October 1992, p. 48.*

14. *CRI report, interviews with Blitz Weinhard officials, May 1992 and February, 1993, and Marty Westerman, "Against the Tide," **Beverage Industry**, January 1991, p. 34.*

15. Personal communication with Joe Ragno, February 16, 1993.

16. Letter from Wayne Senalik, Anheuser-Busch Fairfield plant manager, April 16, 1993.

17. Larry Greenberg, "Canada's Top Brewers Draft Ways to Fight New Rivals", ***Wall Street Journal**, March 16, 1993, and personal communication, March 25, 1993; and personal communication with Margo Dewar, Brewer's Association of Canada, March 25, 1993.*

18. *Noel Desautels, Environmental Resource, March 25, 1993; Sharon Paul, public relations for Labatts, March 25, 1993.*

19. *Personal communication with Steve Rasmussen, Castle Creamery, March 5, 1993.*

20. *Personal communication with Gary Dake, Stewarts, February 25, 1993.*

21. *Robert Stueteville, "Drink it Down, Take it Back," **In Business**, September/October, 1992, p. 48 and Scott Chaplin, "The Return of Refillable Bottles," **Resource Recycling**, March 1991, p.130, and personal communication with Peter Heylin, Encore, Feb. 1993.*

22. *Personal communications with Mike Falasco, Wine Institute, March 25, 1993.*

23. Personal communications with Bob Unke, D&L, March 5, 1993 and Chris Langmack, Niagara Custom Manufacturing, March 8, 1993, CRI Refillable report.

24. Personal communications with Steve Rasmussen, Castle Creamery, March 5, 1993 and Robert Stueteville, "Drink it Down, Take it Back."

25. GE Plastics Publications.

26. Personal communication with Bob Unke, D&L Manufacturing Company, March 5, 1993.

27. Personal communication with John Fletcher, Portland CRinc., March 9, 1993.

Chapter 3

APPENDICES

California FUTURES

Table 3-A.1 Cost-Benefit Analysis for Market Development Policies
20% Refillable Glass Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (Glass Bev Cont	2,102,760,000	1,892,484,000	1,703,235,600	1,532,912,040	1,379,620,836	1,241,658,752	1,117,492,877	
Diversion resulting from Policy (Containers)								
	231,303,600	208,173,240	187,355,916	168,620,324	151,758,292	136,582,463	122,924,216	1,206,718,052
Price and Value of Material								
Market Prices (Price of Glass Bottle)								
Beer - low	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	
Beer - high	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	
Wine - mid	$0.35	$0.35	$0.35	$0.35	$0 35	$0.35	$0.35	
Value of Material Refilled -- $								
low (all low beer)	$32,382,504	$29,144,254	$26,229,828	$23,606,845	$21,246,161	$19,121,545	$17,209,390	$168,940,527
mid (10% wine, 90% beer)	$40,986,998	$36,888,298	$33,199,468	$29,879,521	$26,891,569	$24,202,412	$21,782,171	$213,830,439
high (20% wine, 80% beer)	$45,428,027	$40,885,224	$36,796,702	$33,117,032	$29,805,329	$26,824,796	$24,142,316	$236,999,425
Costs								
Collection and Washing Costs								
Cost per bottle	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	
Recycler Savings from Refilling	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	
Value of Avoided Recycling								
Per bottle	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	
Net collection and refilling costs	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Total Net Cost for collection and refilling								
	$18,504,288	$16,653,859	$14,988 473	$13,489,626	$12,140,663	$10,926,597	$9,833,937	$96,537,444
Additional investment w/o trading	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$14,670,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	810	729	656	590	531	478	430	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	1,133	1,020	918	826	744	669	602	
Jobs Lost	237	214	192	173	156	140	126	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	380	342	307	277	249	224	202	
Multiplier Jobs	181	163	147	132	119	107	96	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$5,444,531	$5,042,180	$4,669,563	$4,324 482	$4,004,903	$3,708,941	$3,434,850	$30,629,450
Capital Investment								
Capital Investment by Industry								
With Trading,	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$5,230,000
Without Trading	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$19,900,000
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	
Private	$1,596,000	$1,642,284	$1,689,910	$1,738,918	$1,789,346	$1,841,237	$1,894,633	
Net Benefit or (Cost)								
low	$17,586,747	$15,746,230	$14,072,770	$12,550,247	$11,164,094	$9,901,139	$8,749,474	$89,770,702
mid	$26,191,241	$23,490,275	$21,042,410	$18,822,924	$16,809,503	$14,982,007	$13,322,255	$134,660,613
high	$30,632,270	$27,487,201	$24,639,644	$22,060,434	$19,723,262	$17,604,390	$15,682,400	$157,829,600
Without trading (low)	$14,769,045	$12,928,528	$11,255,068	$9,732,545	$8,346,392	$7,083,437	$5,931,772	$70,046,787
Benefit or (Cost) per bottle refilled								
low	$0.08	$0.08	$0 08	$0.07	$0.07	$0.07	$0.07	$0.07
mid	$0.11	$0.11	$0 11	$0 11	$0.11	$0.11	$0.11	$0.11
High	$0.13	$0.13	$0 13	$0.13	$0.13	$0.13	$0.13	$0.13
Without trading (low)	$0.06	$0.06	$0.06	$0 06	$0.05	$0.05	$0.05	$0.06
Benefit or (Cost) per ton of bottles								
low	$304	$303	$300	$298	$294	$290	$285	$298
mid	$438	$437	$435	$432	$429	$425	$420	$432
High	$497	$495	$493	$491	$487	$483	$478	$490
Without trading (low)	$255	$248	$240	$231	$220	$207	$193	$232

21-Apr-93

Table 3-A.2 Cost-Benefit Analysis for Market Development Policies
25% Refillable Glass Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (Glass Bev. Cont.	2,102,760,000	1,892,484,000	1,703,235,800	1,532,912,040	1,379,820,836	1,241,858,752	1,117,492,877	
Diversion resulting from Policy (Containers)	336,441,600	302,797,440	272,517,696	245,265,926	220,739,334	198,665,400	178,798,860	1,755,226,257
Price and Value of Material								
Market Prices (Price of Glass Bottle)								
Beer - low	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	
Beer - high	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	
Wine - mid	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	
Value of Material Refilled -- $								
low (all low beer)	$47,101,824	$42,391,642	$38,152,477	$34,337,230	$30,903,507	$27,813,156	$25,031,840	$245,731,676
mid (10% wine, 90% beer)	$59,617,452	$53,655,706	$48,290,136	$43,461,122	$39,115,010	$35,203,509	$31,683,158	$311,026,093
high (20% wine, 80% beer)	$66,077,130	$59,469,417	$53,522,475	$48,170,228	$43,353,205	$39,017,885	$35,116,096	$344,726,437
Costs								
Collection and Washing Costs								
Cost per bottle	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	
Recycler Savings from Refilling	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	
Value of Avoided Recycling								
Per bottle	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	
Net collection and refilling costs	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Total Net Cost for collection and refilling	$26,915,328	$24,223,795	$21,801,416	$19,621,274	$17,659,147	$15,893,232	$14,303,909	$140,418,101
Additional investment w/o trading	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$14,870,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	1,178	1,060	954	858	773	695	626	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	1,649	1,484	1,335	1,202	1,082	973	876	
Jobs Lost	345	311	280	252	226	204	183	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	552	497	447	402	362	326	293	
Multiplier Jobs	264	238	214	192	173	156	140	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$7,919,318	$7,334,080	$6,792,092	$6,290,156	$5,825,313	$5,394,823	$4,996,145	$44,551,927
Capital Investment								
Capital Investment by Industry								
With Trading	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$5,230,000
Without Trading	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$19,900,000
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	
Private	$1,596,000	$1,642,284	$1,689,910	$1,738,918	$1,789,346	$1,841,237	$1,894,633	
Net Benefit or (Cost)								
low	$26,369,814	$23,715,582	$21,305,005	$19,114,657	$17,123,387	$15,311,998	$13,663,248	$136,603,671
mid	$38,885,441	$34,979,647	$31,442,664	$28,238,550	$25,334,870	$22,702,350	$20,314,566	$201,898,088
high	$45,345,120	$40,793,358	$36,675,003	$32,947,656	$29,573,065	$26,516,726	$23,747,504	$235,598,432
Without trading (low)	$23,552,112	$20,897,880	$18,487,303	$16,296,955	$14,305,665	$12,494,295	$10,845,546	$116,879,756
Benefit or (Cost) per bottle refilled								
low	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08
mid	$0.12	$0.12	$0.12	$0.12	$0.11	$0.11	$0.11	$0.12
High	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13
Without trading (low)	$0.07	$0.07	$0 07	$0.07	$0.06	$0.06	$0.06	$0.07
Benefit or (Cost) per ton of bottles								
low	$314	$313	$313	$312	$310	$308	$306	$311
mid	$447	$447	$447	$446	$444	$442	$440	$445
High	$505	$505	$505	$504	$502	$501	$498	$503
Without trading (low)	$280	$276	$271	$266	$259	$252	$243	$266

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Table 3-A.3 Cost-Benefit Analysis for Market Development Policies
Reduced Job Impact -- 15% Refillable Glass Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (Glass Bev Cont	2 102.760 000	1,892,484,000	1,703.235,600	1,532,912,040	1.379.820,838	1.241,858.752	1,117,492,877	
Diversion resulting from Policy (Containers)								
	126,165,600	113,549,040	102,194,136	91,974,722	82,777,250	74,499,525	67 049,573	658,209,846
Price and Value of Material								
Market Prices (Price of Glass Bottle)								
Beer - low	$0.14	$0.14	$0.14	$0.14	$0 14	$0.14	$0.14	
Beer - high	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	
Wine - mid	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	
Value of Material Refilled -- $								
low (all low beer)	$17.683.184	$15,896,866	$14,307,179	$12,876,461	$11,588,815	$10 429,934	$9,386,940	$92,149,378
mid (10% wine, 90% beer)	$22,356,544	$20,120,890	$18,108,801	$16,297,921	$14,668,129	$13,201,316	$11,881,184	$116,634,785
high (20% wine, 80% beer)	$24,778,924	$22,301,031	$20,070,928	$18,063,835	$16,257,452	$14,631,707	$13,168,536	$129,272 414
Costs								
Collection and Washing Costs								
Cost per bottle	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	
Recycler Savings from Refilling	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	
Value of Avoided Recycling								
Per bottle	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	
Net collection and refilling costs	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Total Net Cost for collection and refilling								
	$10,093,248	$9,083,923	$8,175,531	$7,357,978	$6,622,180	$5,959,982	$5,363,986	$52,656,788
Additional investment w/o trading	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$14,870,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 2.0								
Jobs Created	252	227	204	184	166	149	134	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	353	318	286	258	232	209	188	
Jobs Lost	129	116	105	94	85	76	69	
CA Multiplier	1.6	1 6	1.6	1 6	1.6	1.6	1.6	
Total Jobs Lost	207	186	168	151	136	122	110	
Multiplier Jobs	23	21	19	17	15	14	12	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$698,763	$647,125	$599,302	$555,014	$513,998	$476,014	$440,836	$3,931,052
Capital Investment								
Capital Investment by Industry								
With Trading	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$5,230,000
Without Trading	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$19,900,000
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	
Private	$1,596,000	$1,642,284	$1,689,910	$1,738,918	$1,789,346	$1,841,237	$1,894,633	
Net Benefit or (Cost)								
low	$6,532,699	$5,673,723	$4,892,802	$4,182,043	$3,534,327	$2,943,236	$2,402,982	$30,161,812
mid	$11,226,060	$9,897,747	$8,694,424	$7,603,503	$6,613,641	$5,714,616	$4,897,226	$54,647,218
high	$13,648,439	$12,077,889	$10,656,552	$9,369,417	$8,202,964	$7,145,009	$6,184,578	$67,284,847
Without trading (low)	$3,714,997	$2,856,021	$2,075,100	$1,364,341	$716,625	$125,534	($414,720)	$10,437,897
Benefit or (Cost) per bottle refilled								
low	$0.05	$0.05	$0.05	$0.05	$0.04	$0.04	$0.04	$0.05
mid	$0.09	$0 09	$0.09	$0.08	$0.08	$0.08	$0.07	$0.08
High	$0.11	$0.11	$0.10	$0 10	$0.10	$0.10	$0.09	$0.10
Without trading (low)	$0.03	$0.03	$0.02	$0.01	$0.01	$0.00	($0.01)	$0.02
Benefit or (Cost) per ton of bottles								
low	$207	$200	$192	$182	$171	$158	$143	$183
mid	$344	$337	$329	$320	$309	$297	$283	$321
High	$406	$399	$391	$382	$372	$360	$346	$383
Without trading (low)	$118	$101	$81	$59	$35	$7	($25)	$63

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Table 3-A.4 Cost-Benefit Analysis for Market Development Policies
Increased Job Multiplier - 15% Refillable Glass Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (Glass Bev. Cont.	2.102.760.000	1.892.484.000	1.703.235.600	1,532,912,040	1,379,620,836	1.241.658.752	1.117.492.877	
Diversion resulting from Policy (Containers)								
	126.165.600	113.549.040	102.194.136	91.974.722	82.777.250	74.499.525	67.049.573	658.209.846
Price and Value of Material								
Market Prices (Price of Glass Bottle)								
Beer - low	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	
Beer - high	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	
Wine - mid	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	
Value of Material Refilled -- $								
low (all low beer)	$17.663.184	$15.896.866	$14.307.179	$12.876.461	$11.588.815	$10.429.934	$9.386.940	$92.149.378
mid (10% wine, 90% beer)	$22.356.544	$20.120.890	$18.108.801	$16.297.921	$14.668.129	$13.201.316	$11.881.184	$116.634.785
high (20% wine, 80% beer)	$24.778.924	$22.301.031	$20.070.928	$18.063.835	$16.257.452	$14.631.707	$13.168.536	$129.272.414
Costs								
Collection and Washing Costs								
Cost per bottle	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	
Recycler Savings from Refilling	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	
Value of Avoided Recycling								
Per bottle	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	
Net collection and refilling costs	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Net Cost for colln./refilling								
	$10.093.248	$9.083.923	$8.175.531	$7.357.978	$6.622.180	$5.959.962	$5.363.966	$52.656.788
Additional investment w/o trading	$2.817.702	$2.817.702	$2.817.702	$2.817.702	$2.817.702	$2.817.702	$2.817.702	$14.670.000
Job Impacts								
Jobs Per 1.000.000 bottles refilled -- 3.5								
Jobs Created	442	397	358	322	290	261	236	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Created	707	636	572	515	464	417	375	
Jobs Lost	129	116	105	94	85	76	69	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	207	186	168	151	136	122	110	
Multiplier Jobs	187	169	152	137	123	111	100	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$5.619.222	$5.203.961	$4.819.389	$4.463.236	$4.133.403	$3.827.944	$3.545.059	$31.612.213
Capital Investment								
Capital Investment by Industry								
With Trading	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$5,230,000
Without Trading	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$19,900,000
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	
Private	$1,596,000	$1,642,284	$1,689,910	$1,738,918	$1,789,346	$1,841,237	$1,894,633	
Net Benefit or (Cost)								
low	$11.453.158	$10.230.560	$9.112.889	$8.090.265	$7.153.731	$6.295.166	$5.507.204	$57.842.973
mid	$16.146.518	$14.454.584	$12.914.511	$11.511.724	$10.233.045	$9.066.549	$8.001.448	$82.328.379
high	$18.568.898	$16.634.725	$14.876.638	$13.277.639	$11.822.368	$10.496.940	$9.288.800	$94.966.008
Without trading (low)	$8.635.456	$7.412.858	$6.295.187	$5.272.563	$4.336.029	$3.477.464	$2.689.502	$38.119.058
Benefit or (Cost) per bottle refilled								
low	$0.09	$0.09	$0.09	$0.09	$0.09	$0.08	$0.08	$0.09
mid	$0.13	$0.13	$0.13	$0.13	$0.12	$0.12	$0.12	$0.13
High	$0.15	$0.15	$0.15	$0.14	$0.14	$0.14	$0.14	$0.14
Without trading (low)	$0.07	$0.07	$0.06	$0.06	$0.05	$0.05	$0.04	$0.06
Benefit or (Cost) per ton of bottles								
low	$363	$360	$357	$352	$346	$338	$329	$352
mid	$495	$493	$489	$484	$479	$471	$462	$484
High	$552	$549	$546	$541	$536	$528	$520	$541
Without trading (low)	$274	$261	$246	$229	$210	$187	$160	$232

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Table 3-A.5 Cost-Benefit Analysis for Market Development Policies 15% Refillable Glass Beverage Containers - with Avoided Landfill								
	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (Glass Bev Cont	2.102.760 000	1.892.484.000	1.703.235.600	1,532,912.040	1,379,620,836	1,241,658,752	1,117,492,877	
Diversion resulting from Policy (Containers)								
	126 165.600	113.549.040	102.194.136	91.974.722	82.777.250	74.499.525	67 049.573	658.209.846
Price and Value of Material								
Market Prices (Price of Glass Bottle)								
Beer - low	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	
Beer - high	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	
Wine - mid	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	$0.35	
Value of Material Refilled -- $								
low (all low beer)	$17.663.184	$15.896.866	$14.307.179	$12.876.461	$11.588.815	$10.429.934	$9.386.940	$92.149.378
mid (10% wine, 90% beer)	$22.356.544	$20.120.890	$18.108,801	$16.297.921	$14.668.129	$13.201.316	$11.881.184	$116.634.785
high (20% wine, 80% beer)	$24.778.924	$22.301.031	$20.070.928	$18.063.835	$16.257.452	$14.631.707	$13.168.536	$129.272.414
Costs								
Collection and Washing Costs								
Cost per bottle	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	
Recycler Savings from Refilling	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	
Value of Avoided Land Disposal								
Per bottle	$0.02	$0.02	$0.02	$0.02	$0.03	$0.03	$0.03	
Net collection and refilling costs	$0.07	$0.07	$0 07	$0.07	$0.06	$0.06	$0.06	
Net Cost for colln./refilling								
	$8.894.675	$7.834.884	$6.872.556	$6.024.344	$5.256.355	$4.563.096	$3.955.925	$43.401.835
Additional investment w/o trading	$2.817.702	$2.817.702	$2.817.702	$2.817.702	$2.817.702	$2.817.702	$2.817.702	$14.670.000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	442	397	358	322	290	261	235	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	618	556	501	451	406	365	329	
Jobs Lost	129	116	105	94	85	76	69	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	207	186	168	151	136	122	110	
Multiplier Jobs	99	89	80	72	65	58	53	
Average Value of Jobs	$30,000	$30.870	$31.765	$32.686	$33.634	$34.610	$35.613	
Net Value of Jobs Created	$2.969.744	$2.750.280	$2.547.034	$2 358.809	$2.184.493	$2.023.059	$1.873.555	$16.706.973
Capital Investment								
Capital Investment by Industry								
With Trading	$1,004.539	$1,004.539	$1,004.539	$1,004.539	$1,004.539	$1,004.539	$1,004.539	$5.230.000
Without Trading	$3.822,241	$3.822.241	$3.822,241	$3.822.241	$3.822,241	$3.822.241	$3.822,241	$19.900.000
Administrative Costs								
Public	$140.000	$144.060	$148.238	$152.537	$156.960	$161.512	$166.196	
Private	$1.596.000	$1.642.284	$1.689.910	$1.738.918	$1.789.348	$1.841.237	$1.894.633	
Net Benefit or (Cost)								
low	$10.002.253	$9.025.918	$8.143.510	$7.319.471	$6.570.646	$5.887.147	$5.243.741	$52.192.685
mid	$14.695.614	$13.249.942	$11.945.132	$10.740.931	$9.649.959	$8.658.529	$7.737.985	$76.678.092
high	$17.117.993	$15.430.084	$13.907.259	$12.506.845	$11.239.283	$10.088.920	$9.025.337	$89.315.721
Without trading (low)	$7.184.551	$6.208.216	$5.325.808	$4.501.769	$3.752.944	$3.069.445	$2.426.039	$32.468.771
Benefit or (Cost) per bottle refilled								
low	$0.08	$0.08	$0 08	$0.08	$0.08	$0.08	$0.08	$0.08
mid	$0.12	$0.12	$0.12	$0.12	$0.12	$0.12	$0.12	$0.12
High	$0 14	$0 14	$0.14	$0.14	$0.14	$0.14	$0.13	$0.14
Without trading (low)	$0.06	$0.05	$0.05	$0.05	$0.05	$0.04	$0.04	$0.05
Benefit or (Cost) per ton of bottles								
low	$317	$318	$319	$318	$318	$316	$313	$317
mid	$451	$452	$452	$452	$451	$450	$447	$451
High	$509	$510	$510	$510	$509	$508	$505	$509
Without trading (low)	$228	$219	$208	$196	$181	$165	$145	$197

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Table 3-A.6 Cost-Benefit Analysis for Market Development Policies 15% Refillable Glass Beverage Containers - Reduced Wine Bottle Cost	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (Glass Bev Cont.	2,102,760,000	1,892,484,000	1,703,235,600	1,532,912,040	1,379,620,836	1,241,658,752	1,117,492,877	
Diversion resulting from Policy (Containers)	126,165,600	113,549,040	102,194,136	91,974,722	82,777,250	74,499,525	67,049,573	658,209,846
Price and Value of Material								
Market Prices (Price of Glass Bottle)								
Beer - low	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	
Beer - high	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	
Wine - mid	$0.28	$0.28	$0.28	$0.28	$0.28	$0.28	$0.28	
Value of Material Refilled -- $								
low (all low beer)	$17,663,184	$15,896,866	$14,307,179	$12,876,461	$11,588,815	$10,429,934	$9,386,940	$92,149,378
mid (10% wine, 90% beer)	$21,473,385	$19,326,047	$17,393,442	$15,654,098	$14,088,688	$12,679,819	$11,411,837	$112,027,316
high (20% wine, 80% beer)	$23,012,605	$20,711,345	$18,640,210	$16,776,189	$15,098,570	$13,588,713	$12,229,842	$120,057,476
Costs								
Collection and Washing Costs								
Cost per bottle	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	
Recycler Savings from Refilling	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	
Value of Avoided Recycling								
Per bottle	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01	
Net collection and refilling costs	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Total Net Cost for collection and refilling	$10,093,248	$9,083,923	$8,175,531	$7,357,978	$6,622,180	$5,959,962	$5,363,966	$52,656,788
Additional investment w/o trading	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$2,817,702	$14,670,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3 5								
Jobs Created	442	397	358	322	290	261	235	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	618	556	501	451	406	365	329	
Jobs Lost	129	116	105	94	85	76	69	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	207	186	168	151	136	122	110	
Multiplier Jobs	99	89	80	72	65	58	53	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$2,969,744	$2,750,280	$2,547,034	$2,358,809	$2,184,493	$2,023,059	$1,873,555	$16,706,973
Capital Investment								
Capital Investment by Industry								
With Trading	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$1,004,539	$5,230,000
Without Trading	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$3,822,241	$19,900,000
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	
Private	$1,596,000	$1,642,284	$1,689,910	$1,738,916	$1,789,346	$1,841,237	$1,894,633	
Net Benefit or (Cost)								
low	$8,803,680	$7,776,878	$6,840,535	$5,985,838	$5,204,821	$4,490,281	$3,835,700	$42,937,732
mid	$12,613,881	$11,206,059	$9,926,797	$8,763,474	$7,704,694	$6,740,166	$5,860,597	$62,815,670
high	$14,153,102	$12,591,358	$11,173,566	$9,885,566	$8,714,577	$7,649,061	$6,678,602	$70,845,830
Without trading (low)	$5,985,978	$4,959,176	$4,022,832	$3,168,135	$2,387,119	$1,672,579	$1,017,998	$23,213,817
Benefit or (Cost) per bottle refilled								
low	$0.07	$0.07	$0.07	$0.07	$0.06	$0.06	$0.06	$0.07
mid	$0.10	$0.10	$0.10	$0.10	$0.09	$0.09	$0.09	$0.10
High	$0.11	$0.11	$0.11	$0.11	$0.11	$0.10	$0.10	$0.11
Without trading (low)	$0.05	$0.04	$0.04	$0.03	$0.03	$0.02	$0.02	$0.04
Benefit or (Cost) per ton of bottles								
low	$279	$274	$268	$260	$252	$241	$229	$261
mid	$387	$382	$376	$369	$360	$350	$338	$369
High	$421	$416	$410	$403	$395	$385	$374	$404
Without trading (low)	$190	$175	$157	$138	$115	$90	$61	$141

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Table 3-A.7 Cost-Benefit Analysis for Market Development Policies
10% Refillable Plastic Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption	531,214,200	525,902,058	520,843,037	515,436,807	510,282,241	505,179,419	500,127,624	
Diversion resulting from Policy (Containers)								
	53,121,420	52,590,206	52,084,304	51,543,861	51,028,224	50,517,942	50,012,762	360,878,519
Price and Value of Material								
Market Prices (Price of Plastic Bottle or Milk Container)								
Low (three half-pint cartons)	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Mid (half gallon milk)	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	
High (PET 2l Soda)	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	
Value of Material Refilled -- $								
Low (10% HG , 60% HP, 30% PET)	$2,868,557	$2,839,871	$2,811,472	$2,783,358	$2,755,524	$2,727,969	$2,700,689	$19,487,440
Mid(10%HG, 45% HP, 45% PET)	$7,051,869	$6,981,350	$6,911,536	$6,842,421	$6,773,997	$6,706,257	$6,639,194	$47,906,623
High(10% HG, 30%HP, 60%PET)	$8,047,895	$7,967,416	$7,887,742	$7,808,865	$7,730,776	$7,653,468	$7,576,934	$54,673,096
Costs								
Collection and Washing Costs - cost per bottle								
Low - three half pint cartons	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
High - half gallon or PET	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	
Value of Avoided Recycling								
Per bottle	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	
Net collection and recycling costs								
Half-Pint Cartons	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	
Large bottles	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	
Net Cost for colln./refilling								
Low Value Mix	$3,718,499	$3,681,314	$3,644,501	$3,608,056	$3,571,976	$3,536,256	$3,500,893	
Mid Value Mix	$4,156,751	$4,115,184	$4,074,032	$4,033,291	$3,992,959	$3,953,029	$3,913,499	
High Value Mix	$4,595,003	$4,549,053	$4,503,562	$4,458,527	$4,413,941	$4,369,802	$4,326,104	
Additional Investment Without Trading	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$76,980,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	186	184	182	180	179	177	175	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	260	258	255	253	250	248	245	
Jobs Lost (.08/million cont. refilled)	4	4	4	4	4	4	4	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	7	7	7	7	7	6	6	
Multiplier Jobs	68	67	66	66	65	64	64	
Average Value of Jobs	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
Net Value of Jobs Created	$2,027,113	$2,006,842	$1,986,774	$1,966,906	$1,947,237	$1,927,765	$1,908,487	$13,771,124
Capital Investment								
Capital Investment by Industry								
With trading	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$4,020,000
Without Trading	$15,557,866	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,866	$15,557,866	$81,000,000
Administrative Costs								
Public	$140,000	$144,060	$149,822	$155,815	$162,048	$168,530	$175,271	
Private	$1,596,000	$1,642,284	$1,707,975	$1,776,294	$1,847,346	$1,921,240	$1,998,090	
Net Benefit or (Cost)								
Low	($558,829)	($620,945)	($704,053)	($789,902)	($878,809)	($970,292)	($1,065,078)	($5,587,708)
Mid	$3,186,231	$3,086,864	$2,986,481	$2,843,926	$2,718,881	$2,591,223	$2,460,822	$19,854,228
High	$3,744,006	$3,638,862	$3,513,156	$3,385,134	$3,254,678	$3,121,861	$2,985,956	$23,643,452
Without trading (high)	($9,341,842)	($9,463,985)	($9,608,520)	($9,751,202)	($9,898,153)	($10,047,498)	($10,199,369)	($68,308,570)
Benefit or (Cost) per bottle refilled								
Low	($0.011)	($0.012)	($0.014)	($0.015)	($0.017)	($0.019)	($0.021)	($0.015)
Mid	$0.06	$0.06	$0.06	$0.06	$0.05	$0.05	$0.05	$0.06
High	$0.07	$0.07	$0.07	$0.07	$0.06	$0.06	$0.06	$0.07
Without trading (high)	($0.18)	($0.18)	($0.18)	($0.19)	($0.19)	($0.20)	($0.20)	($0.19)
Benefit or (Cost) per ton of bottles								
Low	($158)	($177)	($203)	($230)	($258)	($288)	($319)	($232)
Mid	$900	$880	$855	$828	$799	$769	$738	$825
High	$1,057	$1,038	$1,012	$985	$957	$927	$896	$983
Without trading (high)	($2,638)	($2,699)	($2,768)	($2,838)	($2,910)	($2,983)	($3,059)	($2,839)

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Table 3-A.8 Cost-Benefit Analysis for Market Development Policies
20% Refillable Plastic Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption	531,214,200	525,902,058	520,643,037	515,436,607	510,282,241	505,179,419	500,127,624	
Diversion resulting from Policy (Containers)								
	106,242,840	105,180,412	104,128,607	103,087,321	102,056,448	101,035,884	100,025,525	721,757,037
Price and Value of Material								
Market Prices (Price of Plastic Bottle or Milk Container)								
Low (three half-pint cartons)	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Mid (half gallon milk)	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	
High (PET 2l Soda)	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	
Value of Material Refilled -- $								
Low (10% HG , 60% HP, 30% PET)	$5,737,113	$5,679,742	$5,622,945	$5,566,715	$5,511,048	$5,455,938	$5,401,378	$38,974,880
Mid(10%HG, 45% HP, 45% PET)	$14,103,737	$13,962,700	$13,823,073	$13,684,842	$13,547,993	$13,412,514	$13,278,388	$95,813,247
High(10% HG, 30%HP, 60%PET)	$16,095,790	$15,934,832	$15,775,484	$15,617,729	$15,461,552	$15,306,936	$15,153,867	$109,346,191
Costs								
Collection and Washing Costs - cost per bottle								
Low - three half pint cartons	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
High - half gallon or PET	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	
Value of Avoided Recycling								
Per bottle	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	
Net collection and recycling costs								
Half-Pint Cartons	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	
Large bottles	$0 10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	
Net Cost for colln./refilling								
Low Value Mix	$7,436,999	$7,362,629	$7,289,003	$7,216,112	$7,143,951	$7,072,512	$7,001,787	
Mid Value Mix	$8,313,502	$8,230,367	$8,148,064	$8,066,583	$7,985,917	$7,906,058	$7,826,997	
High Value Mix	$9,190,006	$9,098,106	$9,007,125	$8,917,053	$8,827,883	$8,739,604	$8,652,208	
Additional Investment Without Trading	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$76,980,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	372	368	364	361	357	354	350	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	521	515	510	505	500	495	490	
Jobs Lost (.08/million cont. refilled)	8	8	8	8	8	8	8	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	14	13	13	13	13	13	13	
Multiplier Jobs	135	134	132	131	130	129	127	
Average Value of Jobs	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
Net Value of Jobs Created	$4,054,227	$4,013,685	$3,973,548	$3,933,812	$3,894,474	$3,855,529	$3,816,974	$27,542,249
Capital Investment								
Capital Investment by Industry								
With trading	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$4,020,000
Without Trading	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$81,000,000
Administrative Costs								
Public	$140,000	$144,060	$149,822	$155,815	$162,048	$168,530	$175,271	
Private	$1,596,000	$1,642,284	$1,707,975	$1,776,294	$1,847,346	$1,921,240	$1,998,090	
Net Benefit or (Cost)								
Low	$618,341	$544,454	$449,692	$352,305	$252,177	$149,165	$43,205	$2,409,360
Mid	$8,108,462	$7,959,673	$7,790,759	$7,619,962	$7,447,156	$7,272,215	$7,095,005	$53,293,231
High	$9,224,011	$9,064,067	$8,864,109	$8,702,378	$8,518,749	$8,333,092	$8,145,273	$60,871,680
Without trading (high)	($2,161,951)	($2,355,893)	($2,569,509)	($2,784,581)	($3,001,178)	($3,219,493)	($3,439,644)	($19,532,229)
Benefit or (Cost) per bottle refilled								
Low	$0.006	$0.005	$0.004	$0.003	$0.002	$0.001	$0.000	$0.003
Mid	$0.08	$0.08	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07
High	$0.09	$0.09	$0.09	$0.08	$0.08	$0.08	$0.08	$0.08
Without trading (high)	($0.02)	($0.02)	($0.02)	($0.03)	($0.03)	($0.03)	($0.03)	($0.03)
Benefit or (Cost) per ton of bottles								
Low	$87	$78	$65	$51	$37	$22	$6	$50
Mid	$1,145	$1,135	$1,122	$1,109	$1,095	$1,080	$1,064	$1,108
High	$1,302	$1,293	$1,280	$1,266	$1,252	$1,237	$1,221	$1,265
Without trading (high)	($305)	($338)	($370)	($405)	($441)	($478)	($516)	($406)

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Table 3-A.9 Cost-Benefit Analysis for Market Development Policies
25% Refillable Plastic Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption	531,214,200	525,902,058	520,843,037	515,436,607	510,282,241	505,179,419	500,127,624	
Diversion resulting from Policy (Containers)								
	132,803,550	131,475,515	130,160,759	128,859,152	127,570,560	126,294,855	125,031,906	902,196,297
Price and Value of Material								
Market Prices (Price of Plastic Bottle or Milk Container)								
Low (three half-pint cartons)	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Mid (half gallon milk)	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	
High (PET 2l Soda)	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	
Value of Material Refilled -- $								
Low (10% HG, 60% HP, 30% PET)	$7,171,392	$7,099,678	$7,028,681	$6,958,394	$6,888,810	$6,819,922	$6,751,723	$48,718,600
Mid(10%HG, 45% HP, 45% PET)	$17,629,671	$17,453,375	$17,278,841	$17,106,052	$16,934,992	$16,765,642	$16,597,986	$119,766,558
High(10% HG, 30%HP, 60%PET)	$20,119,738	$19,918,540	$19,719,355	$19,522,161	$19,326,940	$19,133,670	$18,942,334	$136,682,739
Costs								
Collection and Washing Costs - cost per bottle								
Low - three half pint cartons	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
High - half gallon or PET	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	
Value of Avoided Recycling								
Per bottle	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	
Net collection and recycling costs								
Half-Pint Cartons	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	
Large bottles	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	
Net Cost for colln./refilling								
Low Value Mix	$9,296,249	$9,203,286	$9,111,253	$9,020,141	$8,929,939	$8,840,640	$8,752,233	
Mid Value Mix	$10,391,878	$10,287,959	$10,185,079	$10,083,229	$9,982,396	$9,882,572	$9,783,747	
High Value Mix	$11,487,507	$11,372,632	$11,258,906	$11,146,317	$11,034,853	$10,924,505	$10,815,260	
Additional Investment Without Trading	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$76,980,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	465	460	456	451	446	442	438	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	651	644	638	631	625	619	613	
Jobs Lost (.08/million cont. refilled)	11	11	10	10	10	10	10	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	17	17	17	16	16	16	16	
Multiplier Jobs	169	167	166	164	162	161	159	
Average Value of Jobs	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
Net Value of Jobs Created	$5,067,783	$5,017,106	$4,966,935	$4,917,265	$4,868,093	$4,819,412	$4,771,218	$34,427,811
Capital Investment								
Capital Investment by Industry								
With trading	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$4,020,000
Without Trading	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$16,657,865	$15,557,865	$81,000,000
Administrative Costs								
Public	$140,000	$144,060	$149,822	$155,815	$162,048	$168,530	$175,271	
Private	$1,596,000	$1,642,284	$1,707,975	$1,776,294	$1,847,346	$1,921,240	$1,998,090	
Net Benefit or (Cost)								
Low	$1,206,927	$1,127,153	$1,026,565	$923,409	$817,570	$708,924	$597,346	$6,407,894
Mid	$10,569,577	$10,396,177	$10,202,898	$10,007,979	$9,811,294	$9,612,711	$9,412,096	$70,012,733
High	$11,964,014	$11,776,670	$11,569,586	$11,361,000	$11,150,785	$10,938,807	$10,724,931	$79,465,794
Without trading (high)	$1,427,994	$1,198,153	$948,997	$698,760	$447,309	$194,509	($59,762)	$4,855,941
Benefit or (Cost) per bottle refilled								
Low	$0.009	$0.009	$0.008	$0.007	$0.006	$0.006	$0.005	$0.007
Mid	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08
High	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09
Without trading (high)	$0.01	$0.01	$0.01	$0.01	$0.00	$0.00	$0.00	$0.01
Benefit or (Cost) per ton of bottles								
Low	$136	$129	$118	$107	$96	$84	$72	$107
Mid	$1,194	$1,188	$1,176	$1,165	$1,154	$1,142	$1,129	$1,164
High	$1,351	$1,344	$1,333	$1,322	$1,311	$1,299	$1,287	$1,322
Without trading (high)	$161	$137	$109	$81	$53	$23	($7)	$81

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California FUTURES

Table 3-A.10 Cost-Benefit Analysis for Market Development Policies Reduced Job Impact 15% Refillable Plastic Beverage Containers	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption	531,214,200	525,902,058	520,643,037	515,436,607	510,282,241	505,179,419	500,127,624	
Diversion resulting from Policy (Containers)								
	79,682,130	78,885,309	78,096,456	77,315,491	76,542,336	75,776,913	75,019,144	541,317,778
Price and Value of Material								
Market Prices (Price of Plastic Bottle or Milk Container)								
Low (three half-pint cartons)	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Mid (half gallon milk)	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	
High (PET 2l Soda)	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	
Value of Material Refilled -- $								
Low (10% HG , 60% HP, 30% PET)	$4,302,635	$4,259,807	$4,217,209	$4,175,037	$4,133,286	$4,091,953	$4,051,034	$29,231,160
Mid(10%HG, 45% HP, 45% PET)	$10,577,803	$10,472,025	$10,367,304	$10,263,631	$10,160,995	$10,059,385	$9,958,791	$71,859,935
High(10% HG, 30%HP, 60%PET)	$12,071,643	$11,951,124	$11,831,613	$11,713,297	$11,596,164	$11,480,202	$11,365,400	$82,009,643
Costs								
Collection and Washing Costs - cost per bottle								
Low - three half pint cartons	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
High - half gallon or PET	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	
Value of Avoided Recycling								
Per bottle	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	
Net collection and recycling costs								
Half-Pint Cartons	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	
Large bottles	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	
Total Net Cost for collection and refilling								
Low Value Mix	$5,577,749	$5,521,972	$5,466,752	$5,412,084	$5,357,964	$5,304,384	$5,251,340	
Mid Value Mix	$6,235,127	$6,172,775	$6,111,048	$6,049,937	$5,989,438	$5,929,543	$5,870,248	
High Value Mix	$6,892,504	$6,823,579	$6,755,343	$6,687,790	$6,620,912	$6,554,703	$6,489,156	
Additional Investment Without Trading	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$76,980,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled --2								
Jobs Created	159	158	156	155	153	152	150	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	223	221	219	216	214	212	210	
Jobs Lost (.08/million cont. refilled)	6	6	6	6	6	6	6	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	10	10	10	10	10	10	10	
Multiplier Jobs	54	53	52	52	51	51	50	
Average Value of Jobs	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
Net Value of Jobs Created	$1,606,392	$1,590,328	$1,574,425	$1,558,680	$1,543,093	$1,527,663	$1,512,386	$10,912,966
Capital Investment								
Capital Investment by Industry								
With trading	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$4,020,000
Without Trading	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$81,000,000
Administrative Costs								
Public	$140,000	$144,060	$149,822	$155,815	$162,048	$168,530	$175,271	
Private	$1,596,000	$1,642,284	$1,707,975	$1,776,294	$1,847,346	$1,921,240	$1,998,090	
Net Benefit or (Cost)								
Low	($1,404,522)	($1,456,181)	($1,532,917)	($1,610,477)	($1,690,978)	($1,774,536)	($1,861,281)	($11,332,894)
Mid	$4,213,068	$4,103,233	$3,972,884	$3,840,265	$3,705,257	$3,567,734	$3,427,569	$26,830,009
High	$5,049,730	$4,931,529	$4,792,898	$4,652,078	$4,508,951	$4,363,392	$4,215,270	$32,513,846
Without trading (high)	($7,186,175)	($7,329,875)	($7,493,750)	($7,659,560)	($7,827,427)	($7,997,480)	($8,169,851)	($53,664,119)
Benefit or (Cost) per bottle refilled								
Low	($0.018)	($0.018)	($0.020)	($0.021)	($0.022)	($0.023)	($0.025)	($0.021)
Mid	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05
High	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Without trading (high)	($0.09)	($0.09)	($0.10)	($0.10)	($0.10)	($0.11)	($0.11)	($0.10)
Benefit or (Cost) per ton of bottles								
Low	($264)	($277)	($294)	($312)	($331)	($351)	($372)	($314)
Mid	$793	$780	$763	$745	$726	$706	$685	$743
High	$951	$938	$921	$903	$884	$864	$843	$901
Without trading (high)	($1,353)	($1,394)	($1,439)	($1,486)	($1,534)	($1,583)	($1,634)	($1,487)

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Table 3-A.11 Cost-Benefit Analysis for Market Development Policies
Increased Job Multiplier - 15% Refillable Plastic Beverage Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption	531,214,200	525,902,056	520,843,037	515,436,607	510,282,241	505,179,419	500,127,624	
Diversion resulting from Policy (Containers)								
	79,682,130	78,885,309	78,096,456	77,315,491	76,542,336	75,776,913	75,019,144	541,317,778
Price and Value of Material								
Market Prices (Price of Plastic Bottle or Milk Container)								
Low (three half-pint cartons)	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Mid (half gallon milk)	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	
High (PET 2l Soda)	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	
Value of Material Refilled -- $								
Low (10% HG , 60% HP, 30% PET)	$4,302,835	$4,259,807	$4,217,209	$4,175,037	$4,133,286	$4,091,953	$4,051,034	$29,231,160
Mid(10%HG, 45% HP, 45% PET)	$10,577,803	$10,472,025	$10,367,304	$10,263,631	$10,160,995	$10,059,385	$9,958,791	$71,859,935
High(10% HG, 30%HP, 60%PET)	$12,071,643	$11,951,124	$11,831,613	$11,713,297	$11,596,164	$11,480,202	$11,365,400	$82,009,643
Costs								
Collection and Washing Costs - cost per bottle								
Low - three half pint cartons	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
High - half gallon or PET	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	
Value of Avoided Recycling								
Per bottle	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	
Net collection and recycling costs								
Half-Pint Cartons	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	
Large bottles	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	
Total Net Cost for collection and refilling								
Low Value Mix	$5,577,749	$5,521,972	$5,466,752	$5,412,084	$5,357,964	$5,304,384	$5,251,340	
Mid Value Mix	$6,235,127	$6,172,775	$6,111,048	$6,049,937	$5,989,438	$5,929,543	$5,870,248	
High Value Mix	$6,892,504	$6,823,579	$6,755,343	$6,687,790	$6,620,912	$6,554,703	$6,489,156	
Additional Investment Without Trading	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$78,980,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	279	276	273	271	268	265	263	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Created	446	442	437	433	429	424	420	
Jobs Lost (.08/million cont. refilled)	6	6	6	6	6	6	6	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	10	10	10	10	10	10	10	
Multiplier Jobs	157	156	154	152	151	149	148	
Average Value of Jobs	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
Net Value of Jobs Created	$4,713,995	$4,666,855	$4,620,186	$4,573,984	$4,528,245	$4,482,962	$4,438,133	$32,024,360
Capital Investment								
Capital Investment by Industry								
With trading	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$4,020,000
Without Trading	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$81,000,000
Administrative Costs								
Public	$140,000	$144,060	$149,822	$155,815	$162,048	$168,530	$175,271	
Private	$1,596,000	$1,642,284	$1,707,975	$1,776,294	$1,847,346	$1,921,240	$1,998,090	
Net Benefit or (Cost)								
Low	$1,703,081	$1,618,346	$1,512,845	$1,404,827	$1,294,173	$1,180,762	$1,064,466	$9,778,499
Mid	$7,320,671	$7,179,760	$7,018,645	$6,855,569	$6,690,408	$6,523,034	$6,353,315	$47,941,403
High	$8,157,333	$8,008,056	$7,836,658	$7,667,382	$7,494,102	$7,316,692	$7,141,016	$53,625,239
Without trading (high)	($4,078,572)	($4,253,348)	($4,447,989)	($4,644,256)	($4,842,276)	($5,042,181)	($5,244,105)	($32,552,726)
Benefit or (Cost) per bottle refilled								
Low	$0.021	$0.021	$0.019	$0.018	$0.017	$0.016	$0.014	$0.018
Mid	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.08	$0.09
High	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10
Without trading (high)	($0.05)	($0.05)	($0.06)	($0.06)	($0.06)	($0.07)	($0.07)	($0.06)
Benefit or (Cost) per ton of bottles								
Low	$321	$308	$291	$273	$254	$234	$213	$271
Mid	$1,378	$1,365	$1,348	$1,330	$1,311	$1,291	$1,270	$1,328
High	$1,536	$1,523	$1,506	$1,488	$1,469	$1,449	$1,428	$1,486
Without trading (high)	($768)	($809)	($854)	($901)	($949)	($998)	($1,049)	($902)

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Table 3-A.12 Cost-Benefit Analysis for Market Development Policies
15% Refillable Plastic Beverage Containers -- With Avoided landfill

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption	531,214,200	525,902,058	520,643,037	515,438,607	510,282,241	505,179,419	500,127,624	
Diversion resulting from Policy (Containers)	79,682,130	78,885,309	78,096,456	77,315,491	76,542,336	75,776,913	75,019,144	541,317,776
Price and Value of Material								
Market Prices (Price of Plastic Bottle or Milk Container)								
Low (three half-pint cartons)	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
Mid (half gallon milk)	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	$0.09	
High (PET 2l Soda)	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20	
Value of Material Refilled -- $								
Low (10% HG , 60% HP, 30% PET)	$4,302,835	$4,259,807	$4,217,209	$4,175,037	$4,133,286	$4,091,953	$4,051,034	$29,231,160
Mid(10%HG, 45% HP, 45% PET)	$10,577,803	$10,472,025	$10,367,304	$10,263,631	$10,160,995	$10,059,385	$9,958,791	$71,859,935
High(10% HG, 30%HP, 60%PET)	$12,071,843	$11,951,124	$11,831,613	$11,713,297	$11,596,164	$11,480,202	$11,365,400	$82,009,643
Costs								
Collection and Washing Costs - cost per bottle								
Low - three half pint cartons	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08	
High - half gallon or PET	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	$0.13	
Value of Avoided Landfill								
Per bottle	$0.005	$0.006	$0.006	$0.007	$0.007	$0.008	$0.008	
Net collection and recycling costs								
Half-Pint Cartons	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	
Large bottles	$0.12	$0.12	$0.12	$0.12	$0.12	$0.12	$0.12	
Net Cost for colln./refilling								
Low Value Mix	$7,314,820	$7,210,117	$7,101,571	$6,994,475	$6,883,707	$6,769,404	$6,656,699	
Mid Value Mix	$7,972,197	$7,860,921	$7,745,867	$7,632,328	$7,515,182	$7,394,564	$7,275,607	
High Value Mix	$8,629,575	$8,511,725	$8,390,163	$8,270,180	$8,146,656	$8,019,723	$7,894,515	
Additional Investment Without Trading	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$14,785,733	$76,980,000
Job Impacts								
Jobs Per 1,000,000 bottles refilled -- 3.5								
Jobs Created	279	276	273	271	268	265	263	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	390	387	383	379	375	371	368	
Jobs Lost (.08/million cont. refilled)	6	6	6	6	6	6	6	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Lost	10	10	10	10	10	10	10	
Multiplier Jobs	101	100	99	98	97	96	95	
Average Value of Jobs	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	
Net Value of Jobs Created	$3,040,670	$3,010,263	$2,980,161	$2,950,359	$2,920,856	$2,891,647	$2,862,731	$20,656,686
Capital Investment								
Capital Investment by Industry								
With trading	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$772,131	$4,020,000
Without Trading	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$15,557,865	$81,000,000
Administrative Costs								
Public	$140,000	$144,060	$149,822	$155,815	$162,048	$168,530	$175,271	
Private	$1,596,000	$1,642,284	$1,707,975	$1,776,294	$1,847,346	$1,921,240	$1,998,090	
Net Benefit or (Cost)								
Low	($1,707,314)	($1,726,391)	($1,761,999)	($1,801,189)	($1,838,960)	($1,875,574)	($1,916,295)	($12,627,722)
Mid	$3,910,276	$3,835,023	$3,743,801	$3,649,553	$3,557,275	$3,466,699	$3,372,555	$25,535,181
High	$4,746,938	$4,663,319	$4,563,813	$4,461,366	$4,360,969	$4,262,356	$4,160,256	$31,219,018
Without trading (high)	($7,488,967)	($7,598,085)	($7,722,833)	($7,850,272)	($7,975,409)	($8,098,516)	($8,224,865)	($54,958,948)
Benefit or (Cost) per bottle refilled								
Low	($0.021)	($0.022)	($0.023)	($0.023)	($0.024)	($0.025)	($0.026)	($0.023)
Mid	$0.05	$0.05	$0.05	$0.05	$0.05	$0.05	$0.04	$0.05
High	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Without trading (high)	($0.09)	($0.10)	($0.10)	($0.10)	($0.10)	($0.11)	($0.11)	($0.10)
Benefit or (Cost) per ton of bottles								
Low	($321)	($328)	($338)	($349)	($360)	($371)	($383)	($350)
Mid	$738	$729	$719	$708	$697	$686	$674	$708
High	$894	$887	$877	$866	$855	$844	$832	$865
Without trading (high)	($1,410)	($1,445)	($1,483)	($1,523)	($1,563)	($1,603)	($1,645)	($1,523)

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CHAPTER 4
80% RECYCLED CONTENT IN BOXBOARD AND CORRUGATED

INTRODUCTION

Californians presently consume between four and one-half and five million tons of corrugated paper and paperboard annually. That consumption should rise to nearly six and one-half million tons by the end of the century. Most of the consumption immediately returns to the wastestream upon use. Only a statistically insignificant portion is retained by consumers for such purposes as storage of personal goods or short term backstock of goods available for retail sale.

The dozen and one-half paperboard mills and two hundred fifty paperboard converting plants in California have the capacity to produce as much new corrugated and paperboard stock as California consumes. As a matter of reality, a significant portion of new goods arrive in California in corrugated and paperboard containers produced elsewhere and a large amount of locally produced merchandise is shipped out of state in paper containers.

HIGHLIGHTS OF THE ANALYSIS

- *This policy results in a benefit of between $13 and $115 per ton diverted.*
- *The total net benefit over the seven year period ranges from $130 million to $1.7 billion.*
- *This policy will divert almost 13 million tons of corrugated, about 4% of the overall diversion requirement.*
- *About 2,800 jobs will be created as a result of this policy, at an annual benefit of $43,000 per job.*
- *The 80% corrugated policy is unique among the six analyzed because it has both a net benefit and a high diversion impact.*
- *If diversion as a result of the policy increased, due to exporting California corrugated to nearby out-of-state manufacturers, or to siting of new facilities in the state, the benefit of the policy would increase substantially.*

WASTE GENERATION AND DIVERSION

Use of secondary fibers in corrugated and boxboard containers can have a significant impact on diversion. The policy would result in 2 to 4 million tons of diversion annually from 1994 to 2000. By 2000, total paper diversion is projected to reach 44%. This doubles the total diversion rate for paper from 5% to 11% of the wastestream.

Table 4.1. Waste Generation Data for Paper and Paperboard
Corrugated and Boxboard

Tons of Waste	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SRRE	14,030,000	14,338,660	14,654,111	14,976,501	15,305,984	15,642,716	15,986,855	16,338,566	16,698,015	17,065,371	17,440,809
EPA/Franklin	8,540,400	8,728,289	8,920,311	9,116,558	9,317,122	9,522,099	9,731,585	9,945,680	10,164,485	10,388,104	10,616,642
Aggregate	11,285,200	11,533,474	11,787,211	12,046,529	12,311,553	12,582,407	12,859,220	13,142,123	13,431,250	13,726,737	14,028,726
Baseline Diversion	2,144,188	2,318,228	2,498,889	2,686,376	2,880,903	3,082,690	3,291,960	3,508,947	3,733,887	3,967,027	4,208,618
% Diversion	19%	20%	21%	22%	23%	25%	26%	27%	28%	29%	30%
Policy Diversion	0	0	0	0	1,700,000	1,700,000	1,800,000	1,800,000	1,900,000	1,900,000	1,900,000
Total Diversion	2,144,188	2,318,228	2,498,889	2,686,376	4,580,903	4,782,690	5,091,960	5,308,947	5,633,887	5,867,027	6,108,618
% Paper Diversion	19%	20%	21%	22%	37%	38%	40%	40%	42%	43%	44%
% AB 939 Diversion	5%	5%	5%	6%	10%	10%	10%	10%	11%	11%	11%

THE COST-BENEFIT MODEL

Requiring 80% recycled content in corrugated and boxboard sold in the state would result in a benefit of between $13 and $115 per ton diverted. Based on the cost-benefit model, this policy results in a significant net benefit of between $130 million and $1.75 billion over seven years. The wide range illustrates the sensitivity of the costs and benefits to price and the volume of material diverted. The benefits and costs of this policy are driven by several factors:

- The variability in volume and value of the material diverted.
- The net savings from recycling paper.
- The additional cost to the end-user.
- A positive impact from multiplier jobs.

Recycling of corrugated results in a net benefit, since the cost of recycling is about half as much as the cost of landfilling. This serves to drive the positive benefit of the policy. The savings due simply to recycling over the seven year period range from $534 million to $800 million.

Collection and recycling of corrugated and boxboard will create over 2,000 jobs. When the additional indirect jobs are added, the total number of jobs created increases to about 3,000.

The policy does result in significant cost to industry for administration -- an estimate of over $30 million annually. This figure is high due to the large number of firms regulated, however it represents only $3,700 per firm. Capital investment, included in the net cost benefit as end-user costs is also significant. The policy would encourage investment in equipment that allows the use of secondary fibers rather than virgin.

Table 4.2. Cost-Benefit Analysis for Market Development Policies
80% Recycled Content in Corrugated and Paperboard

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	5,700,000	5,600,000	5,900,000	6,200,000	6,300,000	6,500,000	6,500,000	
Diversion resulting from Policy (tons)								
Low	1,360,000	1,360,000	1,440,000	1,440,000	1,520,000	1,520,000	1,520,000	10,160,00
Mid	1,700,000	1,700,000	1,800,000	1,800,000	1,900,000	1,900,000	1,900,000	12,700,00
High	2,040,000	2,040,000	2,160,000	2,160,000	2,280,000	2,280,000	2,280,000	15,240,00
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$25	$25	$25	$25	$25	$25	$25	
Mid	$55	$55	$55	$55	$55	$55	$55	
High	$65	$65	$65	$65	$65	$65	$65	
Value of Material Diverted -- $								
Low-Low	$34,000,000	$34,000,000	$36,000,000	$36,000,000	$38,000,000	$38,000,000	$38,000,000	$254,000,000
Mid-Mid	$93,500,000	$93,500,000	$99,000,000	$99,000,000	$104,500,000	$104,500,000	$104,500,000	$698,500,000
High-High	$132,600,000	$132,600,000	$140,400,000	$140,400,000	$148,200,000	$148,200,000	$148,200,000	$990,600,000
Costs								
Collection and Recycling Costs								
Cost per ton	$48	$48	$48	$48	$48	$48	$48	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	($31)	($37)	($44)	($51)	($59)	($68)	($77)	
Net Cost for colln./recy.								
Low	($41,480,000)	($49,640,000)	($62,640,000)	($72,720,000)	($88,920,000)	($102,600,000)	($116,280,000)	($534,280,000)
Mid	($51,850,000)	($62,050,000)	($78,300,000)	($90,900,000)	($111,150,000)	($128,250,000)	($145,350,000)	($667,850,000)
High	($62,220,000)	($74,460,000)	($93,960,000)	($109,080,000)	($133,380,000)	($153,900,000)	($174,420,000)	($801,420,000)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$39	$39	$37	$37	$35	$35	$35	
High	$65	$65	$61	$61	$58	$58	$58	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$462,021,431
High-Low	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$616,028,575
Job Impacts								
Jobs Created	2,040	2,040	2,160	2,160	2,280	2,280	2,280	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	2,856	2,856	3,024	3,024	3,192	3,192	3,192	
Multiplier Jobs Created	816	816	864	864	912	912	912	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$24,480,000	$25,189,920	$27,445,159	$28,241,066	$30,674,507	$31,564,068	$32,479,426	$200,074,148
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$343,636,364
High	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$687,272,727
Administrative Costs								
Public	$280,000	$288,120	$296,475	$305,073	$313,920	$323,024	$332,392	$2,139,005
Private	$31,500,000	$32,413,500	$33,353,492	$34,320,743	$35,316,044	$36,340,210	$37,394,076	$240,638,084
Net Benefit or (Cost)								
Low	($19,824,062)	($11,675,782)	$4,431,110	$14,331,170	$33,960,460	$47,496,752	$61,026,876	$129,546,504
Mid	$72,046,938	$82,035,238	$105,092,130	$117,512,191	$144,691,481	$161,647,773	$178,599,897	$861,625,648
High	$187,520,000	$199,548,300	$226,155,192	$243,095,252	$276,624,542	$297,000,834	$317,372,958	$1,749,317,079
Benefit or (Cost) per ton diverted								
Low	($15)	($9)	$3	$10	$22	$31	$40	$13
Mid	$42	$48	$58	$65	$76	$85	$94	$68
High	$92	$98	$106	$113	$121	$130	$139	$11[illegible]

30-Apr-93

SENSITIVITY ANALYSIS

We modified several of the variables in the cost-benefit model to determine the impact on the cost-effectiveness of this policy. This analysis shows, at least at the higher diversion estimates, that the policy remains cost-effective, even as we change our assumptions on a number of inputs. The results of the sensitivity analysis are provided in Table 4-3 and Chart 4-3.

Chart 4.3 80% RECYCLED CONTENT IN CORRUGATED AND BOXBOARD

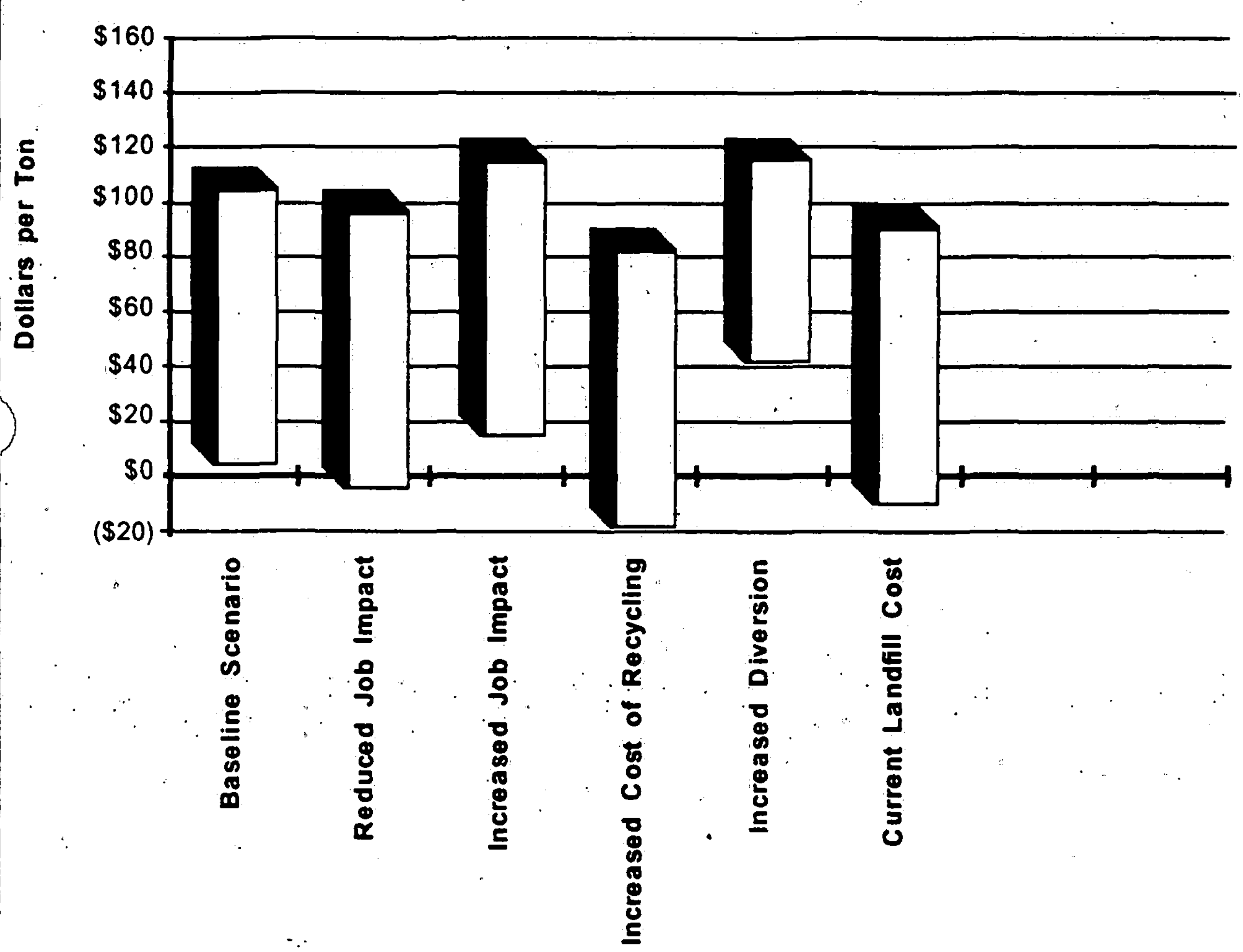

Table 4.3 80% Recycled Content in Corrugated and Boxboard Sensitivity Analysis			
	Low	Mid	High
Baseline Scenario (Table 4.2)			
Total Net Benefit (Cost) (Million $)	$130	$862	$1,749
1996 Net Benefit (Cost) (Million $)	$4	$105	$228
Benefit (Cost) per ton ($/ton)	$13	$68	$115
Reduced Job Impact (Table 4-A.1)			
Total Net Benefit (Cost) (Million $)	$13	$745	$1,633
1996 Net Benefit (Cost) (Million $)	($12)	$89	$212
Benefit (Cost) per ton ($/ton)	$1	$59	$107
Increased Job Impact (Table 4-A.2)			
Total Net Benefit (Cost) (Million $)	$230	$962	$1,849
1996 Net Benefit (Cost) (Million $)	$18	$95	$212
Benefit (Cost) per ton ($/ton)	$23	$76	$121
Increased Cost of Recycling (Table 4-A.3)			
Total Net Benefit (Cost) (Million $)	($99)	$576	$1,406
1996 Net Benefit (Cost) (Million $)	($28)	$65	$180
Benefit (Cost) per ton ($/ton)	($10)	$45	$92
Increased Diversion (Table 4-A.4)			
Total Net Benefit (Cost) (Million $)	$764	$1,943	$3,376
1996 Net Benefit (Cost) (Million $)	$82	$236	$427
Benefit (Cost) per ton ($/ton)	$51	$91	$121
Current Landfill Cost (Table 4-A.5)			
Total Net Benefit (Cost) (Million $)	($20)	$675	$1,525
1996 Net Benefit (Cost) (Million $)	($6)	$92	$213
Benefit (Cost) per ton ($/ton)	($2)	$53	$100

Reduced Job Impact

In this analysis we used an estimate of 2,000 tons per job for collection and recycling, rather than 920 tons per job. The higher number may be more reflective of more efficient commercial corrugated collection. This change reduces the benefit at the low level by a factor of ten, however, the impact at the higher diversion levels is not significant. In the first few years, when the avoided landfill value is low, the policy results in a net cost at the low diversion levels.

Increased Job Impact

In this scenario, we use the 920 tons per job figure and, instead of the more conservative 1.4 job multiplier, use a higher multiplier of 1.6. As expected, this results in a greater benefit at all levels, however, the impact is relatively modest.

Increased Cost of Recycling

The baseline model uses a fairly low recycling cost for commercial curbside collection, and assumes that most corrugated is picked up through this system. Here, we assume, instead, that one-half of the corrugated is picked up commercially at a cost of $40 per ton, and the other half through curbside at a cost of $100 per ton, for an average of $70 per ton. This change results in a net cost for the policy at the low diversion levels of $10 per ton, and $99 million over seven years. The mid and high levels still have a net benefit, although this is reduced somewhat from baseline.

Increased Diversion

Much of the corrugated that is sold in the state is produced elsewhere, and as a result, the policy will not create markets for a full 80% of sales. In this analysis we assume that higher levels will be diverted in the state, either through exports to manufacturers in nearby states, or by siting of new manufacturing facilities in California. Here, we assume that 35%, 50%, and 65% of corrugated sales will be diverted at the low, mid, and high diversion levels. This increases the benefit of the policy, and again, the low diversion level is particularly sensitive, increasing from a benefit of $13 per ton baseline to $51 per ton with increased diversion.

Current Landfill Cost

In this analysis we use the 1992 average tip fee and collection cost in California, and adjust to future dollars, rather than using the cost of new landfills, adjusted to present value. The current landfill cost ranges, in the model, from $82 to $89 per ton. This change reduces the net benefit of recycling corrugated, and as a result reduces the overall benefit of the policy. At the low diversion level the policy results in a cost of $2 per ton, however the benefit at the higher diversion levels remains positive.

TRADING VS. NON-TRADING

If the policy includes trading, industry will be able to reduce capital investment directly related to the policy. Without trading, all firms that produce or sell corrugated and boxboard in the state will have to meet the high content standard, or stop selling their product in the state. If they choose to keep selling corrugated in California they will need to invest in equipment that allows use of secondary materials. Capital investment could be as high as $130 million a year. With trading, firms that do not meet the standard may comply by purchasing recycled content credits. Some investment will probably be necessary, or occur anyway, as firms invest in new equipment.

DATA AND ASSUMPTIONS

WASTE GENERATION MODEL

Because it is difficult to separate quantity estimates for paper in the wastestream and because all paper grades can be used in corrugated and boxboard, we present generation and diversion data for all paper. Annual growth in paper generation is 2.2%, based on Franklin /EPA The Source Reduction and Recycling Element (SRRE) data and Franklin/EPA figures for paper are quite different. SRRE data is based on waste characterizations, and Franklin data on paper consumption, which may account for some of the variability. The aggregate figure represents the average of the two estimates. Baseline diversion in 1990 is 19%. Diversion, without the policy, is expected to increase by 1% a year to 2000. This assumes increased paper recycling under AB 939.

COST-BENEFIT MODEL

California consumption of paperboard and corrugated is based on API figures for US consumption, adjusted by GDP. Growth to 2000 is based on previous trends. California production figures are used to estimate diversion resulting from the policy. These figures are also based on previous trends and GDP in the corrugated industry. The mid-range figure is 80% of California production. The high figure is 130% of California production. This assumes that some California paper is shipped to manufacturers out-of-state for consumption. The James River Halsey plant is estimated to consume about 20% of California's mixed office paper. The low figure assumes 80% diversion, as a worst case scenario.

Market Prices

Market prices for corrugated and paperboard vary widely. All paper grades can and are used in production of these grades. A price of $55 per ton is a reasonable average for corrugated in current markets. The high and low figures provide a range for price fluctuation and quality of materials delivered. Paper prices are based on figures in ***Recycling Times*** *and Bureau of Labor statistics. While prices fluctuate throughout the year, the annual average has remained fairly consistent the last several years for each of the paper grades.*

Costs

The cost of recycling is based on studies of curbside and commercial recycling programs. The cost of most curbside programs range from just over to just under $100 per ton. Commercial corrugated collection is a relatively well established industry. The cost per ton was estimated to be $30 per ton, given that the corrugated would not be collected if it cost more than the scrap payment to do so. Because most corrugated is collected commercially, we use the $30 per ton figure for 75% of the collection, and the $100 per ton for the remaining 25%, for an average collection price of $48 per ton.

The end-user cost is based on the capital investment and the mid-and high-range diversion figures. This represents the additional cost to the paper industry to make recycled content corrugated and boxboard.

Job Impacts

Jobs in the paper manufacturing industry are not expected to be impacted. It does not require additional employees to use secondary rather than virgin fibers. There may be some losses in the timber industry (many out-of-state), however this is likely to be more than compensated by increases in recycling jobs. We used an average of 920 tons per job to determine the number of jobs created through collection and recycling. This is based on preliminary figures from the California recycling job survey.

Capital Investment

Capital investment for the 15 firms in California paper industry producing corrugated and boxboard is projected to be about $132 million annually. We do not attempt to separate investment in the different paper grades in this analysis. We used an average investment figure for the 15 firms in the state that manufacture corrugated or boxboard. With trading, this policy could potentially require no new capital investment, the low figure. For the mid-range figure we assume that one-half of the investment in the industry is a result of the policy. This would mean that 50% of the in-state corrugated and boxboard manufacturers change equipment to allow use of secondary fibers. The high figure represents 100% of the investment by the industry. This would be the no-trading scenario, in which all firms would be required to use secondary fibers.

Administration

There are between 8,000 and 10,000 firms that would be regulated under this policy. This assumes that firms are regulated at the point of first sale in the state. We assume one person at 5% for each of 9,000 firms for private administration, and 4 state staff to implement.

INDUSTRY CAPABILITY

The recommended 80% recycled content mandate is based on several factors. Primarily, it is intended to encourage the industry to commit its capital investments to state of the art production equipment which can handle up to 100% recycled content.

The industry has been able to produce 100% recycled content corrugating medium (the wrinkled inner portion of corrugated paper) for several years. The primary concerns expressed by the industry related to the linerboard. However, in recent months, great strides have been made. The following is excerpted from the January, 1993 issue of Pulp & Paper magazine:

> *Recycled linerboard production based on 100% wastepaper has been growing rapidly in the U.S. and statistics for this grade are now included in this section [Production, capacity, utilization, and consumption statistics which appear each month].*

According to the latest American Paper Institute survey, total linerboard capacity is expected to increase 1.7%/year over the 1993-95 period. Most of this capacity expansion will be in recycled board, which is expected to increase from about 700,000 tons in 1991 to 1.76 million tons by 1995.

Among recycled linerboard projects, Temple-Inland in late 1992 started up a 210,000-tpy [tons-per-year] machine at its new Maysville, Ky., mill.[1]

The most recent published detailed breakdown of capital expenditures (1987),[2] indicated that the corrugated and boxboard firms in California invest about $100 million annually in upgraded plant and equipment.[3] (A portion of that sum goes to mandated pollution abatement.) Our intent in recommending a high proportion of recycled content for the subject material is to encourage the industry to apply its capital investment plans toward equipment and machinery which will use recovered wastepaper as its feedstock.

The economics of furnish for linerboard, corrugating medium, and paperboard favor high (as much as 100%) recycled content, once the initial capital investment is made.[4] The end product is cost competitive with material made from virgin pulp and in most applications is structurally equal to or better than corrugated and boxboard made from virgin pulp.

The technological development and investment in capital equipment to handle recycled furnish in the industry will happen, although not necessarily in California.

> The largest capacity additions will come from Stone Container Corp. and Inland Container Corp., who will add approximately 740,000 tons of recycled containerboard capacity in 1992. Stone is converting an existing kraft linerboard mill in Jacksonville, Florida, to produce about 530,000 tpy of 100% recycled containerboard, and Inland Container is building a new greenfield mill in Maysville, Kentucky, to produce 210,000 tpy.
>
> Production of recycled paperboard will be paced by continued steady demand for recycled folding cartons and the displacement of kraft linerboard and semichemical corrugating medium by the recycled containerboard grades. Manufacturers of corrugated boxes plan to use more recycled linerboard and corrugating medium to increase the amount of recycled fiber in their packaging. This trend has accelerated since the introduction of new box performance tests that permit mills to use more recycled fiber in their containerboard.
>
> Consumer preference has played an important role in the increased use of recycled grades for folding cartons. The demand for recycled folding cartons should remain strong. In 1991, about 56% of folding cartons manufactured in the U.S. were made from recycled paperboard, up from 53% of the folding carton market in 1990.[5]

BENEFITS

By mandating high content levels for corrugated and boxboard in the near term - in California - several significant and beneficial events should occur:

- As much as four million tons of wastepaper will be diverted annually from California's wastestream.

- California's existing paperboard mills could develop into efficient, state of the art production facilities which would give them a competitive advantage when seeking new business.

- The infrastructure for handling large quantities of recovered waste would develop based on an economically viable material. Some of the waste products which are more questionable from an economic view could piggyback the development of their recovery, separation, preparation, and transport on wastepaper.

The goals of AB 939 look to the year 2000 for the completion of 50% diversion. In formulating the specifics of policy application for paper product recycled content, the Board should consider that the industry replaces its capital stock and equipment on a cycle of fifteen to twenty years. If the mandates move in step with routine investment and replacement, there should be less resistance from affected firms.

One approach would call for a scaled requirement from a base of the 30% which the industry currently claims is being used in boxboard production.[6] Each year would apply a 5% increase in recycled content until the overall 80% objective is reached. This could be accomplished either annually, or more likely with five year targets: 30% in 1994, 55% in 1998, 80% in 2003 (For this product, even 100% by 2008). Such a schedule would allow producers to plan their capital investments within the period they customarily use. They would simply be required to focus on machinery and equipment suitable for higher levels of recycled content. For those who have investment plans in the near term, trading would permit them to accelerate the recapture of their investment.

SITING AND EMPLOYMENT CONSIDERATIONS

Recycled content mandates for paper industry products will not exist in a vacuum. There have been historical difficulties associated with the siting of manufacturing facilities for the paper industry which need to be resolved.

There are currently about 36,000 jobs in the paper and allied products industries in California.[7] Approximately 20,000 of those are directly involved with the production of corrugated and/or boxboard.[8] By encouraging the development of modern, efficient manufacturing facilities, the Board would help to ensure that those jobs would not only stay in California but would be augmented by the support and supply businesses that serve them. Ideally, the difficulties associated with siting paper industry plants will be resolved to the benefit of establishing new facilities within California. The state will have available a valuable resource in its wastepaper stream. The economics of transportation of this dense material would ordinarily call for recovery facilities and factories capable of using the feedstock to be located close to the source.

If regulations call for significant recycled content, but the corresponding siting issues fail to be resolved, California will spur capital investment, job creation and wastestream diversion in other states which have less difficulties with siting and are within the transportation envelope.

The combination of increased production capacity for recycled furnish, public interest in recycled content, and changes in requirements for boxboard strengths focusing on compression and edge testing rather than just bursting strength will enhance the demand for fibers recovered from the paper wastestream. However, the development of any meaningful regulations for the paper wastestream must include a strategic plan to draw the active involvement and support of the communities which contribute significantly to the creation of the wastepaper. Otherwise, we may provide the economic incentives for growth in a basic industry outside California and inadvertently encourage the export of a valuable resource.

ADMINISTRATION

The administration of any recycled content mandate for the corrugated and paperboard industry in California would be relatively easy. There are less than three hundred California firms primarily involved in the production of linerboard, corrugating medium or conversion of those materials to boxes and other containers. Nationally, the number is approximately 6,500. Monitoring at point of sale would increase the number of impacted firms to about 9,000. While this number is substantial, it may be easier to regulate these firms, as they are all located in the state.

Many, if not most, paperboard and corrugated containers now distributed include a symbol and statement announcing their recycled content as an advertising device. By defining recycled content to provide uniform understanding of pre/post consumer elements then requiring that all corrugated and paperboard containers include a recycled proportion statement on an external surface, the Board would put the recycled content or its absence in public view. Reporting could take any of several forms:

- For Standard Industrial Classification (SIC) 263, paperboard mills, a simple report showing tonnage of paperboard, linerboard or corrugating medium produced and tonnage of post-consumer wastepaper purchased or retrieved and the recycled content proportion with a statement of the credits transactions for tonnage traded to reach compliance would be sufficient. The report would be associated with any other regularly scheduled report such as income tax, sales tax, unitary tax, etc.

- For SIC 265, paperboard containers and boxes, a short table would be sufficient. It would show tonnage purchased at given levels of recycled content with an overall calculation of the total proportion. Vendors would be required to give the container and box manufacturers a certification of the recycled content for each shipment which the box manufacturers would retain along with their other transaction records. Following the recycled content table would be a statement of the credits transactions for tonnage traded to reach compliance. The report would be associated with any other regularly scheduled report as above.

- Reports would be subject to random audit with similar penalties and assessments which would occur for failure to comply with any other mandated reporting.

SUMMARY

The corrugated and boxboard recycled content policy appears to have a strong positive impact both in diversion potential and for its overall net benefit. These features make this policy attractive. The policy will have a substantial impact on the paper industry, and a more thorough assessment of these impacts would be essential. The policy can be designed, however, to minimize these impacts. If the timeline for implementation is on a scale that allows for timely reinvestment in equipment to handle secondary paper pulp, rather than an immediate and costly retooling, the negative impact on the paper industry could be minimized.

ENDNOTES

1. Pulp & Paper, January, 1993, page 11.

2. Despite the "Annual Survey" in the title of this series, the Bureau of the Census publishes the Geographic Area Report every five years. The 1992 version should be available shortly.

3. US Department of Commerce, Bureau of the Census, ***Annual Survey of Manufacture's*** *Geographic Area Series, 1987, page CA-16.*

4. Personal communication with Jeff Walch, Green Bay Packaging, November 4, 1992.

5. Pulp & Paper, June, 1992, Page 13.

6. American Paper Institute, ***Recovered Paper Statistical Highlights, 1991*** *Washington, DC., 1992, page 8.*

7. California Statistical Abstract, 1992 edition, page 114.

8. US Department of Commerce, op. cit.

Chapter 4

APPENDICES

California FUTURES

Table 4-A.1 Cost-Benefit Analysis for Market Development Policies Reduced Job Impact - 80% Recycled Content in Corrugated and Paperboard		1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion									
CA Consumption (tons)		5,700,000	5,800,000	5,900,000	6,200,000	6,300,000	6,500,000	6,500,000	
Diversion resulting from Policy (tons)									
	Low	1,360,000	1,360,000	1,440,000	1,440,000	1,520,000	1,520,000	1,520,000	10,160,000
	Mid	1,700,000	1,700,000	1,800,000	1,800,000	1,900,000	1,900,000	1,900,000	12,700,000
	High	2,040,000	2,040,000	2,160,000	2,160,000	2,280,000	2,280,000	2,280,000	15,240,000
Price and Value of Material									
Market Prices (paid by end-users $/ton)									
	Low	$25	$25	$25	$25	$25	$25	$25	
	Mid	$55	$55	$55	$55	$55	$55	$55	
	High	$65	$65	$65	$65	$65	$65	$65	
Value of Material Diverted -- $									
	Low-Low	$34,000,000	$34,000,000	$36,000,000	$36,000,000	$38,000,000	$38,000,000	$38,000,000	$254,000,000
	Mid-Mid	$93,500,000	$93,500,000	$99,000,000	$99,000,000	$104,500,000	$104,500,000	$104,500,000	$698,500,000
	High-High	$132,600,000	$132,600,000	$140,400,000	$140,400,000	$148,200,000	$148,200,000	$148,200,000	$990,600,000
Costs									
Collection and Recycling Costs									
Cost per ton		$48	$48	$48	$48	$48	$48	$48	
Value of Avoided Land Disposal									
Per ton		$78	$84	$91	$98	$106	$116	$124	
Net collection and recycling costs		($31)	($37)	($44)	($51)	($59)	($68)	($77)	
Net Cost for colln./recy									
	Low	($41,480,000)	($49,640,000)	($62,640,000)	($72,720,000)	($88,920,000)	($102,600,000)	($116,280,000)	($534,280,000)
	Mid	($51,850,000)	($62,050,000)	($78,300,000)	($90,900,000)	($111,150,000)	($128,250,000)	($145,350,000)	($667,850,000)
	High	($62,220,000)	($74,460,000)	($93,960,000)	($109,080,000)	($133,380,000)	($153,900,000)	($174,420,000)	($801,420,000)
Cost of Use by End-User $/ton									
	Low	$0	$0	$0	$0	$0	$0	$0	
	Mid	$39	$39	$37	$37	$35	$35	$35	
	High	$65	$65	$61	$61	$58	$58	$58	
Total addit. Cost to end-user									
	Low-High	$0	$0	$0	$0	$0	$0	$0	$0
	Mid-Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$462,021,431
	High-Low	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$616,028,575
Job Impacts									
Jobs Created		850	850	900	900	950	950	950	
CA Multiplier		1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created		1,190	1,190	1,260	1,260	1,330	1,330	1,330	
Multiplier Jobs Created		340	340	360	360	380	380	380	
Average Value of Jobs		$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created		$10,200,000	$10,495,800	$11,435,463	$11,767,112	$12,781,045	$13,151,695	$13,533,094	$83,364,226
Capital Investment									
Capital Investment by Industry									
	Low	$0	$0	$0	$0	$0	$0	$0	$0
	Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$343,636,364
	High	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$687,272,727
Administrative Costs									
	Public	$260,000	$268,120	$296,475	$305,073	$313,920	$323,024	$332,392	$2,139,005
	Private	$31,500,000	$32,413,500	$33,353,492	$34,320,743	$35,316,044	$36,340,210	$37,394,076	$240,638,064
Net Benefit or (Cost)									
	Low	($34,104,082)	($26,569,902)	($11,578,566)	($2,142,786)	$16,066,998	$29,084,379	$42,082,544	$12,838,585
	Mid	$57,766,938	$67,341,118	$89,082,454	$101,038,234	$126,798,018	$143,235,400	$159,653,565	$744,915,726
	High	$173,240,000	$184,854,180	$212,145,516	$226,621,296	$258,731,080	$278,588,461	$298,426,627	$1,632,607,159
Benefit or (Cost) per ton diverted									
	Low	($25)	($20)	($8)	($1)	$11	$19	$28	$1
	Mid	$34	$40	$49	$56	$67	$75	$84	$59
	High	$85	$91	$98	$105	$113	$122	$131	$107

3-May-93

Table 4-A.2 Cost-Benefit Analysis for Market Development Policies Increased Job Impact - 80% Recycled Content in Corrugated and Paperboard								
	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons	5.700.000	5.800.000	5.900.000	6.200.000	6.300.000	6.500.000	6.500.000	
Diversion resulting from Policy (tons)								
Low	1.360.000	1.360.000	1.440.000	1.440.000	1.520.000	1.520.000	1.520.000	10.160.000
Mid	1.700.000	1.700.000	1.800.000	1.800.000	1.900.000	1.900.000	1.900 000	12.700.000
High	2.040.000	2.040.000	2.160.000	2.160.000	2.280.000	2.280.000	2.280.000	15.240.000
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$25	$25	$25	$25	$25	$25	$25	
Mid	$55	$55	$55	$55	$55	$55	$55	
High	$65	$65	$65	$65	$65	$65	$65	
Value of Material Diverted -- $								
Low-Low	$34.000.000	$34.000.000	$36.000.000	$36.000.000	$38.000.000	$38.000.000	$38.000.000	$254.000.000
Mid-Mid	$93.500.000	$93.500.000	$99.000.000	$99.000.000	$104.500.000	$104.500.000	$104.500.000	$698.500.000
High-High	$132.600.000	$132.600.000	$140.400.000	$140.400.000	$148.200.000	$148.200.000	$148.200.000	$990.600.000
Costs								
Collection and Recycling Costs								
Cost per ton	$48	$48	$48	$48	$48	$48	$48	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	($31)	($37)	($44)	($51)	($59)	($68)	($77)	
Net Cost for colln./recy.								
Low	($41.480.000)	($49.640.000)	($62.640.000)	($72.720.000)	($88.920.000)	($102.600.000)	($116.280.000)	($534.280.000)
Mid	($51.850.000)	($62.050.000)	($78.300.000)	($90.900.000)	($111.150.000)	($128.250.000)	($145.350.000)	($667.850.000)
High	($62.220.000)	($74.460.000)	($93.960.000)	($109.080.000)	($133.380.000)	($153.900.000)	($174.420.000)	($801.420.000)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$39	$39	$37	$37	$35	$35	$35	
High	$65	$65	$61	$61	$58	$58	$58	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$66.003.062	$66.003.062	$66.003.062	$66.003.062	$66.003.062	$66.003.062	$66.003.062	$462.021.431
High-Low	$88.004.082	$88.004.082	$88.004.082	$88.004.082	$88.004.082	$88.004.082	$88.004.082	$616.028.575
Job Impacts								
Jobs Created	2.040	2.040	2.160	2.160	2.280	2.280	2.280	
CA Multiplier	1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Created	3.264	3.264	3.456	3.456	3.648	3.648	3.648	
Multiplier Jobs Created	1.224	1.224	1.296	1.296	1.368	1.368	1.368	
Average Value of Jobs	$30.000	$30.870	$31.765	$32.686	$33.634	$34.610	$35.613	
Net Value of Jobs Created	$36.720.000	$37.784.880	$41.167.738	$42.361.602	$46.011.761	$47.346.102	$48.719.139	$300.111.221
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$66.003.062	$66.003.062	$66.003.062	$66.003.062	$66.003.062	$66.003.062	$66.003.062	$343.636.364
High	$132.006.123	$132.006.123	$132.006.123	$132.006.123	$132.006.123	$132.006.123	$132.006.123	$687.272.727
Administrative Costs								
Public	$260.000	$268.120	$298.475	$305.073	$313.920	$323.024	$332.392	$2.139.005
Private	$31.500.000	$32.413.500	$33.353.492	$34.320.743	$35.316.044	$36.340.210	$37.394.076	$240.638.064
Net Benefit or (Cost)								
Low	($7.584.082)	$719.178	$18.153.689	$28.451.704	$49.297.714	$63.278.786	$77.268.589	$229.585.578
Mid	$84.286.938	$94.630.198	$118.814.710	$131.632.725	$160.028.734	$177.429.808	$194.839.610	$961.662.721
High	$199.760.000	$212.143.260	$241.877.771	$257.215.786	$291.961.796	$312.762.868	$333.612.671	$1.849.354.153
Benefit or (Cost) per ton diverted								
Low	($6)	$1	$13	$20	$32	$42	$51	$23
Mid	$50	$58	$66	$73	$84	$93	$103	$78
High	$98	$104	$112	$119	$128	$137	$146	$121

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Table 4-A.3 Cost-Benefit Analysis for Market Development Policies
Increased Cost of Recycling - 80% Recycled Content in Corrugated and Paperboard

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	5,700,000	5,800,000	5,900,000	6,200,000	6,300,000	6,500,000	6,500,000	
Diversion resulting from Policy (tons)								
Low	1,360,000	1,360,000	1,440,000	1,440,000	1,520,000	1,520,000	1,520,000	10,160,000
Mid	1,700,000	1,700,000	1,800,000	1,800,000	1,900,000	1,900,000	1,900,000	12,700,000
High	2,040,000	2,040,000	2,160,000	2,160,000	2,280,000	2,280,000	2,280,000	15,240,000
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$25	$25	$25	$25	$25	$25	$25	
Mid	$55	$55	$55	$55	$55	$55	$55	
High	$65	$65	$65	$65	$65	$65	$65	
Value of Material Diverted -- $								
Low-Low	$34,000,000	$34,000,000	$36,000,000	$36,000,000	$38,000,000	$38,000,000	$38,000,000	$254,000,000
Mid-Mid	$93,500,000	$93,500,000	$99,000,000	$99,000,000	$104,500,000	$104,500,000	$104,500,000	$698,500,000
High-High	$132,600,000	$132,600,000	$140,400,000	$140,400,000	$148,200,000	$148,200,000	$148,200,000	$990,600,000
Costs								
Collection and Recycling Costs								
Cost per ton	$70	$70	$70	$70	$70	$70	$70	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	($8)	($14)	($21)	($28)	($36)	($45)	($54)	
Net Cost for colln./recy.								
Low	($10,880,000)	($19,040,000)	($30,240,000)	($40,320,000)	($54,720,000)	($68,400,000)	($82,080,000)	($305,680,000)
Mid	($13,600,000)	($23,800,000)	($37,800,000)	($50,400,000)	($68,400,000)	($85,500,000)	($102,600,000)	($382,100,000)
High	($16,320,000)	($28,560,000)	($45,360,000)	($60,480,000)	($82,080,000)	($102,600,000)	($123,120,000)	($458,520,000)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$39	$39	$37	$37	$35	$35	$35	
High	$65	$65	$61	$61	$58	$58	$58	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$462,021,431
High-Low	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$616,028,575
Job Impacts								
Jobs Created	2,040	2,040	2,160	2,160	2,280	2,280	2,280	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	2,856	2,856	3,024	3,024	3,192	3,192	3,192	
Multiplier Jobs Created	816	816	864	864	912	912	912	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$24,480,000	$25,189,920	$27,445,159	$28,241,088	$30,674,507	$31,564,068	$32,479,426	$200,074,148
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$343,636,364
High	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$687,272,727
Administrative Costs								
Public	$260,000	$268,120	$296,475	$305,073	$313,920	$323,024	$332,392	$2,139,005
Private	$31,500,000	$32,413,500	$33,353,492	$34,320,743	$35,316,044	$36,340,210	$37,394,076	$240,638,064
Net Benefit or (Cost)								
Low	($50,424,082)	($42,475,782)	($27,968,890)	($18,068,830)	($239,540)	$13,296,752	$26,826,876	($99,051,496)
Mid	$33,796,938	$43,785,238	$64,592,130	$77,012,191	$101,941,481	$118,897,773	$135,849,897	$575,875,648
High	$141,620,000	$153,648,300	$179,555,192	$194,495,252	$225,324,542	$245,700,834	$266,072,958	$1,406,417,079
Benefit or (Cost) per ton diverted								
Low	($37)	($31)	($19)	($13)	$0	$9	$18	($10)
Mid	$20	$26	$36	$43	$54	$63	$71	$45
High	$69	$75	$83	$90	$99	$108	$117	$92

30-Apr-93

Table 4-A.4 Cost-Benefit Analysis for Market Development Policies
Increased Diversion -- 80% Recycled Content in Corrugated and Paperboard

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	5,700,000	5,800,000	5,900,000	6,200,000	6,300,000	6,500,000	6,500,000	
Diversion resulting from Policy (tons)								
Low	1,995,000	2,030,000	2,065,000	2,170,000	2,205,000	2,275,000	2,275,000	15,015,000
Mid	2,850,000	2,900,000	2,950,000	3,100,000	3,150,000	3,250,000	3,250,000	21,450,000
High	3,705,000	3,770,000	3,835,000	4,030,000	4,095,000	4,225,000	4,225,000	27,885,000
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$25	$25	$25	$25	$25	$25	$25	
Mid	$55	$55	$55	$55	$55	$55	$55	
High	$65	$65	$65	$65	$65	$65	$65	
Value of Material Diverted -- $								
Low-Low	$49,875,000	$50,750,000	$51,625,000	$54,250,000	$55,125,000	$56,875,000	$56,875,000	$375,375,000
Mid-Mid	$156,750,000	$159,500,000	$162,250,000	$170,500,000	$173,250,000	$178,750,000	$178,750,000	$1,179,750,000
High-High	$240,825,000	$245,050,000	$249,275,000	$261,950,000	$266,175,000	$274,625,000	$274,625,000	$1,812,525,000
Costs								
Collection and Recycling Costs								
Cost per ton	$48	$48	$48	$48	$48	$48	$48	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	($31)	($37)	($44)	($51)	($59)	($68)	($77)	
Net Cost for colln./recy.								
Low	($60,847,500)	($74,095,000)	($89,827,500)	($109,585,000)	($128,992,500)	($153,562,500)	($174,037,500)	($790,947,500)
Mid	($86,925,000)	($105,850,000)	($128,325,000)	($156,550,000)	($184,275,000)	($219,375,000)	($248,625,000)	($1,129,925,000)
High	($113,002,500)	($137,605,000)	($166,822,500)	($203,515,000)	($239,557,500)	($285,187,500)	($323,212,500)	($1,468,902,500)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$23	$23	$22	$21	$21	$20	$20	
High	$36	$35	$34	$33	$32	$31	$31	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$462,021,431
High-Low	$71,080,220	$71,080,220	$71,080,220	$71,080,220	$71,080,220	$71,080,220	$71,080,220	$497,561,541
Job Impacts								
Jobs Created	3,420	3,480	3,540	3,720	3,780	3,900	3,900	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	4,788	4,872	4,956	5,208	5,292	5,460	5,460	
Multiplier Jobs Created	1,368	1,392	1,416	1,488	1,512	1,560	1,560	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$41,040,000	$42,971,040	$44,979,566	$48,637,395	$50,855,104	$53,991,169	$55,556,912	$338,031,186
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$343,636,364
High	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$687,272,727
Administrative Costs								
Public	$280,000	$288,120	$296,475	$305,073	$313,920	$323,024	$332,392	$2,139,005
Private	$31,500,000	$32,413,500	$33,353,492	$34,320,743	$35,316,044	$36,340,210	$37,394,076	$240,638,064
Net Benefit or (Cost)								
Low	$48,902,280	$64,034,200	$81,701,679	$106,766,359	$128,262,419	$156,685,215	$177,662,725	$764,015,076
Mid	$186,931,936	$209,616,356	$235,901,537	$275,056,518	$306,747,076	$349,449,873	$379,202,383	$1,942,907,686
High	$363,087,500	$392,924,420	$427,427,099	$479,476,579	$520,957,639	$577,140,435	$615,667,945	$3,376,681,617
Benefit or (Cost) per ton diverted								
Low	$25	$32	$40	$49	$58	$69	$78	$51
Mid	$66	$72	$80	$89	$97	$108	$117	$91
High	$98	$104	$111	$119	$127	$137	$146	$121

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Table 4-A.5 Cost-Benefit Analysis for Market Development Policies *Current Landfill Cost - 80% Recycled Content in Corrugated and Paperboard*								
	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	5,700,000	5,800,000	5,900,000	6,200,000	6,300,000	6,500,000	6,500,000	
Diversion resulting from Policy (tons)								
Low	1,360,000	1,360,000	1,440,000	1,440,000	1,520,000	1,520,000	1,520,000	10,160,000
Mid	1,700,000	1,700,000	1,800,000	1,800,000	1,900,000	1,900,000	1,900,000	12,700,000
High	2,040,000	2,040,000	2,160,000	2,160,000	2,280,000	2,280,000	2,280,000	15,240,000
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$25	$25	$25	$25	$25	$25	$25	
Mid	$55	$55	$55	$55	$55	$55	$55	
High	$65	$65	$65	$65	$65	$65	$65	
Value of Material Diverted -- $								
Low-Low	$34,000,000	$34,000,000	$36,000,000	$36,000,000	$38,000,000	$38,000,000	$38,000,000	$254,000,000
Mid-Mid	$93,500,000	$93,500,000	$99,000,000	$99,000,000	$104,500,000	$104,500,000	$104,500,000	$698,500,000
High-High	$132,600,000	$132,600,000	$140,400,000	$140,400,000	$148,200,000	$148,200,000	$148,200,000	$990,600,000
Costs								
Collection and Recycling Costs								
Cost per ton	$48	$48	$48	$48	$48	$48	$48	
Value of Avoided Land Disposal								
Per ton	$82	$83	$84	$85	$86	$88	$89	
Net collection and recycling costs	($35)	($36)	($37)	($38)	($39)	($41)	($42)	
Net Cost for colln./recy								
Low	($46,920,000)	($48,280,000)	($52,560,000)	($54,000,000)	($58,520,000)	($61,560,000)	($63,080,000)	($384,920,000)
Mid	($58,650,000)	($60,350,000)	($65,700,000)	($67,500,000)	($73,150,000)	($76,950,000)	($78,850,000)	($481,150,000)
High	($70,380,000)	($72,420,000)	($78,840,000)	($81,000,000)	($87,780,000)	($92,340,000)	($94,620,000)	($577,380,000)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$39	$39	$37	$37	$35	$35	$35	
High	$65	$65	$61	$61	$58	$58	$58	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$462,021,431
High-Low	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$88,004,082	$616,028,575
Job Impacts								
Jobs Created	2,040	2,040	2,160	2,160	2,280	2,280	2,280	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	2,856	2,856	3,024	3,024	3,192	3,192	3,192	
Multiplier Jobs Created	816	816	864	864	912	912	912	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$24,480,000	$25,189,920	$27,445,159	$28,241,088	$30,674,507	$31,564,088	$32,479,428	$200,074,148
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$66,003,062	$343,636,364
High	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$132,006,123	$687,272,727
Administrative Costs								
Public	$280,000	$288,120	$296,475	$305,073	$313,920	$323,024	$332,392	$2,139,005
Private	$31,500,000	$32,413,500	$33,353,492	$34,320,743	$35,316,044	$36,340,210	$37,394,076	$240,638,064
Net Benefit or (Cost)								
Low	($14,384,082)	($13,235,762)	($5,648,890)	($4,388,830)	$3,560,460	$6,456,752	$7,828,876	($19,811,498)
Mid	$78,846,938	$80,335,238	$92,492,130	$94,112,191	$106,691,481	$110,347,773	$112,099,897	$674,925,848
High	$195,680,000	$197,508,300	$213,035,192	$215,015,252	$231,024,542	$235,440,834	$237,572,958	$1,525,277,079
Benefit or (Cost) per ton diverted								
Low	($11)	($10)	($4)	($3)	$2	$4	$5	($2)
Mid	$46	$47	$51	$52	$56	$58	$59	$53
High	$96	$97	$99	$100	$101	$103	$104	$100

3-May-93

CHAPTER 5
30% RECYCLED CONTENT IN PRINTING AND WRITING PAPER

INTRODUCTION

This policy would require that printing and writing paper sold in the state have at least 30% recycled content. Californians consume approximately three and one-half million tons of printing and writing paper annually. By the end of the decade that figure should rise by an additional million tons to four and one-half million tons. Only a relatively small proportion, 20% to 25%, is actually produced in the state; the balance is imported. Thus, any policy which mandates recycled content in writing papers will have to address the impact on the California waste stream and regulation of consumption and procurement in order to be effective.

HIGHLIGHTS OF THE ANALYSIS

- *This policy results in a benefit of between $53 and $101 per ton diverted.*
- *Over the seven years of the analysis, the total benefit ranges from $136 million to $421 million.*
- *The policy will divert about 3 million tons of high grade paper, substantially less than is actually consumed in the state, and less than 1% towards AB 939 diversion requirements.*
- *The policy will result in the creation of almost 400 new jobs, at an annual benefit of $48,000 per job.*
- *The positive impact of this policy is driven by the high value of the paper that is diverted.*

WASTE GENERATION AND DIVERSION

While large volumes of mixed and office paper are consumed in the state, only a small amount is actually produced in California. Thus, the diversion impacts of this policy are limited. The policy would contribute only about 1% to overall diversion in the state.

Table 5.1. Waste Generation Data for Paper and Paperboard
Printing and Writing Paper

Tons of Waste	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SRRE	14,030,000	14,338,660	14,654,111	14,976,501	15,305,984	15,642,716	15,986,855	16,338,566	16,698,015	17,065,371	17,440,809
EPA/Franklin	8,540,400	8,728,289	8,920,311	9,116,558	9,317,122	9,522,099	9,731,585	9,945,680	10,164,485	10,388,104	10,616,642
Aggregate	11,285,200	11,533,474	11,787,211	12,046,529	12,311,553	12,582,407	12,859,220	13,142,123	13,431,250	13,726,737	14,028,726
Baseline Diversion	2,144,188	2,318,228	2,498,889	2,686,376	2,880,903	3,082,690	3,291,960	3,508,947	3,733,887	3,967,027	4,208,618
% Diversion	19%	20%	21%	22%	23%	25%	26%	27%	28%	29%	30%
Policy Diversion	0	0	0	0	400,000	400,000	400,000	500,000	500,000	500,000	500,000
Total Diversion	2,144,188	2,318,228	2,498,889	2,686,376	3,280,903	3,482,690	3,691,960	4,008,947	4,233,887	4,467,027	4,708,618
% Paper Diversion	19%	20%	21%	22%	27%	28%	29%	31%	32%	33%	34%
% AB 939 Diversion	5%	5%	5%	6%	7%	7%	7%	8%	8%	9%	9%

THE COST-BENEFIT MODEL

Based on the cost-benefit model, this policy results in a net benefit of between $53 and $101 per ton of paper diverted. Over the seven year period in the analysis, this is a benefit of between $136 million and $421 million. This benefit is driven by the high value of the material diverted, and in later years, the benefit resulting from recycling rather than landfilling.

Like the corrugated policy, the job impact is relatively high. Most of these jobs would be in collecting and processing paper, and are not counted as a benefit of the policy, but as a cost incorporated into the cost of collecting and recycling. The policy will result in almost 700 new jobs in the first year, with about 200 of those being indirect jobs.

Unlike most of the other policies, trading for the paper policy might not have a significant impact. If paper wholesalers were the group that was required to meet the standard, credits would be generated through purchasing greater amounts of recycled content paper. It would be difficult to determine whether the credits generated were from in-state or out-of-state. The policy might not result in significant trading anyway, as paper wholesalers would simply change what they buy to meet the requirement. This would increase purchases of recycled content paper, but would not have a significant impact on paper markets in the state.

Chart 5.2 ANNUAL BENEFIT OR (COST) PER TON FOR 30% R/C PRINTING & WRITING

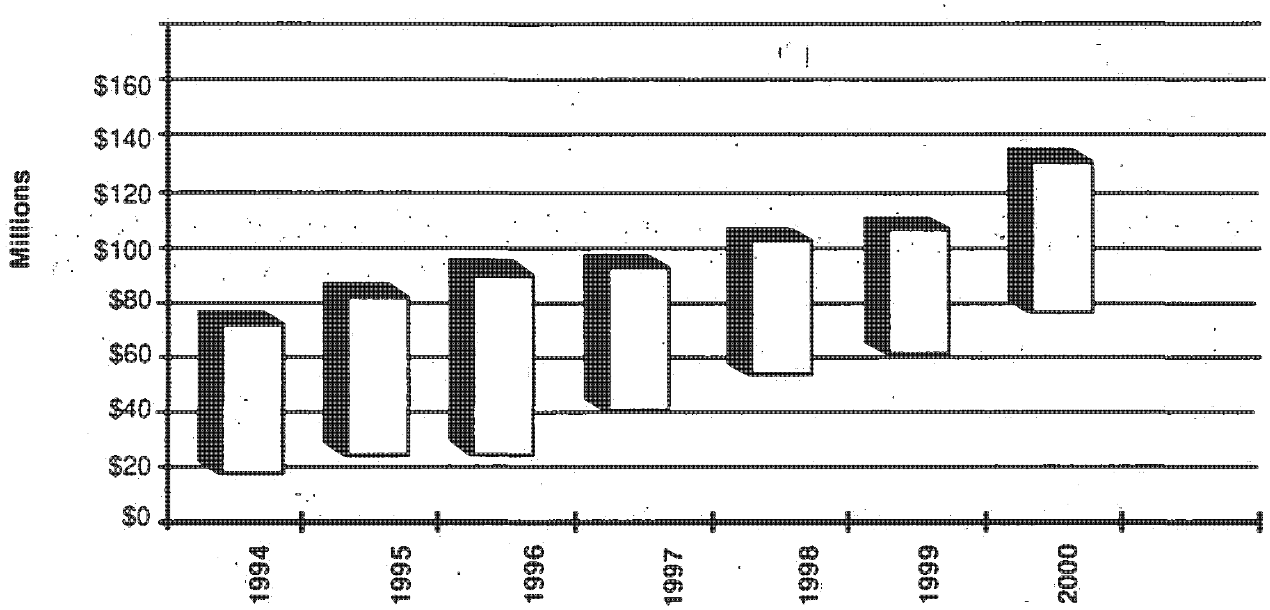

Table 5.2. Cost-Benefit Analysis for Market Development Policies
30% Recycled Content in Printing and Writing Paper

		1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion									
CA Consumption (tons)		3,900,000	4,000,000	4,100,000	4,300,000	4,400,000	4,600,000	4,500,000	
Diversion resulting from Policy (tons)									
	Low	320,000	320,000	320,000	400,000	400,000	400,000	400,000	2,560 C.
	Mid	400,000	400,000	400,000	500,000	500,000	500,000	500,000	3,200 C
	High	520,000	520,000	520,000	650,000	650,000	650,000	650,000	4,160 0.
Price and Value of Material									
Market Prices (paid by end-users $/ton)									
	Low	$80	$80	$80	$80	$80	$80	$80	
	Mid	$85	$85	$85	$85	$85	$85	$85	
	High	$90	$90	$90	$90	$90	$90	$90	
Value of Material Diverted -- $:									
	Low-Low	$25,600,000	$25,600,000	$25,600,000	$32,000,000	$32,000,000	$32,000,000	$32,000,000	$204,800,00
	Mid-Mid	$34,000,000	$34,000,000	$34,000,000	$42,500,000	$42,500,000	$42,500,000	$42,500,000	$272,000,00
	High-High	$46,800,000	$46,800,000	$46,800,000	$58,500,000	$58,500,000	$58,500,000	$58,500,000	$374,400,00
Costs									
Collection and Recycling Costs									
Cost per ton		$100	$100	$100	$100	$100	$100	$100	
Value of Avoided Land Disposal									
Per ton		$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs		$22	$16	$9	$2	($6)	($15)	($24)	
Net Cost for colln./recy.									
	Low	$7,040,000	$5,120,000	$2,880,000	$800,000	($2,400,000)	($6,000,000)	($9,600,000)	($2,160,00
	Mid	$8,800,000	$6,400,000	$3,600,000	$1,000,000	($3,000,000)	($7,500,000)	($12,000,000)	($2,700,00
	High	$11,440,000	$8,320,000	$4,680,000	$1,300,000	($3,900,000)	($9,750,000)	($15,600,000)	($3,510,00
Cost of Use by End-User $/ton									
	Low	$0	$0	$0	$0	$0	$0	$0	
	Mid	$33	$33	$33	$26	$26	$26	$26	
	High	$51	$51	$51	$41	$41	$41	$41	
Total addit. Cost to end-user									
	Low-High	$0	$0	$0	$0	$0	$0	$0	$0
	Mid-Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$92,404,286
	High-Low	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$113,728,352
Job Impacts									
Jobs Created		480	480	480	600	600	600	600	
CA Multiplier		1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created		672	672	672	840	840	840	840	
Multiplier Jobs Created		192	192	192	240	240	240	240	
Average Value of Jobs		$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created		$5,760,000	$5,927,040	$6,098,924	$7,844,741	$8,072,239	$8,306,334	$8,547,217	$50,556,49
Capital Investment									
Capital Investment by Industry									
	Low	$0	$0	$0	$0	$0	$0	$0	$0
	Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$68,727,27
	High	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$137,454,54
Administrative Costs									
	Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	$1,069,50
	Private	$875,000	$900,375	$926,486	$953,354	$981,001	$1,009,450	$1,038,724	$6,684,39
Net Benefit or (Cost)									
	Low	$7,058,093	$9,115,698	$11,497,293	$21,691,943	$25,087,370	$28,888,464	$32,695,390	$136,034,25
	Mid	$16,744,388	$19,281,993	$22,223,588	$35,038,238	$39,233,665	$43,934,759	$48,641,685	$225,098,31
	High	$40,105,000	$43,362,605	$47,144,201	$63,938,851	$69,334,277	$75,385,371	$81,442,297	$420,712,60
Benefit or (Cost) per ton diverted									
	Low	$22	$28	$36	$54	$63	$72	$82	$[illegible]
	Mid	$42	$48	$56	$70	$78	$88	$97	$[illegible]
	High	$77	$83	$91	$98	$107	$116	$125	$[illegible]

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SENSITIVITY ANALYSIS

We varied several components of the cost-benefit model to test their impact on the cost-effectiveness of this policy. Most of the variables modified here are the same as those modified for the corrugated policy. These results are illustrated in Table 5-3 and Chart 5-3, below.

Chart 5.3 RECYCLED CONTENT IN PRINTING AND WRITING PAPER

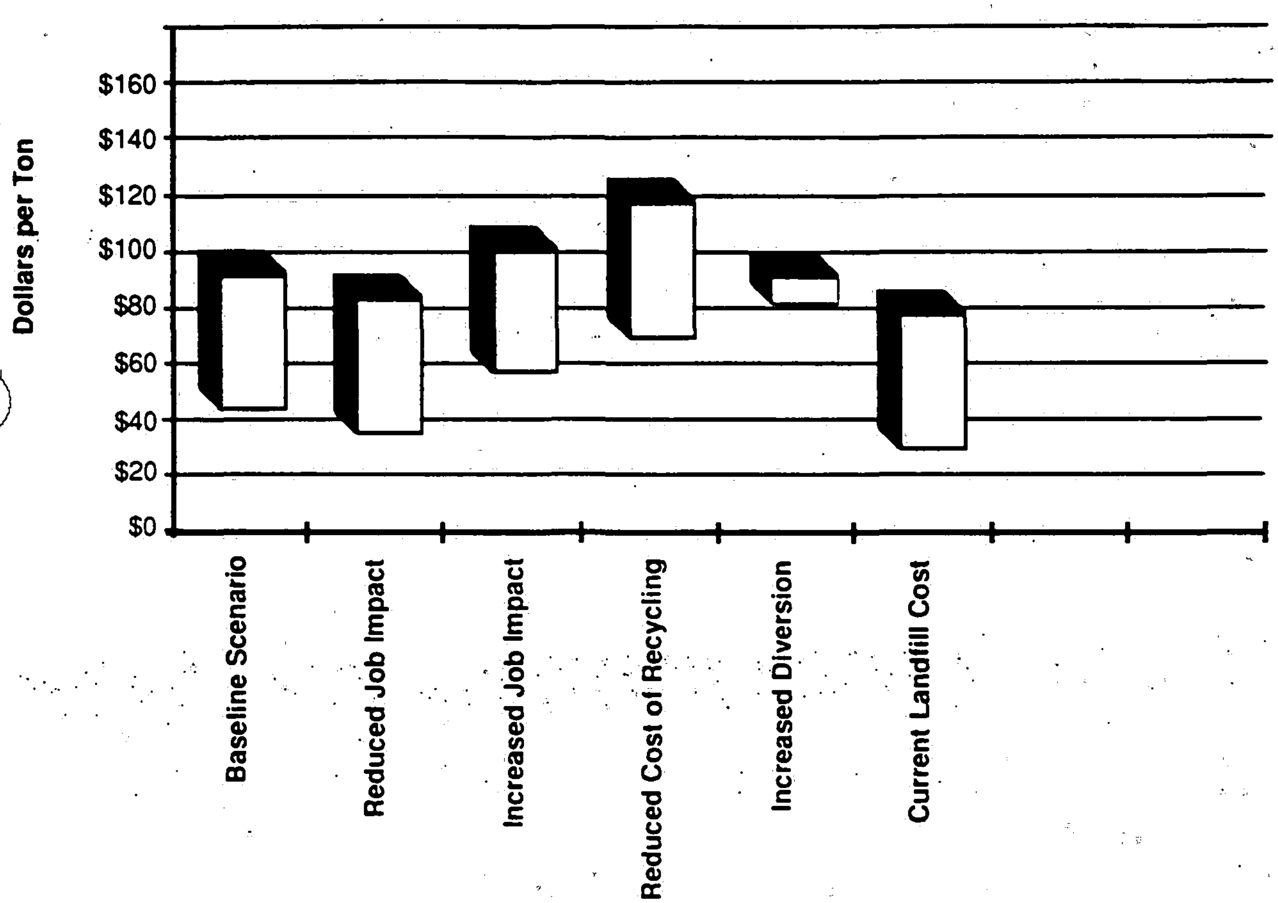

Table 5.3 30% Recycled Content in Printing and Writing Paper Sensitivity Analysis	Low	Mid	High
Baseline Scenario (Table 5.2)			
Total Net Benefit (Cost) (Million $)	$136	$225	$421
1996 Net Benefit (Cost) (Million $)	$11	$22	$47
Benefit (Cost) per ton ($/ton)	$53	$70	$101
Reduced Job Impact (Table 5-A.1)			
Total Net Benefit (Cost) (Million $)	$106	$196	$391
1996 Net Benefit (Cost) (Million $)	$8	$19	$44
Benefit (Cost) per ton ($/ton)	$42	$61	$94
Increased Job Impact (Table 5-A.2)			
Total Net Benefit (Cost) (Million $)	$161	$250	$446
1996 Net Benefit (Cost) (Million $)	$15	$25	$50
Benefit (Cost) per ton ($/ton)	$63	$78	$107
Reduced Cost of Recycling (Table 5-A.3)			
Total Net Benefit (Cost) (Million $)	$200	$305	$525
1996 Net Benefit (Cost) (Million $)	$19	$32	$60
Benefit (Cost) per ton ($/ton)	$78	$95	$126
Increased Diversion (Table 5-A.4)			
Total Net Benefit (Cost) (Million $)	$594	$1,100	$1,787
1996 Net Benefit (Cost) (Million $)	$73	$135	$223
Benefit (Cost) per ton ($/ton)	$100	$93	$100
Current Landfill Cost (Table 5-A.5)			
Total Net Benefit (Cost) (Million $)	$97	$176	$357
1996 Net Benefit (Cost) (Million $)	$9	$19	$44
Benefit (Cost) per ton ($/ton)	$38	$55	$86

Reduced Job Impact

As with the corrugated model, we used a more conservative figure for job creation of 2,000 tons per job. As expected, this reduces the benefit of the policy, although the impact is relatively small.

Increased Job Impact

Here, we used a multiplier of 1.6, rather than the more conservative 1.4. This increases the benefit of the policy, although, again, the change is relatively small.

Reduced Cost of Recycling

The baseline model uses a relatively high cost of recycling, $100 per ton. In this run, we assume that commercial paper collection programs may be more efficient than this, and use, instead, a cost of $70 per ton. This increase the per ton benefit of the policy by $20 to $30, and the overall benefit by about $100 million.

Increased Diversion

Like with corrugated, most printing and writing paper that is sold in the state is not produced here. Thus, the diversion impacts of this policy are relatively limited. Here, we assume that additional paper is diverted to nearby manufacturers out-of-state, or that additional facilities site in California. We use diversion estimates of 20%, 40%, and 60% of sales. The result, particularly at the lower use levels, is a large increase in the benefit of the policy.

Current Landfill Cost

When current, rather than new landfill costs are used in the analysis, the benefit of the policy is reduced. This impact is relatively small, however, and the policy still results in a net benefit at all levels.

DATA AND ASSUMPTIONS

WASTE GENERATION MODEL

Because it is difficult to separate quantity estimates for paper in the wastestream we present generation and diversion data for all paper. Annual growth in paper generation is 2.2%, based on Franklin/EPA. The SRRE data and Franklin/EPA figures for paper are quite different. SRRE data is based on waste characterizations, and Franklin data on paper consumption, which may account for some of the variability. The aggregate figure represents the average of the two estimates. Baseline diversion in 1990 is 19%. Diversion, without the policy, is expected to increase by 1% a year to 2000. This assumes increased paper recycling under AB 939.

COST-BENEFIT MODEL

California consumption of printing and writing paper is based on API (now AFPA) figures for US consumption, adjusted by GDP. Growth to 2000 is based on previous trends. California production figures are used to estimate diversion resulting from the policy. These figures are also based on previous trends and GDP in the paper industry. The mid-range figure is 80% of California production. The high figure is 130% of California production. This assumes that some California paper is shipped to manufacturers out-of-state for consumption. The James River Halsey plant is estimated to consume about 20% of California's mixed office paper. The low figure assumes 80% diversion, as a worst case scenario.

Market Prices

Market prices for sorted mixed office paper range from $80 to $90 per ton. While prices fluctuate throughout the year, the annual average has remained fairly consistent the last several years. Paper prices are based on the US Bureau of Labor Statistics' "Producer Price Index."

Costs

The cost of recycling is based on studies of curbside and commercial recycling programs. Most of these costs range from just over to just under $100 per ton. The end-user cost is based on the capital investment and the mid-range diversion figure. This represents the additional cost to plants in California that manufacture high grade paper to make recycled content printing and writing paper.

Job Impacts

Jobs in the paper industry are not expected to be impacted. It does not require additional employees to use secondary rather than virgin fibers. There may be some losses in the timber industry (many out-of-state), however this is likely to be more than compensated by increases in recycling jobs. The job increases in the model are based on a figure of 920 tons per collection and recycling job, the preliminary figure from our survey of California recycling programs.

Capital Investment

Capital investment in the California paper industry is projected to be about $290 million a year. This figures represent total paper industry investment. For the analysis we use the average investment that would be required by the three paper manufacturers in the state that produce writing paper. With trading, this policy could potentially require no new capital investment, the low figure. For the mid-range figure we assume that one-half of the investment in the industry is a result of the policy. This would mean that 50% of the in-state manufacturers change equipment to allow use of secondary fibers. The high figure represents 100% of the investment by the industry. This would be the no-trading scenario, in which all firms would be required to use secondary fibers.

Administration

There are between 200 and 250 paper wholesalers and major purchasers that would be regulated under this policy. This assumes that firms are regulated at the point of first sale in the state. We assume one person at 5% for each of these firms for private administration, and 2 state staff to implement.

INDUSTRY ASSESSMENT

Most writing papers are produced on high speed machinery which is both modern and relatively intolerant of contaminants. Those writing papers which now contain high recycled content are produced on equipment which was designed for smaller runs requiring more labor per ton of output. Consequently, the current price of high recycled-content writing paper places it at a competitive disadvantage to paper produced from virgin furnish. Recycled content policies which focus on writing papers will have to consider factors which may be beyond the immediate scope of ordinary market development for demand.

With the foregoing in view, we have recommended 30% recycled content as a regulatory mandate for writing papers with trading allowed across product types. Our goal is to both develop policies which succeed in diversion of materials from the wastestream in conformance with AB 939 mandates and provide the basis for the growth of California industry and the jobs that industry will provide.

A content mandate with trading will permit the industry to direct its recoveries to the most efficient end uses which may be grades other than writing papers. It will be necessary to develop definitions of "recycled content" to clarify the difference between pre- and post-consumer content. The industry now claims that it recovers 37%[1] of the paper wastestream while the most recent EPA estimates developed by Franklin Associates place the value closer to 25%.[2] The difference is principally the industry policy of counting "in-house" or "run-around" scrap in its recovery figures.

Instead of reducing the overall demand for writing papers, the emergence of the "electronic office" has actually increased the total demand for writing paper though shifting the mix of papers from thin forms stock and carbon-less copy stock to paper suitable for computer based printing systems. The industry believes that there will be a steady increase in demand for fine writing papers through the end of the century, but that the impact of recycling will require attention.

> The rapid emergence of recycling is a key development to watch, and its importance to printing and writing producers will increase. *It is not expected to have a major influence on printing and writing papers, from the standpoint of changing demand, i.e., either up or down* [emphasis added] . However, consumers are much more aware of the amount of waste generated by all forms of direct mail, magazines, office papers, etc. Thus, the industry needs to watch carefully for any major changes impacting demand by consumers. Concern for the environment and paper going to landfills is expected to be manifested in rising demand for recycled grades.[3]

SUMMARY

This policy results in a relatively high per ton benefit. However, the fact that most printing and writing paper is produced out-of-state limits the impact the policy will have on California markets. A more wholistic approach to paper recycled content, outlined below, might be more viable.

AN ALTERNATIVE APPROACH: ONE RECYCLED CONTENT POLICY FOR PAPER

Recycled content for paper products may be considered for the industry as a whole rather than on a product by product basis. Generally, any recovered paper fiber can be used as the furnish to some degree for any other paper grade. Some will work better than others to be sure, but factors of distance and availability enter the equation.

The members of the American Forest and Paper Association (AFPA) have set a goal of recovery of 40% of the paper wastestream by 1995. By their calculation, they are nearly there now, claiming 36.6%. However, since they include mill "run-around" scrap in their calculations, the post-consumer number is substantially smaller. Their own internal studies indicate that overall diversion in excess of 50% would not be cost efficient.

The industry does not want mandated recycled content standards at all, but is especially opposed to those set on a grade by grade basis. It believes that individual manufacturers can best utilize waste paper based on considerations of paper grade, transport distances, mill requirements, type and quality of scrap, etc. There is a recognition that the industry will have to do something to avoid something being done to it.

Perhaps the most effective long term approach would be trading in "wastepaper credits" installed as the mechanism to account for the variation in performance by each mill.

The Board in consultation with interested and affected parties could establish recycled content goals for the industry as a whole. Each mill or first importer into California would be accountable for the diversion of 50% of the tonnage of paper products produced or imported. Firms could trade among themselves to account for the differences in individual capabilities within the industry. At the end of the accounting period - quarter, half-year, or year - the firms would be required to submit a statement which identified the tonnage produced or imported, the wastepaper tonnage purchased out of the wastestream, a statement of transactions for wastepaper credits and the net. Firms which possessed an overage could keep them to either offset their own production for the next year or have available for trading during that year. Firms which were short would pay a fee for the shortage. The fee would be set by agreement to begin, but would escalate if preset goals for the industry are not achieved.

It is essential to consider drawing the industry itself into the decisions on how to best divert the wastepaper now going to landfill. They know that there will be some effort to regulate them; they have indicated that they are willing to participate. It would be best to use that to the benefit of all rather than simply regulate a set of percentages and hope they meet them.

ENDNOTES

1. *American Paper Institute.* ***Recovered Paper Statistical Highlights,*** *1991, page 2.*

2. *US Bureau of the Census.* ***Statistical Abstract of the United States: 1992,*** *Table 360, page 216.*

3. *Kenneth E. Lowe, editor of Pulp & Paper Forecaster quoted in Pulp & Paper, January, 1993, page 95.*

Chapter 5

APPENDICES

California FUTURES

Table 5-A.1 Cost-Benefit Analysis for Market Development Policies
Reduced Job Impact - 30% Recycled Content in Printing and Writing Paper

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	3,900,000	4,000,000	4,100,000	4,300,000	4,400,000	4,500,000	4,500,000	
Diversion resulting from Policy (tons)								
Low	320,000	320,000	320,000	400,000	400,000	400,000	400,000	2,560,000
Mid	400,000	400,000	400,000	500,000	500,000	500,000	500,000	3,200,000
High	520,000	520,000	520,000	650,000	650,000	650,000	650,000	4,160,000
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$80	$80	$80	$80	$80	$80	$80	
Mid	$85	$85	$85	$85	$85	$85	$85	
High	$90	$90	$90	$90	$90	$90	$90	
Value of Material Diverted -- $								
Low-Low	$25,600,000	$25,600,000	$25,600,000	$32,000,000	$32,000,000	$32,000,000	$32,000,000	$204,800,000
Mid-Mid	$34,000,000	$34,000,000	$34,000,000	$42,500,000	$42,500,000	$42,500,000	$42,500,000	$272,000,000
High-High	$46,800,000	$46,800,000	$46,800,000	$58,500,000	$58,500,000	$58,500,000	$58,500,000	$374,400,000
Costs								
Collection and Recycling Costs								
Cost per ton	$100	$100	$100	$100	$100	$100	$100	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	$22	$16	$9	$2	($6)	($15)	($24)	
Net Cost for colln./recy.								
Low	$7,040,000	$5,120,000	$2,880,000	$800,000	($2,400,000)	($6,000,000)	($9,600,000)	($2,160,000)
Mid	$8,800,000	$6,400,000	$3,600,000	$1,000,000	($3,000,000)	($7,500,000)	($12,000,000)	($2,700,000)
High	$11,440,000	$8,320,000	$4,680,000	$1,300,000	($3,900,000)	($9,750,000)	($15,600,000)	($3,510,000)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$33	$33	$33	$26	$26	$26	$26	
High	$51	$51	$51	$41	$41	$41	$41	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$92,404,286
High-Low	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$113,728,352
Job Impacts								
Jobs Created	200	200	200	250	250	250	250	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	280	280	280	350	350	350	350	
Multiplier Jobs Created	80	80	80	100	100	100	100	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$2,400,000	$2,469,600	$2,541,218	$3,268,642	$3,363,433	$3,460,972	$3,561,341	$21,065,206
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$68,727,273
High	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$137,454,545
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	$1,069,503
Private	$875,000	$900,375	$926,486	$953,364	$981,001	$1,009,450	$1,038,724	$6,684,391
Net Benefit or (Cost)								
Low	$3,698,093	$5,658,258	$7,939,587	$17,115,844	$20,378,564	$24,043,103	$27,709,513	$106,542,961
Mid	$13,384,388	$15,824,553	$18,665,882	$30,462,139	$34,524,859	$39,089,398	$43,655,808	$195,607,027
High	$36,745,000	$39,905,165	$43,586,495	$59,362,752	$64,625,471	$70,540,010	$76,456,420	$391,221,313
Benefit or (Cost) per ton diverted								
Low	$12	$18	$25	$43	$51	$60	$69	$42
Mid	$33	$40	$47	$61	$69	$78	$87	$61
High	$71	$77	$84	$91	$99	$109	$118	$94

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California FUTURES

Table 5A-2 Cost-Benefit Analysis for Market Development Policies
Increased Job Impact - 30% Recycled Content in Printing and Writing Paper

		1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion									
CA Consumption (tons)		3,900,000	4,000,000	4,100,000	4,300,000	4,400,000	4,500,000	4,500,000	
Diversion resulting from Policy (tons)									
	Low	320,000	320,000	320,000	400,000	400,000	400,000	400,000	2,560,000
	Mid	400,000	400,000	400,000	500,000	500,000	500,000	500,000	3,200,000
	High	520,000	520,000	520,000	650,000	650,000	650,000	650,000	4,160,000
Price and Value of Material									
Market Prices (paid by end-users $/ton)									
	Low	$80	$80	$80	$80	$80	$80	$80	
	Mid	$85	$85	$85	$85	$85	$85	$85	
	High	$90	$90	$90	$90	$90	$90	$90	
Value of Material Diverted -- $									
	Low-Low	$25,600,000	$25,600,000	$25,600,000	$32,000,000	$32,000,000	$32,000,000	$32,000,000	$204,800,000
	Mid-Mid	$34,000,000	$34,000,000	$34,000,000	$42,500,000	$42,500,000	$42,500,000	$42,500,000	$272,000,000
	High-High	$46,800,000	$46,800,000	$46,800,000	$58,500,000	$58,500,000	$58,500,000	$58,500,000	$374,400,000
Costs									
Collection and Recycling Costs									
Cost per ton		$100	$100	$100	$100	$100	$100	$100	
Value of Avoided Land Disposal									
Per ton		$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs		$22	$16	$9	$2	($6)	($15)	($24)	
Net Cost for colln./recy.									
	Low	$7,040,000	$5,120,000	$2,880,000	$800,000	($2,400,000)	($6,000,000)	($9,600,000)	($2,160,000)
	Mid	$8,800,000	$6,400,000	$3,600,000	$1,000,000	($3,000,000)	($7,500,000)	($12,000,000)	($2,700,000)
	High	$11,440,000	$8,320,000	$4,680,000	$1,300,000	($3,900,000)	($9,750,000)	($15,600,000)	($3,510,000)
Cost of Use by End-User $/ton									
	Low	$0	$0	$0	$0	$0	$0	$0	
	Mid	$33	$33	$33	$26	$26	$26	$26	
	High	$51	$51	$51	$41	$41	$41	$41	
Total addit. Cost to end-user									
	Low-High	$0	$0	$0	$0	$0	$0	$0	$0
	Mid-Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$92,404,286
	High-Low	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$113,728,352
Job Impacts									
Jobs Created		480	480	480	600	600	600	600	
CA Multiplier		1.6	1.6	1.6	1.6	1.6	1.6	1.6	
Total Jobs Created		768	768	768	960	960	960	960	
Multiplier Jobs Created		288	288	288	360	360	360	360	
Average Value of Jobs		$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created		$8,640,000	$8,890,560	$9,148,386	$11,767,112	$12,108,358	$12,459,500	$12,820,826	$75,834,742
Capital Investment									
Capital Investment by Industry									
	Low	$0	$0	$0	$0	$0	$0	$0	$0
	Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$68,727,273
	High	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$137,454,545
Administrative Costs									
	Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	$1,069,503
	Private	$875,000	$900,375	$926,486	$953,354	$981,001	$1,009,450	$1,038,724	$6,684,391
Net Benefit or (Cost)									
	Low	$9,938,093	$12,079,218	$14,546,755	$25,614,314	$29,123,489	$33,041,631	$36,968,998	$161,312,497
	Mid	$19,624,388	$22,245,513	$25,273,050	$38,960,609	$43,269,784	$48,087,926	$52,915,293	$250,376,563
	High	$42,985,000	$46,326,125	$50,193,663	$67,861,221	$73,370,397	$79,538,538	$85,715,906	$445,990,849
Benefit or (Cost) per ton diverted									
	Low	$31	$38	$45	$64	$73	$83	$92	$63
	Mid	$49	$56	$63	$78	$87	$96	$106	$78
	High	$83	$89	$97	$104	$113	$122	$132	$107

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Table 5-A.3 Cost-Benefit Analysis for Market Development Policies

Reduced Cost of Recycling - 30% Recycled Content in Printing and Writing Paper

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	3,900,000	4,000,000	4,100,000	4,300,000	4,400,000	4,500,000	4,500,000	
Diversion resulting from Policy (tons)								
Low	320,000	320,000	320,000	400,000	400,000	400,000	400,000	2,560,000
Mid	400,000	400,000	400,000	500,000	500,000	500,000	500,000	3,200,000
High	520,000	520,000	520,000	650,000	650,000	650,000	650,000	4,160,000
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$80	$80	$80	$80	$80	$80	$80	
Mid	$85	$85	$85	$85	$85	$85	$85	
High	$90	$90	$90	$90	$90	$90	$90	
Value of Material Diverted -- $								
Low-Low	$25,600,000	$25,600,000	$25,600,000	$32,000,000	$32,000,000	$32,000,000	$32,000,000	$204,800,000
Mid-Mid	$34,000,000	$34,000,000	$34,000,000	$42,500,000	$42,500,000	$42,500,000	$42,500,000	$272,000,000
High-High	$46,800,000	$46,800,000	$46,800,000	$58,500,000	$58,500,000	$58,500,000	$58,500,000	$374,400,000
Costs								
Collection and Recycling Costs								
Cost per ton	$75	$75	$75	$75	$75	$75	$75	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	($3)	($9)	($16)	($23)	($31)	($40)	($49)	
Net Cost for colln./recy.								
Low	($960,000)	($2,880,000)	($5,120,000)	($9,200,000)	($12,400,000)	($16,000,000)	($19,600,000)	($66,160,000)
Mid	($1,200,000)	($3,600,000)	($6,400,000)	($11,500,000)	($15,500,000)	($20,000,000)	($24,500,000)	($82,700,000)
High	($1,560,000)	($4,680,000)	($8,320,000)	($14,950,000)	($20,150,000)	($26,000,000)	($31,850,000)	($107,510,000)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$33	$33	$33	$26	$26	$26	$26	
High	$51	$51	$51	$41	$41	$41	$41	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$92,404,286
High-Low	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$113,728,352
Job Impacts								
Jobs Created	480	480	480	600	600	600	600	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	672	672	672	840	840	840	840	
Multiplier Jobs Created	192	192	192	240	240	240	240	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$5,760,000	$5,927,040	$6,098,924	$7,844,741	$8,072,239	$8,306,334	$8,547,217	$50,556,495
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$68,727,273
High	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$137,454,545
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	$1,069,503
Private	$875,000	$900,375	$926,486	$953,354	$981,001	$1,009,450	$1,038,724	$6,684,391
Net Benefit or (Cost)								
Low	$15,058,093	$17,115,698	$19,497,293	$31,691,943	$35,087,370	$38,888,464	$42,695,390	$200,034,250
Mid	$26,744,388	$29,281,993	$32,223,588	$47,538,238	$51,733,665	$56,434,759	$61,141,685	$305,098,316
High	$53,105,000	$56,362,605	$60,144,201	$80,188,851	$85,584,277	$91,635,371	$97,692,297	$524,712,602
Benefit or (Cost) per ton diverted								
Low	$47	$53	$61	$79	$88	$97	$107	$78
Mid	$67	$73	$81	$95	$103	$113	$122	$95
High	$102	$108	$116	$123	$132	$141	$150	$126

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Table 5-A.4 Cost-Benefit Analysis for Market Development Policies
Increased Diversion - 30% Recycled Content in Printing and Writing Paper

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	3,900,000	4,000,000	4,100,000	4,300,000	4,400,000	4,500,000	4,500,000	
Diversion resulting from Policy (tons)								
Low	780,000	800,000	820,000	860,000	880,000	900,000	900,000	5,940,000
Mid	1,560,000	1,600,000	1,640,000	1,720,000	1,760,000	1,800,000	1,800,000	11,880,000
High	2,340,000	2,400,000	2,460,000	2,580,000	2,640,000	2,700,000	2,700,000	17,820,000
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$80	$80	$80	$80	$80	$80	$80	
Mid	$85	$85	$85	$85	$85	$85	$85	
High	$90	$90	$90	$90	$90	$90	$90	
Value of Material Diverted -- $								
Low-Low	$62,400,000	$64,000,000	$65,600,000	$68,800,000	$70,400,000	$72,000,000	$72,000,000	$475,200,000
Mid-Mid	$132,600,000	$136,000,000	$139,400,000	$146,200,000	$149,600,000	$153,000,000	$153,000,000	$1,009,800,000
High-High	$210,600,000	$216,000,000	$221,400,000	$232,200,000	$237,600,000	$243,000,000	$243,000,000	$1,603,800,000
Costs								
Collection and Recycling Costs								
Cost per ton	$100	$100	$100	$100	$100	$100	$100	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	$22	$16	$9	$2	($6)	($15)	($24)	
Net Cost for colln./recy.								
Low	$17,160,000	$12,800,000	$7,380,000	$1,720,000	($5,280,000)	($13,500,000)	($21,600,000)	($1,320,000)
Mid	$34,320,000	$25,600,000	$14,760,000	$3,440,000	($10,560,000)	($27,000,000)	($43,200,000)	($2,640,000)
High	$51,480,000	$38,400,000	$22,140,000	$5,160,000	($15,840,000)	($40,500,000)	($64,800,000)	($3,960,000)
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$8	$8	$8	$8	$8	$7	$7	
High	$11	$11	$11	$10	$10	$10	$10	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$92,404,286
High-Low	$8,800,408	$8,800,408	$8,800,408	$8,800,408	$8,800,408	$8,800,408	$8,800,408	$61,602,857
Job Impacts								
Jobs Created	1872	1920	1968	2064	2112	2160	2160	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	2,621	2,688	2,755	2,890	2,957	3,024	3,024	
Multiplier Jobs Created	748.8	768	787	826	845	864	864	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$22,464,000	$23,708,160	$25,005,589	$26,985,910	$28,414,280	$29,902,801	$30,769,982	$187,250,722
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$68,727,273
High	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$137,454,545
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	$1,069,503
Private	$875,000	$900,375	$926,486	$953,354	$981,001	$1,009,450	$1,038,724	$6,684,391
Net Benefit or (Cost)								
Low	$57,888,592	$65,063,317	$73,350,457	$84,159,611	$94,155,911	$105,431,431	$114,364,654	$594,413,972
Mid	$106,528,388	$119,863,113	$135,370,253	$155,439,407	$174,235,708	$195,531,226	$212,564,450	$1,099,532,543
High	$180,569,000	$200,263,725	$223,190,865	$252,920,019	$280,716,319	$312,231,839	$337,365,062	$1,787,256,829
Benefit or (Cost) per ton diverted								
Low	$74	$81	$89	$98	$107	$117	$127	$100
Mid	$68	$75	$83	$90	$99	$109	$118	$93
High	$77	$83	$91	$98	$106	$116	$125	$100

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Table 5-A.5 Cost-Benefit Analysis for Market Development Policies
Current Landfill Cost - 30% Recycled Content in Printing and Writing Paper

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	3,900,000	4,000,000	4,100,000	4,300,000	4,400,000	4,500,000	4,500,000	
Diversion resulting from Policy (tons)								
Low	320,000	320,000	320,000	400,000	400,000	400,000	400,000	2,560,000
Mid	400,000	400,000	400,000	500,000	500,000	500,000	500,000	3,200,000
High	520,000	520,000	520,000	650,000	650,000	650,000	650,000	4,160,000
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$80	$80	$80	$80	$80	$80	$80	
Mid	$85	$85	$85	$85	$85	$85	$85	
High	$90	$90	$90	$90	$90	$90	$90	
Value of Material Diverted -- $								
Low-Low	$25,600,000	$25,600,000	$25,600,000	$32,000,000	$32,000,000	$32,000,000	$32,000,000	$204,800,000
Mid-Mid	$34,000,000	$34,000,000	$34,000,000	$42,500,000	$42,500,000	$42,500,000	$42,500,000	$272,000,000
High-High	$46,800,000	$46,800,000	$46,800,000	$58,500,000	$58,500,000	$58,500,000	$58,500,000	$374,400,000
Costs								
Collection and Recycling Costs								
Cost per ton	$100	$100	$100	$100	$100	$100	$100	
Value of Avoided Land Disposal								
Per ton	$82	$83	$84	$85	$86	$88	$89	
Net collection and recycling costs	$18	$17	$16	$15	$14	$12	$11	
Net Cost for colln./recy.								
Low	$5,760,000	$5,440,000	$5,120,000	$6,000,000	$5,600,000	$4,800,000	$4,400,000	$37,120,000
Mid	$7,200,000	$6,800,000	$6,400,000	$7,500,000	$7,000,000	$6,000,000	$5,500,000	$46,400,000
High	$9,360,000	$8,840,000	$8,320,000	$9,750,000	$9,100,000	$7,800,000	$7,150,000	$60,320,000
Cost of Use by End-User $/ton								
Low	$0	$0	$0	$0	$0	$0	$0	
Mid	$33	$33	$33	$26	$26	$26	$26	
High	$51	$51	$51	$41	$41	$41	$41	
Total addit. Cost to end-user								
Low-High	$0	$0	$0	$0	$0	$0	$0	$0
Mid-Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$92,404,286
High-Low	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$16,246,907	$113,728,352
Job Impacts								
Jobs Created	480	480	480	600	600	600	600	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	672	672	672	840	840	840	840	
Multiplier Jobs Created	192	192	192	240	240	240	240	
Average Value of Jobs	$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created	$5,760,000	$5,927,040	$6,098,924	$7,844,741	$8,072,239	$8,306,334	$8,547,217	$50,556,495
Capital Investment								
Capital Investment by Industry								
Low	$0	$0	$0	$0	$0	$0	$0	$0
Mid	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$13,200,612	$68,727,273
High	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$26,401,225	$137,454,545
Administrative Costs								
Public	$140,000	$144,060	$148,238	$152,537	$156,960	$161,512	$166,196	$1,069,503
Private	$875,000	$900,375	$926,486	$953,354	$981,001	$1,009,450	$1,038,724	$6,684,391
Net Benefit or (Cost)								
Low	$8,338,093	$8,795,698	$9,257,293	$16,491,943	$17,087,370	$18,088,464	$18,695,390	$96,754,250
Mid	$18,344,388	$18,881,993	$19,423,588	$28,538,238	$29,233,665	$30,434,759	$31,141,685	$175,998,316
High	$42,185,000	$42,842,605	$43,504,201	$55,488,851	$56,334,277	$57,835,371	$58,692,297	$356,882,602
Benefit or (Cost) per ton diverted								
Low	$26	$27	$29	$41	$43	$45	$47	$38
Mid	$46	$47	$49	$57	$58	$61	$62	$55
High	$81	$82	$84	$85	$87	$89	$90	$86

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CHAPTER 6
REQUIRE PUBLIC AGENCIES TO PURCHASE AT LEAST 80% MSW/YARD TRIMMING COMPOST OR MULCH

INTRODUCTION

Virtually every city and county in the state will be targeting some segment of their organic wastestream for composting in the next several years as they seek to achieve the 25% and 50% diversion goals mandated by AB 939. This movement towards composting is expected to create a compost glut. This policy was proposed as an option that could provide markets for at least a portion of the compost[1] that will be produced in the state.

State and local agencies such as Caltrans, the State Parks, local parks departments, and cities use compost, mulch, or other soil amendments for a variety of projects. This option would specify that at least 80% of that material be purchased from municipal or yard waste compost programs.

As discussed below, the extent to which this policy can ***technically*** consume substantial portions of compost, and the extent to which it can ***realistically*** consume compost are quite different.

HIGHLIGHTS OF THE ANALYSIS

- *The per ton benefit of this policy is highly dependent on the amount of compost utilized. At the low end, the policy results in a cost of $32 per ton, however, there is a net benefit of up to $26 per ton at higher use levels.* ***A potential fatal flaw of this option is that communities could escape it simply by discontinuing the use of compost - 80% of zero is zero.***
- *The overall benefit or (cost) of the policy over the seven year period ranges from a cost of $10 million to a benefit of $209 million.*
- *In order to comply with the AB 939 mandate, most communities will be composting, with or without this policy. The policy can, however, create markets for about 25% of the compost that may be produced at the mid-range use level.*
- *Production and application of compost will result in the creation of over 200 jobs. The annual benefit per job is an estimated $49,000.*
- *While the cost-benefit model results in a net benefit for this policy, it would require that public agencies purchase and apply compost at levels many times greater than they do currently.*

WASTE GENERATION MODEL

While it has been estimated that up to 80% of the municipal wastestream may be composted, it is unrealistic to assume that such a large portion of the wastestream will go to a relatively low value-added application. For this study, we assume that only yard waste, wood waste, and a portion of food and other paper waste are composted in significant quantities. Yard waste compost is relatively easy to produce, and has less potential contamination problems than mixed waste compost. While there may be some mixed waste compost facilities, we would expect that most municipal compost facilities in the state will be directed primarily towards yard waste. Targeting food waste from restaurants and supermarkets also provide low cost composting opportunities.[2]

Diversion of this compostable material in 1990 was at 9%. This policy may not directly impact the diversion of green waste, as most municipalities are planning facilities already to divert the wastestream. We assume that baseline diversion increases significantly, to 60% by 2000. If the maximum yard waste diversion is at 60%, it will contribute 12% toward the overall diversion requirement. 100% diversion of this fraction of the wastestream would contribute to 25% of the overall diversion. While this policy will not result in additional diversion to that already being planned under AB 939, it could potentially create markets for some of the material that is being composted. Using the mid-range estimate for potential public agency compost use, and assuming that there is a 50% reduction during compost production, this policy could create markets for up to 28% of the compost that is produced in the state. This is substantially more than the current estimated usage levels, which will only create markets for 2% of the compost produced in 1994.

THE COST-BENEFIT MODEL

The cost-benefit model shows net benefits for this policy at the mid and high usage levels. The benefits in this model are driven by the high volume of material and the net collection and recycling costs. Because the policy diverts a large portion of the wastestream at the mid and high usage levels, this option results in a relatively large benefit when costs of composting are less than landfilling. Another important benefit in the model is the value of the materials that the compost is replacing. The price figures for these materials, while appropriate at the current usage, will not be maintained if there is a compost glut. Such a supply of compost is likely to drive prices down toward zero.

Table 6.1. Waste Generation Data for Compostable Waste
(Yard Trimmings, Wood Waste and 25% of Food and Other Paper Waste)

Tons of Waste	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SRRE	11,344,000	11,536,848	11,732,974	11,932,435	12,135,286	12,341,586	12,551,393	12,764,767	12,981,768	13,202,458	13,426,900
Baseline Diversion	1,020,960	1,626,696	2,252,731	2,899,582	3,567,774	4,257,847	4,970,352	5,705,851	6,464,920	7,248,149	8,056,140
% Diversion	9%	14%	19%	24%	29%	35%	40%	45%	50%	55%	60%
Policy Diversion (mid)	0	0	0	0	1,016,000	1,033,272	1,050,838	1,068,702	1,086,870	1,105,347	1,124,137
Total Diversion	1,020,960	1,626,696	2,252,731	2,899,582	3,567,774	4,257,847	4,970,352	5,705,851	6,464,920	7,248,149	8,056,140
% of Market used	0%	0%	0%	0%	28%	24%	21%	19%	17%	15%	14%
% "Yard Waste" Div.	9%	14%	19%	24%	29%	35%	40%	45%	50%	55%	60%
% AB 939 Diversion	2%	4%	5%	6%	7%	9%	10%	11%	13%	14%	15%

At low compost uses, as occur currently, the policy results in a net loss of up to $2 million a year, or between $11 and $50 per ton of compost used. This occurs because the cost of administering such a program outweighs the benefits when only a small volume of material is used.

As the amount of compost used increases, the benefits resulting from the mid-range use of the material and avoided disposal increase, and results in a net benefit after the first year. The first year results in a cost because the avoided disposal cost is below the cost of collecting and composting yard waste. However, as the dispesal cost increases, the net benefit of the policy does also. After the first year, the annual benefit at this usage level ranges from $2.6 million to $25 million. This range again illustrates the importance of the avoided landfill cost in this model. The average per ton benefit over the seven year period in the model is $21.

The high usage estimate results in a net benefit in every year, although this also increases as the cost of avoided landfill increases. In this case, while the total benefit is several times greater than the at the mid-use level, the per ton benefit is only a few dollars more, $28 per ton.

Chart 6.2 ANNUAL BENEFIT OR (COST) PER TON FOR 80% COMPOST PROCUREMENT

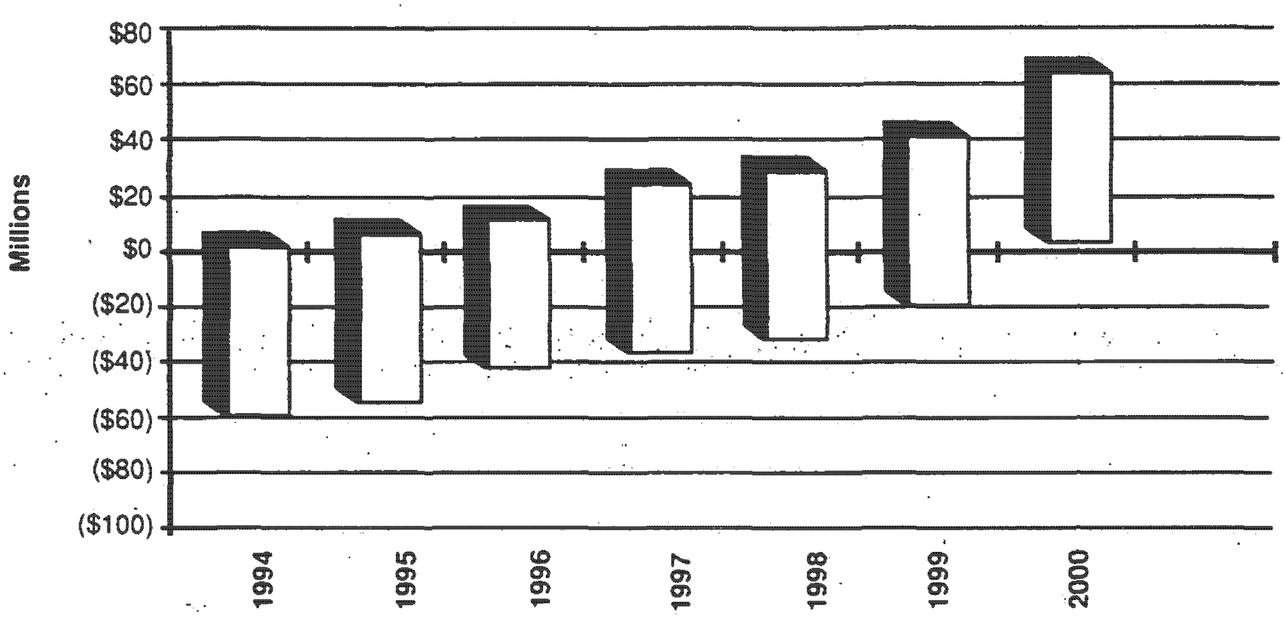

Table 6.2. Cost-Benefit Analysis for Market Development Policies
80% Procurement of Compost by Public Agencies

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
Estimated Compost Production (tons	1,783,887	2,128,924	2,485,176	2,852,925	3,232,460	3,624,075	4,028,070	20,135,517
Potential Public Agency Use (tons)								
Current Estimated Potential	40,000	40,680	41,372	42,075	42,790	43,516	44,257	294,692
Mid Range Potential	508,000	516,636	525,419	534,351	543,435	552,673	562,069	3,742,583
High Range Potential	1,016,000	1,033,272	1,050,838	1,068,702	1,086,870	1,105,347	1,124,137	7,485,165
Price and Value of Material								
Market Prices (of compost substitutes $/ton)								
Low	$5	$5	$5	$5	$5	$5	$5	
Mid	$7	$7	$7	$7	$7	$7	$7	
High	$10	$10	$10	$10	$10	$10	$10	
Value of Material Diverted -- $								
Current-Low	$200,000	$203,400	$206,858	$210,374	$213,951	$217,588	$221,287	$1,473,458
Mid-Mid	$3,556,000	$3,616,452	$3,677,932	$3,740,457	$3,804,044	$3,868,713	$3,934,481	$26,198,079
Full-High	$10,160,000	$10,332,720	$10,508,376	$10,687,019	$10,868,698	$11,053,466	$11,241,375	$74,851,653
Costs								
Collection and Composting Costs								
Cost per ton	$80	$80	$80	$80	$80	$80	$80	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and composting costs	$2	($4)	($11)	($18)	($26)	($35)	($44)	
Total Net Cost for collection and composting								
Low	$80,000	($162,720)	($455,087)	($757,348)	($1,112,544)	($1,523,115)	($1,947,325)	($5,878,139)
Mid	$1,016,000	($2,066,544)	($5,779,607)	($9,618,317)	($14,129,307)	($19,343,565)	($24,731,024)	($74,652,365)
High	$2,032,000	($4,133,088)	($11,559,214)	($19,236,634)	($28,258,615)	($38,687,130)	($49,462,049)	($149,304,729)
Cost of Use by Public Agencies $/ton (Application)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$6	$6	$6	$6	$6	$6	$6	
lit. Cost to end-user (total application cost)								
Low-High	$240,000	$244,080	$248,229	$252,449	$256,741	$261,105	$265,544	$1,768,149
Mid-Mid	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
High-Low	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
Job Impacts								
Jobs Created								
Production and Application of Compost								
Jobs at Current Application	15	15	16	16	16	16	17	
Jobs at Mid Application	191	194	197	200	204	207	211	
Jobs at High Application	381	387	394	401	408	415	422	
California Multiplier	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Multiplier Jobs - Current	3	3	3	3	3	3	3	
Multiplier Jobs- Mid	38	39	39	40	41	41	42	
Multiplier Jobs - High	76	77	79	80	82	83	84	
Average Value of Jobs	$25,000	$25,725	$26,471	$27,239	$28,029	$28,841	$29,678	
Net Value of Jobs Created								
Low	$75,000	$78,487	$82,136	$85,955	$89,951	$94,133	$98,510	$604,172
Mid	$952,500	$996,765	$1,043,128	$1,091,626	$1,142,379	$1,195,492	$1,251,074	$7,672,964
High	$1,905,000	$1,993,569	$2,086,256	$2,183,252	$2,284,758	$2,390,984	$2,502,148	$15,345,968
Capital Investment								
Capital Investment in Composting								Present Value
Low	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$24,990,576
Mid	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$99,962,305
High	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$174,934,034
Administrative Costs								
Public	$1,960,000	$2,038,400	$2,119,936	$2,204,733	$2,292,923	$2,384,640	$2,480,025	$15,480,657
Net Benefit or (Cost)								
Low	($2,005,000)	($1,637,673)	($1,624,084)	($1,403,508)	($1,133,218)	($810,909)	($478,448)	($9,293,038)
Mid	($499,500)	$2,574,637	$6,279,055	$10,108,262	$14,609,068	$19,812,437	$25,168,279	$76,072,439
High	$6,041,000	$12,354,433	$19,932,235	$27,764,767	$36,945,409	$47,536,247	$58,477,271	$209,051,363
Benefit or (Cost) per ton diverted								
Low	($50)	($45)	($39)	($33)	($26)	($19)	($11)	($32)
Mid	($1)	$5	$12	$19	$27	$36	$45	$21
High	$6	$12	$19	$26	$34	$43	$52	$28

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As described in the assumptions, below, the model assumes three levels of public agency compost use. The mid and high figures are substantially higher than the current estimated use level. Using compost at these levels would require considerable public effort to increase use of compost. While there appears to be potential to find public uses for this level of compost, it may be difficult and costly to achieve for practical purposes. A fairly significant cost category in the model, in fact, is the cost to public agencies to apply this level of compost.

Producing and applying large volumes of compost will result in a large number of jobs. While we did not have sufficient data to estimate job loss in this model, it is likely that some compost-related jobs will occur as transfers from one area within a local government to another. The table below summarizes the employment impact of this policy.

TABLE 6-3
JOB IMPACTS OF THE COMPOSTING POLICY -- 1994

	Low Level	Mid Level	High Level
New Direct Jobs	15	191	381
New Multiplier Jobs	3	38	76
Total New Jobs	18	229	457

While this policy results in a net gain at most levels, it requires large public expenditures to achieve this gain. Applying the one-half to one million tons of compost will cost about $1.5 to $3 million a year, and employ up to 300 workers. If public compost use was approached from the perspective of a public works program, rather than a maintenance program, this expenditure might be reasonable.

Capital investment in composting facilities covers a wide range. One mixed waste facility in Delaware is reported to cost over $77 million.[3] Compost facilities can be built for considerably less, especially for yard waste. State expenditures for land and equipment for compost facilities could reach between $25 million and $175 million before the year 2000. The level of investment will depend heavily on the type of facilities local governments choose to build.

TRADING VS. NON-TRADING

This policy includes provisions to allow for trading among agencies for compost use. The objective is to achieve the overall policy goal but allow enough flexibility so that agencies that have specific compost needs, such as botanical gardens, could meet the requirement by purchasing credits, rather than using municipal compost. Given that the current level of use of compost is so low, it is not realistic to assume that trading will occur, or that it is necessary to reduce costs of compliance with the program. The potential fatal flaw of this proposal is that public agencies could reduce the costs of compliance with this policy, simply by using less compost: 80% of zero is zero. The investment in composting facilities will occur with or without the policy, so that trading will not have an impact on the capital investment due to the policy, as it does with the other policies analyzed in this report.

SENSITIVITY ANALYSIS

We examined the impact of modifying segments of the model. While the size of the net benefit or cost varied, in most cases these changes did not change the general outcome -- the low volume use still resulted in a net cost, and the higher usage levels in net benefits. Table 6-4 and Chart 6-4 illustrate the results of this analysis. The full models are in the appendix to the chapter.

Chart 6.4 80% PROCUREMENT OF COMPOST BY PUBLIC AGENCIES

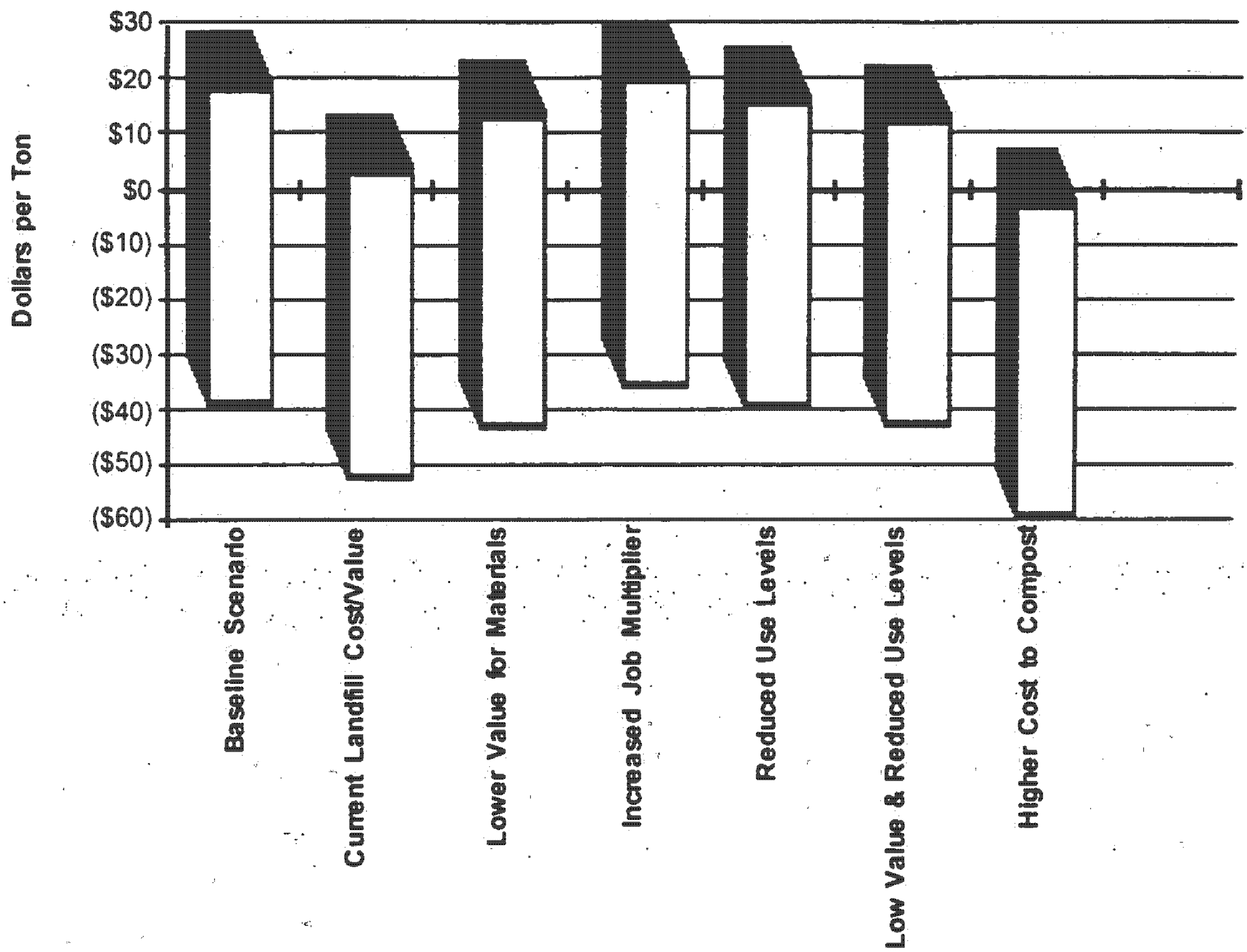

Table 6.4 80% Procurement of Compost by Public Agencies Sensitivity Analysis			
	Low Usage	Moderate Usage	High Usage
Baseline Analysis (Table 6.2)			
Total Net Benefit (Cost) (millions $)	($9)	$78	$209
1996 Net Benefit (Cost) (millions $)	($2)	$6	$20
Benefit (cost) per ton ($/ton)	($32)	$21	$28
Total tons diverted (tons)	295,000	3,743,000	7,485,000
Current Landfill Cost/Value (Table 6-A.1)			
Total Net Benefit (Cost) (millions $)	($14)	$24	$100
1996 Net Benefit (Cost) (millions $)	($2)	$3	$13
Benefit (cost) per ton ($/ton)	($46)	$6	$13
Total tons diverted (tons)	295,000	3,743,000	7,485,000
Lower Value for Materials (Table 6-A.2)			
Total Net Benefit (Cost) (millions $)	($10)	$67	$172
1996 Net Benefit (Cost) (millions $)	($2)	$5	$15
Benefit (cost) per ton ($/ton)	($35)	$18	$23
Total tons diverted (tons)	295,000	3,743,000	7,485,000
Increased Job Multiplier (Table 6-A.3)			
Total Net Benefit (Cost) (millions $)	($9)	$86	$224
1996 Net Benefit (Cost) (millions $)	($2)	$7	$22
Benefit (cost) per ton ($/ton)	($29)	$23	$30
Total tons diverted (tons)	295,000	3,743,000	7,485,000
Reduced Use Levels (Table 6-A.4)			
Total Net Benefit (Cost) (millions $)	($9)	$3	$95
1996 Net Benefit (Cost) (millions $)	($2)	($0.50)	$9
Benefit (cost) per ton ($/ton)	($32)	$4	$26
Total tons diverted (tons)	295,000	737,000	3,684,000
Low Value and Reduced Use Levels (Table 6-A.5)			
Total Net Benefit (Cost) (millions $)	($10)	$0.70	$77
1996 Net Benefit (Cost) (millions $)	($2)	($0.70)	$6
Benefit (cost) per ton ($/ton)	($35)	$1	$21
Total tons diverted (tons)	295,000	737,000	3,684,000
Higher Cost to Compost (Table 6-A.6)			
Total Net Benefit (Cost) (millions $)	($15)	$3	$59
1996 Net Benefit (Cost) (millions $)	($2)	($4)	($1)
Benefit (cost) per ton ($/ton)	($52)	$1	$8
Total tons diverted (tons)	295,000	737,000	3,684,000

Current Landfill Price

In this run we used a collection and landfill cost consistent with the statewide average in 1990, expressed in current dollars. Because this reduces the benefit of composting as compared to land disposal, this essentially reduces the benefit of the policy at all usage levels.

Lower Value for Materials

Here, we reduce the per ton prices of the materials. This is likely to occur as large supplies of organic materials reach the marketplace. While this change reduces the benefit of the policy at all levels, these changes are relatively minor.

Increased Multiplier

The baseline compost model uses a lower multiplier than the other models. This assumes that compost jobs are generally lower paying, and will create less general benefit to the economy. For this analysis we used the 1.4 multiplier that is used for the other policies. As expected, this change increases the benefit of the policy, although the impact is relatively small.

Reduced Use Levels

The baseline model assumes public agency compost use at much higher levels than currently. Here, we assume two lower usage levels, starting at 100,000 tons for the mid level and 500,000 tons for the high level. The impact, in this case, is a reduced benefit. At the new mid-usage level, the policy does not result in a net benefit until the fourth year. At the lower use levels, the policy results in a net cost until the difference between land disposal and composting becomes great enough to create a net benefit.

Low Value and Reduced Use Levels

This basically represents a worst-case scenario -- both reduced use and a lower value for the materials. As expected, the changes result in a reduced benefit. The mid-use level has an overall benefit of only $725,000, substantially less than the baseline analysis of $78 million.

Higher Cost to Compost

While the $80 per ton figure used in the baseline model for composting cost is conservative, we ran the model at $100 per ton to determine the impact. As expected, using a higher compost cost reduces the net benefit of the policy. The policy still results in an overall benefit at the mid and high levels, although the total benefit at the mid level is only $3 million, compared to $78 million for the baseline model.

DATA AND ASSUMPTIONS FOR THE MODELS

WASTE GENERATION DATA

For the analysis, we assume that all yard waste, all wood waste, 25% of the food waste, and 25% of other paper waste are potentially composted. Some additional portion of paper and other organics will most likely be composted, although this amount is probably insignificant compared to yard and wood waste. Only the Source Reduction and Recycling Element data is used in this case, as the Franklin data is not broken down into consistent categories. For example, in Franklin, wood waste is limited to wood packaging. In 1990, 9% of this organic waste stream was diverted from landfills. We assume in the model that, in order to meet AB 939 requirements, the amount diverted will increase by about 5 percentage points each year to a level of 60% by the year 2000. Given different assumptions about the level of diversion and the generation of organic materials, this number could be greater. While this analysis uses conservative figures, a higher number here, however, does not alter the cost-benefit model.

COST-BENEFIT MODEL

Consumption and Diversion

In this analysis, we assume that the entire supply of yard and wood waste and 25% of the food and other paper waste is composted. The weight of the material is reduced by half in the composting process, so that an 8 million ton reduction in waste going to the landfill results in a potential supply of 4 million tons of compost.

The diversion figures range from an estimate of the current usage by public agencies. The high estimate assumes that 10% of the potential is applied every year, and the mid-range assumes half that amount. Both these estimates are orders of magnitude greater than current use. These estimates are based on assumptions about local government use and extrapolation of Caltran's existing use of compost to the entire state.[4]

Market Price

Because the policy is intended to result in the use of MSW/Yard trimming compost in uses similar to those of other mulches, compost, or top soil blends, the market prices are the cost of these materials. Current prices, in cubic yards for compost, humus, topsoil, and mulch range from $15 to $29. A conversion factor of 1,000 lb. per cubic yard compost is applied to keep the figures in tons. Prices are also reduced by 33% to reflect lower costs to public agencies.[5]

Costs

Collection and composting costs in the literature cover a wide range. The National Solid Waste Compost Council survey found that collection and processing costs are between $30 and $70 per ton. Other cost evaluations have found costs ranging from almost nothing to over $100 per ton.[6] *A recent survey by the Institute for Local Self-Reliance (ILSR), reported in Resource Recycling, found a weighted average of almost $80 per ton for collection and processing of yard waste. Based on these studies, we used relatively a conservative estimate of $80 per ton for collecting and processing organic wastes.*

Cost of use by local agencies, or application costs, is based on information from Dan Pollack, of Caltrans. We make some assumptions about increased efficiency for the higher volume use that might occur.

Job Impacts

Jobs due to this policy are in three areas: jobs related to collecting yard waste, producing compost, and application of compost. We assume that a bulk yard waste compost production facility handling up to 200,000 tons per year of year waste requires 5 people to operate, and there would be about 75 employees per million tons of compost produced.[7] For application, we use a figure of 300 persons per million tons of compost applied. This figure is based on application for Caltrans by the California Conservation Corp. The multiplier, 1.2, is for miscellaneous repair service, and personal services.

Capital Investment

These figures cover a wide range, and reflect the variations in investment in composting facilities. The National Composting Council found capital costs ranging from $2,000 to $1 million for yard waste facilities.[8] An ILSR study[9] found capital costs ranging from $0 to $30 per ton. $5 and $30 per ton, multiplied by the amount of compost, are used as the low and high estimates. The mid-cost is based on the "average" facility in the NCC survey, of $44,000 for a 9,100 ton per year facility.

Administration

Administrative requirements are estimated at three state staff people to implement the program, and one 5% staff person from each of the approximately 500 local governments and state agencies that would be regulated.

ASSESSMENT OF IMPACTS OF THE COMPOSTING POLICY

PRODUCT SUBSTITUTION

Existing organic material producers have serious concerns about the impacts of large quantities of municipal compost entering the marketplace. While they generally would like to see an increase in the use of organic materials, they are fearful that increased municipal compost will result, instead, in increased substitution of their products. From a waste management perspective, this may result in no net change in disposal. Many materials currently used commercially are, or were once considered waste. If, for example, the market for bark is replaced by municipal compost, then the bark may, instead, end up in the landfill.[10] Private soil supply operators are concerned about the potential for competition from public composting programs.[11] This stresses the importance of finding new uses for municipal compost: 1) because it is necessary if all the compost that is produces is to be used, and 2) to avoid eliminating an already established organic product industry.

EQUITY AND UNINTENDED IMPACTS

The primary equity concerns of this policy relate to the impact on the organic products industry, discussed above. Because the policy would allow public agencies to trade compost credits, there should not be equity problems among public agencies. If trading was not allowed, it is conceivable that some special facilities, such as botanical gardens, would be hurt by the policy.

While the intent of the policy is to increase the use of compost by public agencies, it could actually result in less use. Because existing use in many agencies is already very low, it might be easier for these agencies to simply eliminate compost use, and avoid the policy altogether.

UNCERTAINTY

The greatest area of uncertainty relates to the level of current and potential compost use by public agencies. While it is clear that existing use is well below the potential, this policy does not guarantee that compost use will increase. This weakness, and some potential solutions are discussed below.

PRACTICAL AND POLITICAL FEASIBILITY

The primary concern relating to this policy is the practicality of applying up to 25 times more compost and mulch than current levels. In a climate where parks' budgets are being severely cut, heavy compost application is not realistic. While compost has benefits related to reducing weeds, reduced water consumption, erosion control, and increasing soil nutrients, it is a "luxury good" in parks. Thus, it is not realistic to assume that the mid and high levels of compost utilization will be achieved unless a public works compost application program is implemented.

A recent study by the Batelle Institute for the Composting Council estimates the existing and potential consumption of compost in the U.S.[12] These figures do not provide any estimates of the amount of consumption by public agencies. This number does not appear to be available. However, estimates of use by various public agencies in California and elsewhere can help to provide some idea of the potential market. The California Department of Food and Agriculture Fertilizing Materials Tonnage Reports for 1991 and the first half of 1992 report that 48,000 tons and 29,000 tons respectively, of commercial organic materials, including compost, manure, and sewage sludge were sold in the state. Our current estimate, 40,000 tons, is significantly lower than potential use, but is realistic given budget constraints among local and state agencies.

If compost was applied across the state at equivalent levels to those in the Caltrans project, and use by local agencies was set at 200 tons per year, potential compost use would be over 11 million tons, several times more than will be generated this year. This is consistent with a statement by a Caltrans official that their current use is "just a drop in the bucket" compared to the potential.[13] Maine's Department of Transportation, which has had an active compost procurement program for several years, applies between 70,000 and 150,000 cubic yards (35,000 to 75,000 tons) of compost and mulch annually.[14] Use of compost by other state agencies, such as Parks and Recreation, Forestry, and General Services is limited.

TABLE 6-5 POTENTIAL COMPOST DEMAND IN THE US AND CALIFORNIA (TONS)			
Segment	**US Demand**	**CA Demand**	**Current Use**
Landscaping	1,000,000	190,000	<20%
Delivered Topsoil	1,850,000	235,000	<5%
Bagged/Retail	4,000,000	523,500	80%
Landfill Final Cover	300,000	14,500	<5%
Mine Reclamation	100,00	20	<5%
Container Nurseries	450,000	208,500	<50%
Field Nurseries	2,000,000	282,500	<1%
Sod Preparation	10,000,000	393,000	<1%
Silviculture	52,000,000	2,633,000	<1%
Agriculture	447,500,000	10,615,000	<1%
Total	519,200,000	15,095,520	<2%

Source: "Compost: United States Supply and Demand Potential" Biomass and Bioenergy, Volume 3, 1992.

There are a number of reasons why public sector consumption of compost is low. The primary reason is lack of funds. Many state and local agencies, and parks in particular, are suffering from severe budget cuts. One county parks maintenance supervisor pointed out that they do not have enough staff to mow the lawn, let alone apply compost. To the extent that it can replace or substitute for other landscaping tasks, such as spraying for pesticides or watering, compost is valuable. However, the compost must be applied manually, at least until more equipment is available. Also, it is much easier to simply spray herbicides. In addition, the fact that many parks are moving towards low-water xeriscape does not bode well for public compost use. In many cases, parks departments are already producing and using small amounts of compost themselves with their green waste. There are some one-time uses by public agencies that may result in more extensive use of compost or mulch, such as new parks, golf courses, and reclamation. However, compost use in daily maintenance is very limited, and is not likely to reach a significant level.

As discussed above, this model may overstate the value of the material that composting is replacing. Another factor which may drive down the price is transportation. It is not cost effective to haul compost long distances. About 10 miles is the break-even distance for transporting compost.[15] Caltrans pays less than $8 per ton for the compost, but their cost is about $20 per ton when the transportation is included.[16] To reduce costs, compost should be used to the extent possible in applications near the source. Tradable credits may help facilitate this.

The analysis of this alternative does suggest some policies which could result in more high value uses of compost. These options should probably be explored before a policy such as this is implemented:

- Serious evaluation and application of compost in agriculture as a mulch, compost, or soil amendment. There is unanimous opinion among those in the composting field that agricultural uses represent the primary market for compost. Here, quality, consistency, and convincing farmers that it is safe, even beneficial to use compost are crucial. According to the Batelle study, the annual agricultural market in the U.S. for compost is 895 million cubic yards (446 million tons), and 21 million cubic yards (10.5 million tons) in California. These figures are based only on agricultural land within 50 miles of a major city.[17] Current production of compost in the US is estimated at less than 9 million tons a year. Appendix C examines agricultural compost market development in California.

- Use of compost for mine reclamation sites. This will not result in significant use statewide, but in some localized areas may represent a high demand.

- Mandated use of compost in new development projects. Permits for building and development could require that the developer use some percentage of MSW generated compost as a replacement for topsoil. Compost blended with topsoil is a viable and low cost alternative to 100% topsoil. While maintenance use of compost is limited, one-time application in new projects can provide a good market for compost. This policy could allow trading of compost credits.

SUMMARY

While this policy has a net benefit in the cost-benefit model, there are a number of problems the policy does not address that make it impractical. Unlike paper, compost is not a commodity that public agencies use in large amounts. Other uses of compost, such as agriculture, mine reclamation, and new developments represent greater potential markets. Policies that encourage or require compost use in these areas should be addressed before this policy is considered.

ENDNOTES

1. Note that compost is defined broadly for this analysis, to include mulch and other organic soil amendments.

2. Gautam Naik, "Small companies reap harvest from food composting." ***Wall Street Journal****, February 18, 1993.*

3. Adam Blackwell and Alicia Neering, "A database on composting facilities: a progress report." ***Resource Recycling*** *, December 1992, p.54-59.*

4. *Personal communications with Richard Paine, Landscape Architect and Dan Pollack., Maintenance Superintendent, District 3 Caltrans, February 1993, and "Progress Report: Evaluation of Compost Use on Freeway Roadsides," Caltrans, December 1992.*

5. *Hasties Sand & Gravel, February 1993.*

6. *Institute for Local Self Reliance (ILSR,)* ***Beyond 40%,: Record Setting Recycling and Composting Programs****, Washington DC 1991; The United States Conference of Mayors, The National Composting Program, promotional information; Solid Waste Composting Council, "SWCC Composting Facility Database: A progress report."* ***Quarterly Newsletter of the Solid Waste Composting Council****, October 1992; Adam Blackwell and Alicia Neering, "A database on composting facilities: a progress report."* ***Resource Recycling*** *, December 1992, p.54-59; Steve Apotheker, "The cost effectiveness of yard debris recovery."* ***Resource Recycling****, April 1993, p.26;*

7. *Mark Wilhelmie, Scott Hyponex, February 1993, and Kathy Kellogg Johnson, Kellogg Supply, February 1993 communication, Bill Schoenecker and Alex McConnell, "Composting yard waste under cover and over air.",* ***Biocycle*** *, January 1993, p.44-45.*

8. *The United States Conference of Mayors, The National Composting Program, promotional information; Solid Waste Composting Council, "SWCC Composting Facility Database: A progress report."* ***Quarterly Newsletter of the Solid Waste Composting Council****, October 1992; Adam Blackwell and Alicia Neering, "A database on composting facilities: a progress report."* ***Resource Recycling*** *, December 1992, p.54-59.*

9. *Institute for Local Self Reliance (ILSR,)* ***Beyond 40%,: Record Setting Recycling and Composting Programs****, Washington DC 1991.*

10. *Bark, until the 1970s, was considered a waste. This perception was changed, largely due to efforts by Kellogg Supply. Understanding the lessons learned with bark in making the transition from waste to product may help ease this transition for yard waste today.*

11. *Bob Lagrasse, National Bark and Soil Producers Association, February 1993; and Kathy Kellogg Johnson, Kellogg Supply, April 28, 1993.*

12. *Donald Slivka, Thomas McClure, Ann Buhr and Ron Albrecht, "Compost: United States Supply and Demand Potential,"* ***Biomass and Bioenergy*** *Vol 3 No. 3-4, 1992; other studies examining use of compost include: Ronald Alexander and Rod Tyler, "Using Compost Successfully,"* ***Lawn and Landscape Maintenance****, November 1992, p.23;* ***Biocycle****, "Special Report: Yard Waste Composting: The challenge of yard waste composting," September 1992, p 30, and Robert C. LaGasse, "Marketing organic soil products,"* ***Biocycle****, March 1992, p.30.*

13. *Personal communication with Dan Pollack, Caltrans, February 1993.*

14. *Personal communications with Jay Kilbourn, RCS/BFI and Clyde Walton, Maine Department of Transportation, February 1993.*

15. Personal communication with Steve Harriman, Sacramento County, California, February 1993.

16. Personal communication with Dan Pollack, February 1993.

17. Donald Slivka, Thomas McClure, Ann Buhr and Ron Albrecht, "Compost: United States Supply and Demand Potential," ***Biomass and Bioenergy*** *Vol 3 No. 3-4, 1992.*

Chapter 6

APPENDICES

California FUTURES

Table 6-A.1 Cost-Benefit Analysis for Market Development Policies

Current Landfill Price -- 80% Procurement of Compost by Public Agencies

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
Estimated Compost Production (tons	1,783,887	2,128,924	2,485,176	2,852,925	3,232,480	3,624,075	4,028,070	20,135,517
Potential Public Agency Use (tons)								
Current Estimated Potential	40,000	40,680	41,372	42,075	42,790	43,518	44,257	294,692
Mid Range Potential	508,000	516,636	525,419	534,351	543,435	552,673	562,069	3,742,583
High Range Potential	1,016,000	1,033,272	1,050,838	1,068,702	1,086,870	1,105,347	1,124,137	7,485,165
Price and Value of Material								
Market Prices (of compost substitutes $/ton)								
Low	$5	$5	$5	$5	$5	$5	$6	
Mid	$7	$7	$7	$7	$7	$7	$7	
High	$10	$10	$10	$10	$10	$10	$10	
Value of Material Diverted -- $								
Current-Low	$200,000	$203,400	$206,858	$210,374	$213,951	$217,588	$221,287	$1,473,458
Mid-Mid	$3,556,000	$3,616,452	$3,677,932	$3,740,457	$3,804,044	$3,868,713	$3,934,481	$26,198,079
Full-High	$10,160,000	$10,332,720	$10,508,376	$10,687,019	$10,868,698	$11,053,466	$11,241,375	$74,851,653
Costs								
Collection and Composting Costs								
Cost per ton	$80	$80	$80	$80	$80	$80	$80	
Value of Avoided Land Disposal								
Per ton	$82	$83	$84	$85	$86	$88	$89	
Net collection and composting costs	($2)	($3)	($4)	($5)	($6)	($8)	($9)	
Total Net Cost for collection and composting								
Low	($80,000)	($122,040)	($165,486)	($210,374)	($256,741)	($348,141)	($398,316)	($1,581,099)
Mid	($1,016,000)	($1,549,908)	($2,101,675)	($2,671,755)	($3,260,609)	($4,421,386)	($5,058,619)	($20,079,952)
High	($2,032,000)	($3,099,816)	($4,203,350)	($5,343,509)	($6,521,219)	($8,842,773)	($10,117,237)	($40,159,905)
Cost of Use by Public Agencies $/ton (Application)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$6	$6	$6	$6	$6	$6	$6	
Total addit. Cost to end-user (total application cost)								
Low-High	$240,000	$244,080	$248,229	$252,449	$256,741	$261,105	$265,544	$1,768,149
Mid-Mid	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
High-Low	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
Job Impacts								
Jobs Created								
Production and Application of Compost								
Jobs at Current Application	15	15	16	16	16	16	17	
Jobs at Mid Application	191	194	197	200	204	207	211	
Jobs at High Application	381	387	394	401	408	415	422	
California Multiplier	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Multiplier Jobs - Current	3	3	3	3	3	3	3	
Multiplier Jobs- Mid	38	39	39	40	41	41	42	
Multiplier Jobs - High	76	77	79	80	82	83	84	
Average Value of Jobs	$25,000	$25,725	$26,471	$27,239	$28,029	$28,841	$29,678	
Net Value of Jobs Created								
Low	$75,000	$78,487	$82,138	$85,955	$89,951	$94,133	$98,510	
Mid	$952,500	$998,765	$1,043,126	$1,091,626	$1,142,379	$1,195,492	$1,251,074	
High	$1,905,000	$1,993,569	$2,086,256	$2,183,252	$2,284,758	$2,390,984	$2,502,148	
Capital Investment								
Capital Investment in Composting								Present Value
Low	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$24,990,576
Mid	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$99,962,305
High	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$174,934,034
Administrative Costs								
Public	$1,960,000	$2,038,400	$2,119,936	$2,204,733	$2,292,923	$2,384,640	$2,480,025	$15,480,657
Net Benefit or (Cost)								
Low	($1,845,000)	($1,878,553)	($1,913,685)	($1,950,479)	($1,989,021)	($1,985,883)	($2,027,456)	($13,590,078)
Mid	$1,532,500	$2,058,201	$2,601,124	$3,161,700	$3,740,371	$4,890,256	$5,515,873	$23,500,027
High	$10,105,000	$11,321,161	$12,576,372	$13,871,643	$15,206,013	$17,691,889	$19,132,459	$99,906,538
Benefit (Cost) per ton diverted								
Low	($46)	($46)	($46)	($46)	($46)	($46)	($46)	($46)
Mid	$3	$4	$5	$6	$7	$9	$10	$6
High	$10	$11	$12	$13	$14	$16	$17	$13

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Table 6-A.2 Cost-Benefit Analysis for Market Development Policies
Lower Value for Materials -- 80% Procurement of Compost by Public Agencies

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
Estimated Compost Production (tons	1,783,887	2,128,924	2,485,176	2,852,925	3,232,460	3,624,075	4,028,070	20,135,517
Potential Public Agency Use (tons)								
Current Estimated Potential	40,000	40,680	41,372	42,075	42,790	43,518	44,257	294,692
Mid Range Potential	508,000	516,636	525,419	534,351	543,435	552,673	562,069	3,742,583
High Range Potential	1,016,000	1,033,272	1,050,838	1,068,702	1,086,870	1,105,347	1,124,137	7,485,165
Price and Value of Material								
Market Prices (of compost substitutes $/ton)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$5	$5	$5	$5	$5	$5	$5	
Value of Material Diverted -- $								
Current-Low	$80,000	$81,360	$82,743	$84,150	$85,580	$87,035	$88,515	$589,383
Mid-Mid	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
Full-High	$5,080,000	$5,166,360	$5,254,188	$5,343,509	$5,434,349	$5,526,733	$5,620,687	$37,425,827
Costs								
Collection and Composting Costs								
Cost per ton	$80	$80	$80	$80	$80	$80	$80	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and composting costs	$2	($4)	($11)	($18)	($26)	($35)	($44)	
Total Net Cost for collection and composting								
Low	$80,000	($162,720)	($455,087)	($757,348)	($1,112,544)	($1,523,115)	($1,947,325)	($5,878,139)
Mid	$1,016,000	($2,066,544)	($5,779,607)	($9,618,317)	($14,129,307)	($19,343,565)	($24,731,024)	($74,652,365)
High	$2,032,000	($4,133,088)	($11,559,214)	($19,236,634)	($28,256,615)	($38,687,130)	($49,462,049)	($149,304,729)
Cost of Use by Public Agencies $/ton (Application)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$6	$6	$6	$6	$6	$6	$6	
Total addit. Cost to end-user (total application cost)								
Low-High	$240,000	$244,080	$248,229	$252,449	$256,741	$261,105	$265,544	$1,768,149
Mid-Mid	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
High-Low	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
Job Impacts								
Jobs Created								
Production and Application of Compost								
Jobs at Current Application	15	15	16	16	16	16	17	
Jobs at Mid Application	191	194	197	200	204	207	211	
Jobs at High Application	381	387	394	401	408	415	422	
California Multiplier	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Multiplier Jobs - Current	3	3	3	3	3	3	3	
Multiplier Jobs- Mid	38	39	39	40	41	41	42	
Multiplier Jobs - High	76	77	79	80	82	83	84	
Average Value of Jobs	$25,000	$25,725	$26,471	$27,239	$28,029	$28,841	$29,678	
Net Value of Jobs Created								
Low	$75,000	$76,487	$82,136	$85,955	$89,951	$94,133	$98,510	$604,172
Mid	$952,500	$996,785	$1,043,128	$1,091,626	$1,142,379	$1,195,492	$1,251,074	$7,672,984
High	$1,905,000	$1,993,569	$2,086,256	$2,183,252	$2,284,758	$2,390,984	$2,502,148	$15,345,968
Capital Investment								
Capital Investment in Composting								Present Value
Low	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$24,990,576
Mid	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$99,962,305
High	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$174,934,034
Administrative Costs								
Public	$1,960,000	$2,038,400	$2,119,936	$2,204,733	$2,292,923	$2,384,840	$2,480,025	$15,480,657
Net Benefit or (Cost)								
Low	($2,125,000)	($1,959,913)	($1,748,199)	($1,529,730)	($1,261,588)	($941,461)	($611,220)	($10,177,112)
Mid	($2,023,500)	$1,024,929	$4,702,799	$8,505,210	$12,976,764	$18,154,417	$23,502,073	$66,844,691
High	$961,000	$7,188,073	$14,676,047	$22,421,256	$31,511,060	$42,009,514	$52,856,564	$171,625,536
Benefit or (Cost) per ton diverted								
Low	($53)	($46)	($42)	($36)	($29)	($22)	($14)	($35)
Mid	($4)	$2	$9	$16	$24	$33	$42	$18
High	$1	$7	$14	$21	$29	$38	$47	$23

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Table 6-A.3 Cost-Benefit Analysis for Market Development Policies
Increased Multiplier -- 80% Procurement of Compost by Public Agencies

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
Estimated Compost Production (tons	1,783,887	2,128,924	2,485,178	2,852,925	3,232,460	3,624,075	4,028,070	20,135,517
Potential Public Agency Use (tons)								
Current Estimated Potential	40,000	40,680	41,372	42,075	42,790	43,518	44,257	294,692
Mid Range Potential	508,000	516,636	525,419	534,351	543,435	552,673	562,069	3,742,583
High Range Potential	1,016,000	1,033,272	1,050,838	1,068,702	1,086,870	1,105,347	1,124,137	7,485,165
Price and Value of Material								
Market Prices (of compost substitutes $/ton)								
Low	$5	$5	$5	$5	$5	$5	$5	
Mid	$7	$7	$7	$7	$7	$7	$7	
High	$10	$10	$10	$10	$10	$10	$10	
Value of Material Diverted -- $								
Current-Low	$200,000	$203,400	$206,858	$210,374	$213,951	$217,588	$221,287	$1,473,458
Mid-Mid	$3,556,000	$3,616,452	$3,677,932	$3,740,457	$3,804,044	$3,868,713	$3,934,481	$26,198,079
Full-High	$10,160,000	$10,332,720	$10,508,376	$10,687,019	$10,868,698	$11,053,466	$11,241,375	$74,851,653
Costs								
Collection and Composting Costs								
Cost per ton	$80	$80	$80	$80	$80	$80	$80	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and composting costs	$2	($4)	($11)	($18)	($26)	($35)	($44)	
Total Net Cost for collection and composting								
Low	$60,000	($162,720)	($455,067)	($757,348)	($1,112,544)	($1,523,115)	($1,947,325)	($5,878,139)
Mid	$1,016,000	($2,066,544)	($5,779,607)	($9,618,317)	($14,129,307)	($19,343,565)	($24,731,024)	($74,652,365)
High	$2,032,000	($4,133,088)	($11,559,214)	($19,236,634)	($28,258,615)	($38,687,130)	($49,462,049)	($149,304,729)
Cost of Use by Public Agencies $/ton (Application)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$6	$6	$6	$6	$6	$6	$6	
Total addit. Cost to end-user (total application cost)								
Low-High	$240,000	$244,080	$248,229	$252,449	$256,741	$261,105	$265,544	$1,768,149
Mid-Mid	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
High-Low	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
Job Impacts								
Jobs Created								
Production and Application of Compost								
Jobs at Current Application	15	15	16	16	16	16	17	
Jobs at Mid Application	191	194	197	200	204	207	211	
Jobs at High Application	381	387	394	401	408	415	422	
California Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Multiplier Jobs - Current	6	6	6	6	6	7	7	
Multiplier Jobs- Mid	76	77	79	80	82	83	84	
Multiplier Jobs - High	152	155	158	160	163	166	169	
Average Value of Jobs	$25,000	$25,725	$26,471	$27,239	$28,029	$28,841	$29,678	
Net Value of Jobs Created								
Low	$150,000	$156,974	$164,272	$171,910	$179,902	$188,266	$197,020	$1,208,344
Mid	$1,905,000	$1,993,569	$2,086,256	$2,183,252	$2,284,758	$2,390,984	$2,502,148	$15,345,968
High	$3,810,000	$3,987,138	$4,172,512	$4,366,505	$4,569,517	$4,781,967	$5,004,295	$30,691,935
Capital Investment								
Capital Investment in Composting								Present Value
Low	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$24,990,576
Mid	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$99,962,305
High	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$174,934,034
Administrative Costs								
Public	$1,960,000	$2,038,400	$2,119,936	$2,204,733	$2,292,923	$2,384,640	$2,480,025	$15,480,657
Net Benefit or (Cost)								
Low	($1,930,000)	($1,759,366)	($1,541,948)	($1,317,551)	($1,043,267)	($716,775)	($379,938)	($8,688,666)
Mid	$453,000	$3,571,621	$7,322,164	$11,199,689	$15,751,448	$21,007,929	$26,439,353	$85,745,423
High	$7,946,000	$14,348,002	$22,018,491	$29,948,020	$39,230,167	$49,927,231	$60,979,419	$224,397,330
Benefit or (Cost) per ton diverted								
Low	($46)	($43)	($37)	($31)	($24)	($16)	($9)	($29)
Mid	$1	$7	$14	$21	$29	$38	$47	$23
High	$8	$14	$21	$28	$36	$45	$54	$30

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Table 6-A.4 Cost-Benefit Analysis for Market Development Policies

Reduced Use Levels -- 80% Procurement of Compost by Public Agencies

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
Estimated Compost Production (tons	1,783,887	2,128,924	2,485,176	2,852,925	3,232,460	3,624,075	4,028,070	20,135,517
Potential Public Agency Use (tons)								
Current Estimated Potential	40,000	40,680	41,372	42,075	42,790	43,518	44,257	294,692
Mid Range Potential	100,000	101,700	103,429	105,187	106,975	108,794	110,643	736,729
High Range Potential	500,000	508,500	517,145	525,936	534,877	543,970	553,217	3,683,644
Price and Value of Material								
Market Prices (of compost substitutes $/ton)								
Low	$5	$6	$5	$5	$5	$5	$6	
Mid	$7	$7	$7	$7	$7	$7	$7	
High	$10	$10	$10	$10	$10	$10	$10	
Value of Material Diverted -- $								
Current-Low	$200,000	$203,400	$206,858	$210,374	$213,951	$217,588	$221,287	$1,473,458
Mid-Mid	$700,000	$711,900	$724,002	$736,310	$748,828	$761,558	$774,504	$5,157,102
Full-High	$5,000,000	$5,085,000	$5,171,445	$5,259,360	$5,348,769	$5,439,698	$5,532,173	$36,836,444
Costs								
Collection and Composting Costs								
Cost per ton	$80	$80	$80	$80	$80	$80	$80	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and composting costs	$2	($4)	($11)	($18)	($26)	($35)	($44)	
Total Net Cost for collection and composting								
Low	$80,000	($162,720)	($455,087)	($757,348)	($1,112,544)	($1,523,115)	($1,947,325)	($5,878,139)
Mid	$200,000	($406,800)	($1,137,718)	($1,893,369)	($2,781,360)	($3,807,788)	($4,868,312)	($14,695,347)
High	$1,000,000	($2,034,000)	($5,688,590)	($9,466,847)	($13,906,799)	($19,038,942)	($24,341,559)	($73,476,737)
Cost of Use by Public Agencies $/ton (Application)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$6	$6	$6	$6	$6	$6	$6	
Total addit. Cost to end-user (total application cost)								
Low-High	$240,000	$244,080	$248,229	$252,449	$256,741	$261,105	$265,544	$1,768,149
Mid-Mid	$400,000	$406,800	$413,716	$420,749	$427,901	$435,176	$442,574	$2,946,915
High-Low	$1,000,000	$1,017,000	$1,034,289	$1,051,872	$1,069,754	$1,087,940	$1,106,435	$7,367,289
Job Impacts								
Jobs Created								
Production and Application of Compost								
Jobs at Current Application	15	15	16	16	16	16	17	
Jobs at Mid Application	38	38	39	39	40	41	41	
Jobs at High Application	188	191	194	197	201	204	207	
California Multiplier	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Multiplier Jobs - Current	3	3	3	3	3	3	3	
Multiplier Jobs- Mid	8	8	8	8	8	8	8	
Multiplier Jobs - High	38	38	39	39	40	41	41	
Average Value of Jobs	$25,000	$25,725	$26,471	$27,239	$28,029	$28,841	$29,678	
Net Value of Jobs Created								
Low	$75,000	$78,487	$82,136	$85,955	$89,951	$94,133	$98,510	$604,172
Mid	$187,500	$196,217	$205,340	$214,887	$224,878	$235,333	$246,274	$1,510,430
High	$937,500	$981,087	$1,026,701	$1,074,435	$1,124,389	$1,176,665	$1,231,372	$7,552,149
Capital Investment								
Capital Investment in Composting								Present Value
Low	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$24,990,576
Mid	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$99,962,305
High	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$174,934,034
Administrative Costs								
Public	$1,960,000	$2,038,400	$2,119,936	$2,204,733	$2,292,923	$2,384,640	$2,480,025	$15,480,657
Net Benefit or (Cost)								
Low	($2,005,000)	($1,837,873)	($1,624,084)	($1,403,506)	($1,133,218)	($810,909)	($478,448)	($9,293,038)
Mid	($1,672,500)	($1,130,283)	($466,591)	$219,085	$1,034,241	$1,984,864	$2,986,491	$2,935,307
High	$1,977,500	$5,044,687	$8,732,510	$12,544,037	$17,017,280	$22,182,726	$27,518,644	$95,017,384
Benefit or (Cost) per ton diverted								
Low	($50)	($45)	($39)	($33)	($26)	($19)	($11)	($32)
Mid	($17)	($11)	($5)	$2	$10	$18	$27	$4
High	$4	$10	$17	$24	$32	$41	$50	$26

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Table 6-A.5 Cost-Benefit Analysis for Market Development Policies

Low Value and Reduced Use Levels -- 80% Procurement of Compost by Public Agencies

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
Estimated Compost Production (tons	1,763,887	2,128,924	2,485,176	2,852,925	3,232,460	3,624,075	4,028,070	20,135,517
Potential Public Agency Use (tons)								
Current Estimated Potential	40,000	40,680	41,372	42,075	42,790	43,518	44,257	294,692
Mid Range Potential	100,000	101,700	103,429	105,187	106,975	108,794	110,643	736,729
High Range Potential	500,000	508,500	517,145	525,936	534,877	543,970	553,217	3,683,644
Price and Value of Material								
Market Prices (of compost substitutes $/ton)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$5	$5	$5	$5	$5	$5	$5	
Value of Material Diverted -- $								
Current-Low	$80,000	$81,360	$82,743	$84,150	$85,580	$87,035	$88,515	$589,383
Mid-Mid	$400,000	$406,800	$413,716	$420,749	$427,901	$435,176	$442,574	$2,946,915
Full-High	$2,500,000	$2,542,500	$2,585,723	$2,629,680	$2,674,384	$2,719,849	$2,766,086	$18,418,222
Costs								
Collection and Composting Costs								
Cost per ton	$80	$80	$80	$80	$80	$80	$80	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and composting costs	$2	($4)	($11)	($18)	($26)	($35)	($44)	
Total Net Cost for collection and composting								
Low	$80,000	($162,720)	($455,067)	($757,348)	($1,112,544)	($1,523,115)	($1,947,325)	($5,678,139)
Mid	$200,000	($406,800)	($1,137,716)	($1,893,369)	($2,781,360)	($3,807,788)	($4,868,312)	($14,695,347)
High	$1,000,000	($2,034,000)	($5,688,590)	($9,466,847)	($13,906,799)	($19,038,942)	($24,341,559)	($73,476,737)
Cost of Use by Public Agencies $/ton (Application)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$6	$6	$6	$6	$6	$6	$6	
Total addit. Cost to end-user (total application cost)								
Low-High	$240,000	$244,080	$248,229	$252,449	$256,741	$261,105	$265,544	$1,768,149
Mid-Mid	$400,000	$406,800	$413,716	$420,749	$427,901	$435,176	$442,574	$2,946,915
High-Low	$1,000,000	$1,017,000	$1,034,289	$1,051,872	$1,069,754	$1,087,940	$1,106,435	$7,367,289
Job Impacts								
Jobs Created								
Production and Application of Compost								
Jobs at Current Application	15	15	16	16	16	16	17	
Jobs at Mid Application	38	38	39	39	40	41	41	
Jobs at High Application	188	191	194	197	201	204	207	
California Multiplier	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Multiplier Jobs - Current	3	3	3	3	3	3	3	
Multiplier Jobs- Mid	8	8	8	8	8	8	8	
Multiplier Jobs - High	38	38	39	39	40	41	41	
Average Value of Jobs	$25,000	$25,725	$26,471	$27,239	$28,029	$28,841	$29,678	
Net Value of Jobs Created								
Low	$75,000	$78,487	$82,136	$85,955	$89,951	$94,133	$98,510	$604,172
Mid	$187,500	$196,217	$205,340	$214,887	$224,878	$235,333	$246,274	$1,510,430
High	$937,500	$981,087	$1,026,701	$1,074,435	$1,124,389	$1,176,665	$1,231,372	$7,552,149
Capital Investment								
Capital Investment in Composting								Present Value
Low	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$24,990,576
Mid	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$99,962,305
High	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$174,934,034
Administrative Costs								
Public	$1,960,000	$2,038,400	$2,119,936	$2,204,733	$2,292,923	$2,384,640	$2,480,025	$15,480,657
Net Benefit or (Cost)								
Low	($2,125,000)	($1,959,913)	($1,746,199)	($1,529,730)	($1,261,568)	($941,461)	($611,220)	($10,177,112)
Mid	($1,972,500)	($1,435,383)	($776,876)	($96,477)	$713,315	$1,658,482	$2,634,561	$725,120
High	($522,500)	$2,502,187	$6,146,768	$9,914,357	$14,342,895	$19,482,877	$24,752,558	$76,599,182
Benefit or (Cost) per ton diverted								
Low	($53)	($48)	($42)	($36)	($29)	($22)	($14)	($35)
Mid	($20)	($14)	($8)	($1)	$7	$15	$24	$1
High	($1)	$5	$12	$19	$27	$36	$45	$21

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Table 6-A.6 Cost-Benefit Analysis for Market Development Policies
Higher Cost to Compost -- 80% Procurement of Compost by Public Agencies

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
Estimated Compost Production (tons	1,783,887	2,128,924	2,485,176	2,852,925	3,232,460	3,624,075	4,028,070	20,135,517
Potential Public Agency Use (tons)								
Current Estimated Potential	40,000	40,680	41,372	42,075	42,790	43,518	44,257	294,692
Mid Range Potential	508,000	516,636	525,419	534,351	543,435	552,673	562,069	3,742,583
High Range Potential	1,016,000	1,033,272	1,050,838	1,068,702	1,086,870	1,105,347	1,124,137	7,485,165
Price and Value of Material								
Market Prices (of compost substitutes $/ton)								
Low	$5	$5	$5	$5	$5	$5	$5	
Mid	$7	$7	$7	$7	$7	$7	$7	
High	$10	$10	$10	$10	$10	$10	$10	
Value of Material Diverted -- $								
Current-Low	$200,000	$203,400	$206,858	$210,374	$213,951	$217,588	$221,287	$1,473,458
Mid-Mid	$3,556,000	$3,616,452	$3,677,932	$3,740,457	$3,804,044	$3,868,713	$3,934,481	$26,198,079
Full-High	$10,160,000	$10,332,720	$10,508,376	$10,687,019	$10,868,698	$11,053,466	$11,241,375	$74,851,653
Costs								
Collection and Composting Costs								
Cost per ton	$100	$100	$100	$100	$100	$100	$100	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and composting costs	$22	$16	$9	$2	($6)	($15)	($24)	
Total Net Cost for collection and composting								
Low	$880,000	$650,880	$372,344	$84,150	($256,741)	($652,764)	($1,062,177)	$15,692
Mid	$11,176,000	$8,266,176	$4,728,769	$1,068,702	($3,260,609)	($8,290,099)	($13,489,650)	$199,289
High	$22,352,000	$16,532,352	$9,457,539	$2,137,404	($6,521,219)	($16,580,199)	($26,979,299)	$398,577
Cost of Use by Public Agencies $/ton (Application)								
Low	$2	$2	$2	$2	$2	$2	$2	
Mid	$4	$4	$4	$4	$4	$4	$4	
High	$6	$6	$6	$6	$6	$6	$6	
Total addit Cost to end-user (total application cost)								
Low-High	$240,000	$244,080	$248,229	$252,449	$256,741	$261,105	$265,544	$1,768,149
Mid-Mid	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
High-Low	$2,032,000	$2,066,544	$2,101,675	$2,137,404	$2,173,740	$2,210,693	$2,248,275	$14,970,331
Job Impacts								
Jobs Created								
Production and Application of Compost								
Jobs at Current Application	15	15	16	16	16	16	17	
Jobs at Mid Application	191	194	197	200	204	207	211	
Jobs at High Application	381	387	394	401	408	415	422	
California Multiplier	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Multiplier Jobs - Current	3	3	3	3	3	3	3	
Multiplier Jobs- Mid	38	39	39	40	41	41	42	
Multiplier Jobs - High	76	77	79	80	82	83	84	
Average Value of Jobs	$25,000	$25,725	$26,471	$27,239	$28,029	$28,841	$29,678	
Net Value of Jobs Created								
Low	$75,000	$78,487	$82,136	$85,955	$89,951	$94,133	$98,510	$604,172
Mid	$952,500	$996,785	$1,043,128	$1,091,626	$1,142,379	$1,195,492	$1,251,074	$7,672,984
High	$1,905,000	$1,993,569	$2,086,256	$2,183,252	$2,284,758	$2,390,984	$2,502,148	$15,345,968
Capital Investment								
Capital Investment in Composting								Present Value
Low	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$4,800,000	$24,990,576
Mid	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$19,200,000	$99,962,305
High	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$33,600,000	$174,934,034
Administrative Costs								
Public	$1,960,000	$2,038,400	$2,119,936	$2,204,733	$2,292,923	$2,384,640	$2,480,025	$15,480,657
Net Benefit or (Cost)								
Low	($2,605,000)	($2,651,473)	($2,451,516)	($2,245,003)	($1,969,021)	($1,681,260)	($1,363,596)	($15,166,869)
Mid	($10,659,500)	($7,757,663)	($4,229,321)	($578,756)	$3,740,371	$8,758,971	$13,946,904	$3,220,766
High	($14,279,000)	($8,311,007)	($1,084,517)	$6,390,730	$15,208,013	$25,429,315	$35,994,522	$59,348,056
Benefit or (Cost) per ton diverted								
Low	($70)	($65)	($59)	($53)	($46)	($39)	($31)	($52)
Mid	($21)	($15)	($8)	($1)	$7	$16	$25	$1
High	($14)	($8)	($1)	$6	$14	$23	$32	$8

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CHAPTER 7
40% RECYCLED CONTENT IN PLASTIC INDUSTRIAL CONTAINERS (PAILS, CRATES, DRUMS, CASES, AND PALLETS) WITH AND WITHOUT TRADING CREDITS

INTRODUCTION

Under this policy, plastic industrial containers such as pails, crates, drums, cases, and pallets sold in California would be required to contain at least 40% recycled content. Because most of these containers are made of HDPE, the policy would develop markets for HDPE milk jugs and other containers collected in the state. These containers are being collected in increasing numbers, but markets are scarce. This policy could provide markets for up to 26% of the HDPE generated in the state. Even at the lowest level, the policy would provide markets for 13% of the HDPE generated, three times more than is currently collected.[1]

The existing level of enthusiasm for and use of secondary materials in plastic containers varies widely among firms.[2] Some firms have invested in equipment and technology that allows them to use high levels of post-consumer plastic. In many cases, the use of customer regrind -- old milk crates from dairies, for example -- is standard procedure, and allows even higher levels of "post-consumer" plastic. One Florida firm invested in equipment to allow them to use secondary plastics in their chlorine bottles and nursery containers in the 1970's when the energy crisis eliminated supplies of some plastic resins. Other manufacturers do not or cannot use post-consumer HDPE, citing FDA regulations, performance of packaging, and cleanliness as reasons.

HIGHLIGHTS OF THE ANALYSIS

- *This policy results in a cost per ton of between $733 and $951 per ton diverted. This high cost is primarily due to the cost of recycling plastic.*
- *The total net cost of the policy over the seven years of the analysis ranges from $527 million to $609 million.*
- *The diversion impacts of this policy are minimal, contributing to only a tenth of a percent of AB 939 diversion. However, the policy will create markets for much of the HDPE that is collected at curbside.*
- *While it will create over 1,000 collection and processing jobs, because of the net cost to the state, the policy will result about 75 new jobs net. The annual cost per job is extremely high -- over $1 million.*
- *If the cost of recycling plastic could be reduced from its current high levels to about $200 per ton, this policy would result in a net benefit rather than a net cost.*

WASTE GENERATION AND DIVERSION

Table 7-1 provides estimates of generation and diversion of HDPE containers through 2000. HDPE containers are only 0.6% by weight of California's wastestream. Thus, policies that are directed at HDPE will not have a significant impact on diversion. If HDPE diversion increases to 15%, as assumed, 27,440 tons will be diverted in 2000. Assuming that the HDPE diverted by the policy is in addition to that already being diverted (a best-case scenario), a total of 66,319 tons of HDPE will be diverted in 2000, 26% of the HDPE and 0.15% of the total wastestream.

Table7.1. Waste Generation Data for Plastic Containers (non PET)

Tons of Waste	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SRRE	279,000	276,210	273,448	270,713	268,006	265,326	262,673	260,046	257,446	254,871	252,323
EPA/Franklin	290,400	287,496	284,621	281,775	278,957	276,168	273,406	270,672	267,965	265,285	262,633
Aggregate	284,700	281,853	279,034	276,244	273,482	270,747	268,039	265,359	262,705	260,078	257,478
Baseline Diversion	11,673	14,656	17,579	20,442	23,246	25,992	28,680	31,312	33,889	36,411	38,879
% Diversion	4%	5%	6%	7%	9%	10%	11%	12%	13%	14%	15%
Policy Diversion	0	0	0	0	18,284	19,564	20,934	22,399	23,967	25,645	27,440
Total Diversion	11,673	14,656	17,579	20,442	41,530	45,556	49,614	53,711	57,856	62,056	66,319
% HDPE Diversion	4%	5%	6%	7%	15%	17%	19%	20%	22%	24%	26%
% Total Diversion	0.03%	0.03%	0.04%	0.04%	0.09%	0.09%	0.10%	0.11%	0.11%	0.12%	0.12%

THE COST-BENEFIT MODEL

The results of the cost-benefit model for this policy show a net cost of between $69 million and $95 million annually between 1994 and 2000. The total cost in that seven year period ranges from $527 million to $609 million. Based on the tonnage, this represents a cost of between $733 and $951 per ton of HDPE diverted. The cost of the policy is primarily due to the high cost of collecting and recycling HDPE. The cost, $750 per ton, far outweighs any of the benefits accrued through the value of the material or new jobs and economic activity. The cost of recycling also is far greater than the avoided land disposal cost of $78 to $124 per ton. This cost does not take into account the full environmental cost of landfilling. However, even the most ambitious estimates of environmental costs come nowhere near $750 per ton.[3]

Chart 7.2 ANNUAL BENEFIT OR (COST) PER TON: 40% R/C INDUSTRIAL CONTAINERS

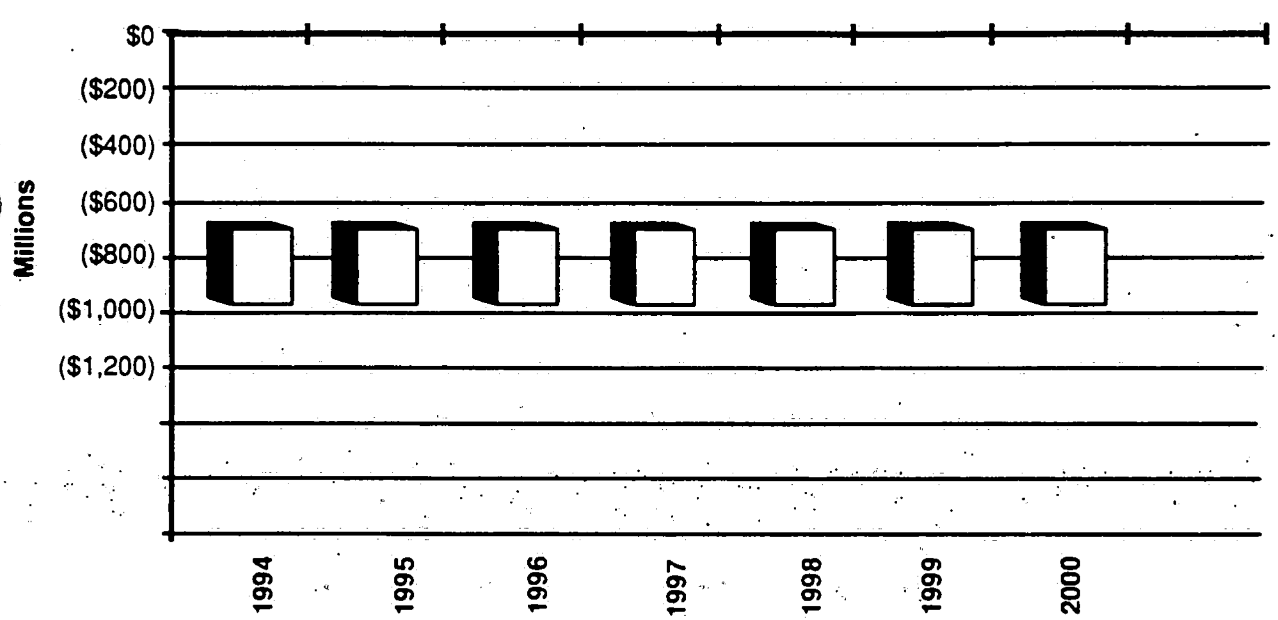


Table 7.2. Cost-Benefit Analysis for Market Development Policies

40% Recycled Content in Plastic Industrial Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	227.782	234.045	240.480	247.092	253.886	260.867	268.040	
Diversion resulting from Policy (tons)								
Low	72.890	74.894	76.954	79.070	81.244	83 477	85.773	554.302
Mid	91.113	93.618	96.192	98.837	101.555	104.347	107.216	692.877
High	109.335	112.342	115.430	118.604	121.865	125.216	128.659	831.452
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$120	$120	$120	$120	$120	$120	$120	
Mid	$140	$140	$140	$140	$140	$140	$140	
High	$160	$160	$160	$160	$160	$160	$160	
Value of Material Diverted -- $								
Low-Low	$8.746.821	$8.987.322	$9.234.436	$9.488.345	$9.749.235	$10.017.298	$10.292.732	$66.516.188
Mid-Mid	$12.755.780	$13.106.511	$13.466.886	$13.837.169	$14.217.634	$14.608.560	$15.010.234	$97.002.774
High-High	$17.493.642	$17.974.644	$18.468.872	$18.976.689	$19.498.469	$20.034.596	$20.585.464	$133.032.378
Costs								
Collection and Recycling Costs								
Cost per ton	$750	$750	$750	$750	$750	$750	$750	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	$672	$666	$659	$652	$644	$635	$626	
Total Net Cost for collection and recycling								
Low	$48.982.196	$50.329.003	$51.712.841	$53.134.730	$54.595.714	$56.096.869	$57.639.300	$372.490.652
Mid	$61.227.745	$62.911.254	$64.641.052	$66.418.412	$68.244.642	$70.121.086	$72.049.124	$465.613.315
High	$73.473.294	$75.493.505	$77.569.262	$79.702.094	$81.893.571	$84.145.303	$86.458.949	$558.735.978
Cost of Use by End-User $/ton								
Low	$28	$27	$27	$26	$25	$24	$24	
Mid	$72	$71	$69	$67	$65	$63	$62	
High	$102	$99	$97	$94	$92	$89	$87	
Total addit. Cost to end-user								
Low-High	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$14.285.385
Mid-Mid	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$46.217.422
High-Low	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$52.099.639
Job Impacts								
Jobs Created (Mid)	769	791	812	835	858	881	906	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	1.077	1.107	1.137	1.168	1.201	1.234	1.268	
Jobs Lost, all industries	1.003	1,021	1.039	1,057	1.075	1.093	1,111	
Net Jobs Gained	74	86	98	112	126	141	156	
Adjusted Jobs Loss (indirect)	-695	-705	-714	-723	-732	-741	-749	
Average Value of Jobs	$30.000	$30.870	$31.765	$32.686	$33.634	$34.610	$35.613	
Net Value of Jobs Created	($20.862.138)	($21.752.402)	($22.673.992)	($23.627.179)	($24.612.120)	($25.628.844)	($26.677.228)	($165.833.903)
Capital Investment								
Capital Investment by Industry								
Low	$2,040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$10.625.000
Mid	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$34.375.000
High	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$58.125.000
Administrative Costs								
– Public	$105.000	$108.045	$111.178	$114.402	$117.720	$121.134	$124.647	$802.127
Private	$350.000	$360.150	$370.594	$381.342	$392.400	$403.780	$415.490	$2.673.756
Net Benefit or (Cost)								
Low	($68.995.319)	($71.005.084)	($73.076.976)	($75.212.113)	($77.411.525)	($79.676.134)	($82.008.738)	($527.383.890)
Mid	($76.391.592)	($78.627.829)	($80.932.420)	($83.308.654)	($85.751.738)	($88.268.773)	($90.858.744)	($584.137.749)
High	($79.337.560)	($81.780.227)	($84.296.924)	($86.889.097)	($89.558.111)	($92.305.234)	($95.131.619)	($609.298.774)
Benefit or (Cost) per ton diverted								
Low	($947)	($948)	($950)	($951)	($953)	($954)	($956)	($951)
Mid	($838)	($840)	($841)	($843)	($844)	($846)	($847)	($843)
High	($726)	($728)	($730)	($733)	($735)	($737)	($739)	($733)

30-Apr-93

SENSITIVITY ANALYSIS

Because the net cost of this policy is driven by the high cost of recycling, we focus the sensitivity analysis on the impact of reducing the cost of recycling. Table 7-4 and Chart 7-4 illustrate these impacts. The full tables are in the Appendix to this chapter.

Table 7.4 40% Recycled Content in Plastic Industrial Containers - Sensitivity Analysis

	Low	Mid	High
40% Recycled Content - Baseline Scenario (Table 7.2)			
Total Net Benefit (Cost) (Million $)	($527)	($584)	($609)
1996 Net Benefit (Cost) (Million $)	($73)	($80)	($84)
Benefit (Cost) per ton ($/ton)	($951)	($843)	($733)
Reduced Cost of Recycling - $500 per ton (Table 7-A.1)			
Total Net Benefit (Cost) (Million $)	($266)	($288)	($278)
1996 Net Benefit (Cost) (Million $)	($37)	($40)	($38)
Benefit (Cost) per ton ($/ton)	($479)	($415)	($335)
Reduced Cost of Recycling- $225 per ton (Table 7-A.2)			
Total Net Benefit (Cost) (Million $)	$6	$22	$70
1996 Net Benefit (Cost) (Million $)	$0.32	$3	$9
Benefit (Cost) per ton ($/ton)	$11	$32	$84
Without Job Loss (Table 7-A.3)			
Total Net Benefit (Cost) (Million $)	($285)	($341)	($366)
1996 Net Benefit (Cost) (Million $)	($40)	($48)	($51)
Benefit (Cost) per ton ($/ton)	($514)	($493)	($441)

If the cost of recycling plastic is reduced to $500 per ton, the policy will still result in a net cost of $300 to $500 per ton diverted. However, when the cost of recycling is reduced to $225, the policy results in a net benefit. Thus, it is not until plastic recycling costs are reduced to the low $200-per-ton range that this policy could result in a net benefit.

For comparison, we also ran the model without including the loss of jobs that would result due to the net cost of the policy. In this case there is still a large net cost, although it is $300 to $400 per ton less than when the full job loss is included.

Consumption and diversion of this policy is low compared to most of the others being reviewed. This is in part a result of the low density of plastic containers. Because of this, while diversion by weight is small, volume-based diversion is higher.

As noted above, recycling costs are the key feature which raise the cost of this policy. Recycling costs are more than five times greater than the value of the material being diverted, and more than six times greater than the avoided land disposal cost. Thus, unless a plastic recycling policy results in substantial benefits of some other kind, it is not likely to be cost effective.

The policy would create a substantial number of jobs for collecting and processing plastic containers. However, because of its net cost to the state, the policy also will result in a large loss of jobs. A net cost of $44 million in 1994 results in a loss of 1,003 jobs in the state. Table 7-3 summarizes job creation and loss.

TABLE 7-3
JOB IMPACTS OF RECYCLED CONTENT IN PLASTIC INDUSTRIAL CONTAINERS -- 1994

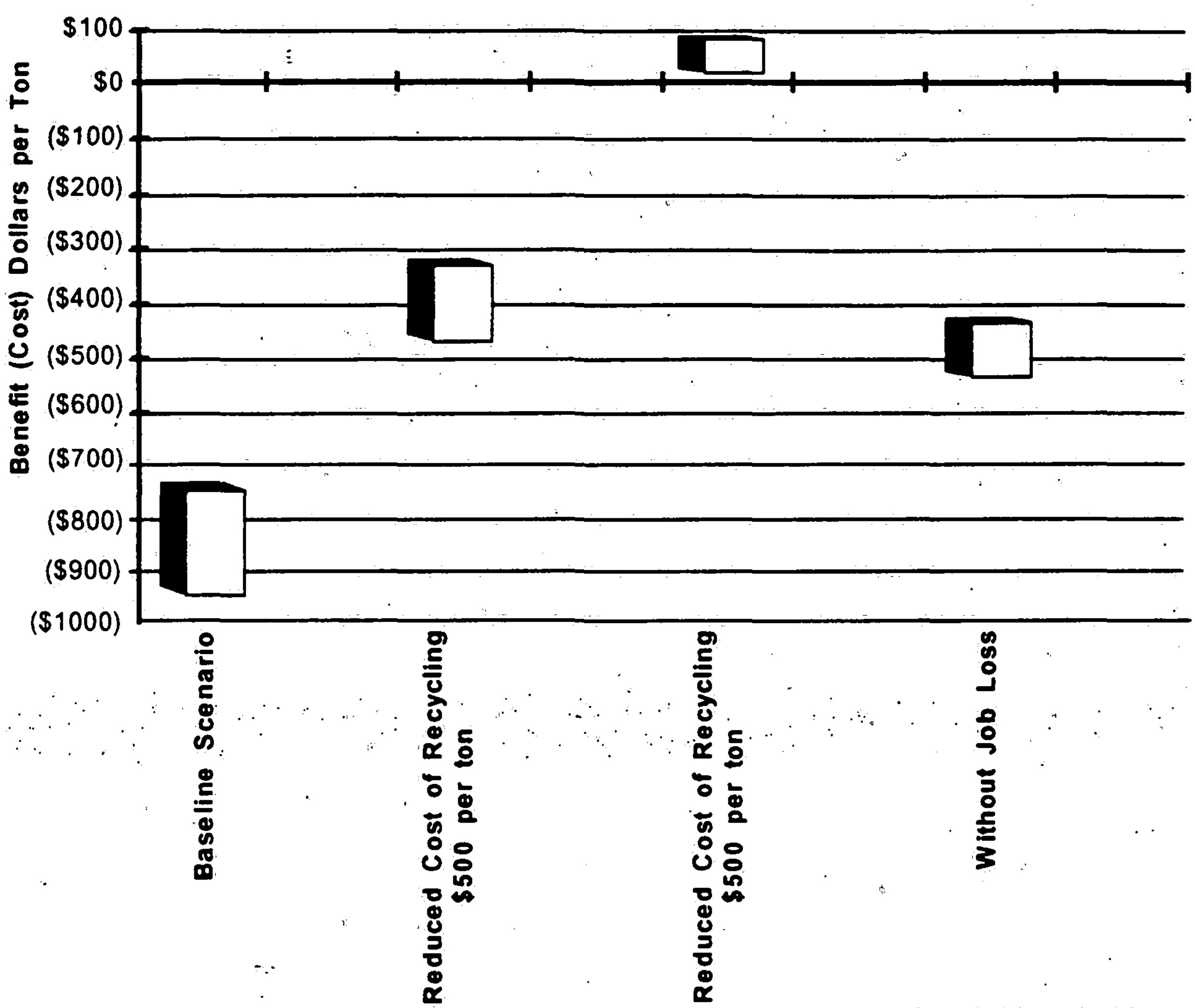
Direct Jobs Created	769
Multiplier (Indirect) Jobs Created	308
Indirect Jobs Lost	1,003
Net Jobs Gained	74

TRADING VS. NON-TRADING

The model allows us to make some predictions on the relative costs of the program with and without trading. A policy without trading will be more costly than one that allows trading. Without trading, every firm that sells or chooses to keep selling industrial containers in the state will be required to make whatever capital investment is necessary to use the secondary materials. Given current levels of production and consumption of plastic industrial containers, a policy without trading will require up to $58 million in capital investment. With trading, the policy could require as little as $10 million in capital investment, and is not likely to be more than $34 million, the level it would be if one-half of the manufacturers re-tool.

With trading, only those firms that can meet the standard or exceed the standard for less than the cost of permits will do so. In the example here, the cost to the end-user to use secondary materials is between $28 and $102 per ton. A firm that must spend $102 per ton to meet the standard will try to buy credits from a firm that already exceeds the standard, and as long as the credits are less than $102 and more than $28, both firms will benefit from the trade. The firm selling credits will try to at least cover their costs of using the material in the sale, so would be willing to sell the credits for anything over that cost.

Chart 7.4 40% RECYCLED CONTENT IN PLASTIC



DATA AND ASSUMPTIONS

WASTE GENERATION MODEL

The underlying assumption of this policy is that HDPE milk jugs and other HDPE containers will be used as a feedstock for the industrial containers. EPA (Franklin) data, adjusted to California by Gross Domestic Products and SRRE data, were compared, and an average figure used as the aggregate generation estimate. The EPA/Franklin factors for estimating generation to the year 2000 were applied to Source Reduction and Reduction Recycling data also. These factors may not be realistic, however, since they predict a 1% reduction in HDPE use and generation. The plastic industry predicts a growth in HDPE consumption of almost 9% annually through 1995.[4] Baseline diversion in 1990, from the SRRE, was 4%, or 11,673 million tons. To estimate baseline diversion to the year 2000 we make the assumption that HDPE diversion will reach 15% by the year 2000. This figure, while not based on any quantified data, is consistent with curbside growth and increased collection due to plastic industry and AB 939 recycling efforts.

COST-BENEFIT MODEL

Consumption Data

The Modern Plastics Resin Sales figures were used for consumption of HDPE and LDPE plastic industrial containers. California's share of the GDP (13.2%) was used to extrapolate from US to California data. GDP was used because it is a more reliable indicator of overall waste generation than a population or geographical basis. Data from 1989 to 1991 was used to calculate an average annual growth rate during that time. This rate was applied to 1993 through 2000 to estimate consumption in future years.

Diversion Resulting From Policy

In general, most plastic containers that are sold in California are produced here because it is not cost effective to ship empty containers across the country. Thus, to estimate the actual diversion in California from the policy, we assumed for the mid-range that all of the HDPE diverted from the policy is from California. To create a bracket around this estimate, we assume that at high level, 120% of the HDPE diverted is from California, and 80% for the low estimate.

Market Price

Per ton HDPE prices were from **Recycling Times** *and* **Plastic Recycling News** *for 1991-1992. A price of 7-cents per pound, or $140 per ton, has been the standard for sorted, baled, and delivered HDPE. The high and low figures provide a bracket for the price based on historical market fluctuations.*

Costs

Recycling costs per ton represents a mid-range price from several studies of recycling costs.[5] Cost for use by end user represents the additional cost to the industrial container manufacturer to make 40% recycled content containers as compared to virgin plastic containers. These numbers are based on capital investment level and the annual tonnage processed.

Job Impacts

Jobs created are based on the survey of California recyclers (See Appendix D). We used a figure of 1 job per 225 tons of plastic collected and one job per 250 tons of plastic processed annually. A multiplier of 1.4 is applied to determine the number of indirect jobs. Because the jobs resulting from the policy are already counted in the collection and recycling costs, only the multiplier jobs are counted as a benefit of the policy.

The policy results in a net gain of 74 jobs, however, for the cost benefit model, only indirect jobs gained and lost are counted in this section. Jobs related to collecting and processing plastic are included in the cost of recycling plastic. The net jobs adjustment is the number of indirect jobs that are lost as a result of the policy, and thus are included as a cost in the model. This is equal to the total number of jobs lost, which are all indirect, minus the number of indirect jobs gained.

This policy also will result in a net loss of jobs in the state due to the cost of compliance with the policy. The job loss is calculated by using the Total Final-Demand Multiplier for Employment. We used the multiplier for Miscellaneous Manufacturing Industries, which is 23.8. This means that for every $1,000,000 loss in output in this industry, a total of 23.8 jobs are lost in all industries in the state. To determine the job loss, we used the net cost of the policy for each year, before the impact of the job loss was calculated. Thus, a net cost of $46 million in 1994 results in a loss of 1,003 jobs.[6] *The net cost of the policy after this loss is accounted for is $76 million.*

Capital Investment

Estimates for capital investment from plastic industrial container manufacturers and processors were used. The low estimate assumes that only processing equipment will be needed, and that manufacturers can meet the requirement with existing technology. This is a best-case scenario -- there are some manufacturers in the state for which this is true, others would need to make some additional investment. The figure is based on a cost of $125 per ton for 85,000 tons of material. The mid and high figures assume that in addition to the investment in processing equipment, manufacturers will need to retool in order to meet the requirement. Here, a mid-range cost of $500 per ton of capacity is used. For the mid-range estimate, we assume that one-half of the manufacturers retool, and for the high range estimate, that all manufacturers retool. In all cases, the total investment was annualized.

Administrative Costs

We assume that 1.5 state staff people would be required to administer the program, at a cost of $70,000 per full time equivalent. For private administration, we estimate that 100 manufacturers would be impacted, and would each allocate one person 5% of the time, to the policy.

ASSESSMENT OF IMPACTS OF THE 40% RECYCLED CONTENT IN PLASTIC INDUSTRIAL CONTAINERS POLICY

PRACTICAL AND POLITICAL FEASIBILITY

The plastic industry, which invested $551 million, or $49 per ton of recycled plastic, in the U.S. between 1990 and 1992, has made a commitment to subsidize the cost of recycling plastic.[7] This subsidization, while costly, has allowed plastic to maintain its market share in a consumer environment that favors recyclable products and packaging. The plastic industry expects to spend a total of $1.2 billion by 1995 on the recycling and reclaiming of post-consumer and manufacturing plastics waste. This investment will provide funding for research and development, capital investment in equipment, recycling costs, market development, grants and loans, and collective investment. The plastics industry receives direct benefits for this investment in the form of market share. Local governments, which also invest in plastic recycling through curbside programs, benefit through the avoided land disposal, however this benefit is well below the cost of recycling plastic.

There are seventeen major polyethylene resin manufacturers in the U.S., with a combined capacity of 13 million tons of HDPE and LDPE. The capacity is above demand for both resin types: domestic production in 1992 was 11.6 million tons, and 10.4 million tons in 1991. Excess capacity of this magnitude keeps prices low and strongly discourages recycling. Recycling of HDPE and LDPE in the U.S. in 1991 was 161,000 pounds, a rate of 1.5%.[8] Increased use of secondary resins will result in reduced demand for virgin resins, and reduced utilization of existing capacity.

Several resin manufacturers presently produce recycled content resins, including Dow, Union Carbide Corporation, and Phillips Plastics. Dow introduced six new recycled content resin grades in 1992: two are unformulated 100% post-consumer HDPE, three are blends of LDPE with 25% post-consumer content, and one is 55% post-consumer polystyrene.[9] Union Carbide and Phillips both opened recycling centers capable of accepting HDPE from curbside programs.[10]

Plastic container manufacturers say they could use higher recycled content levels in their containers if recycled content resins were more readily available. One high growth market is the all-plastic HDPE drum.[11] There does not appear to be a consensus among manufacturers as to the cost advantage of using post-consumer resin. On the marketplace, virgin resin costs almost twice as much as scrap resin. Scrap resin -- either directly from production lines or from old containers -- is especially attractive because it has less contamination than post-consumer HDPE. However, some manufacturers feel that post-consumer HDPE is more costly than virgin HDPE once the processing and cleaning costs are added in.

REGULATIONS, PRODUCT DEGRADATION AND QUALITY CONCERNS

Quality concerns and existing regulations place the greatest limitations on the use of recycled plastic in industrial containers.

Several federal regulations impact the use of recycled content in plastic containers. FDA requirements limit the use of secondary plastic in food-grade containers. While there have been some exceptions, such as PET soda bottles, generally food grade containers cannot use secondary plastic, for fear of contamination. Secondary resins could be sandwiched between virgin resins, however this technology is not fully developed for larger containers. Aside from FDA, OSHA and DOT requirements impact the use of secondary materials. OSHA restrictions on pallets and other plant procedures serve to restrict the use of secondary plastics. DOT requirements for drums preclude the use of secondary plastics.

While it is clear that these requirements place barriers on the use of secondary plastics, it is not clear that they are insurmountable. If industry pressured any of these agencies, they could, in all likelihood, modify their requirements to encourage or allow the use of secondary plastics. It appears that in some cases the existing laws are not challenged, thus avoiding the use of secondary materials.

If existing requirements that limit the use of secondary materials cannot be modified, the policy will not be effective. Food containers and buckets and drums and chemical containers comprise large shares of the plastic industrial containers on the market. If these products were exempted from the policy, the impact of the policy would be drastically reduced. If they were not exempted, but were required to purchase credits from other manufacturers, the supply of credits would probably be insufficient to meet the standard, even if it was reduced to below 40%.

There are valid quality concerns related to the use of post-consumer HDPE in plastic containers. One problem is the increased level of contamination as compared with virgin feedstocks. This does not appear to be a severe problem, and firms that use post-consumer HDPE simply check the quality of the material. HDPE milk jugs are blow-molded, and as a result, the plastic resin is viscous (has a low melt index of less than one). Many plastic industrial containers, such as crates and trays, are injection molded. Even though both are made of HDPE, the resins characteristics are different. Injection molding requires a high melt index of between 6 to 8. To maintain the proper melt index, injection molding processes can only use up to about 25% post-consumer HDPE. In cases where pre-mixed post-consumer resins are available, such as those described above, the recycled content level can be higher without limiting melt-index and shrinkage concerns. In addition, manufacturers can use re-grind of their old containers or scrap to achieve higher levels.

There are also some concerns related to problems that result when different resins shrink at different rates. These issues are more critical when the internal dimensions of the container must meet certain specifications. Using higher levels of post-consumer HDPE also limits the range of colors that can be used. Generally, the higher the level of recycled content, the darker the container. At 25% recycled content there are no color limitations, however at 50%, only darker colors can be used.

PRODUCT SUBSTITUTION AND UNINTENDED IMPACTS

Industrial containers can be made of a variety of materials, and as a result, this policy has the potential to create substitutions between these material types. The primary example is with pallets. Both wooden and plastic industrial pallets are in use today. Plastic pallets typically last longer than wooden pallets, which are often scrapped after a few uses. If the policy makes plastic pallets less attractive because of increased cost or increased paperwork requirements, manufacturers and consumers may switch to wooden pallets. The result will be more wood in the wastestream, and less demand for plastic pallets, and thus for secondary HDPE. If this policy was implemented, a policy to ban wooden pallets from landfills might be necessary. Similar substitutions for other containers would likely occur.

EQUITY

Because this policy only applies to one material type, it will place a greater burden on plastic industrial containers, at the expense of other types of industrial containers. Exemptions for food and hazardous materials containers would place a greater burden on the remainder of the plastic container industry. Plastic container manufacturers that were already using, or easily able to use secondary materials would benefit.

EXISTING INFRASTRUCTURE

Plastic industrial containers do not fall under the purview of existing recycling laws. Manufacturer responsibility options are also not likely to impact these containers. Rigid plastic containers, regulated under SB 235, do not include drums, and other industrial containers. This policy is intended, however, to create markets for materials that may be collected in response to SB 235 and AB 939.

SUMMARY

This policy, while it creates a demand for HDPE that is being collected by communities throughout the state, raises some serious questions about the cost of recycling plastic. Even given the assumptions and uncertainties in the data, the cost of the policy far exceeds the benefits, especially when the low impact on overall diversion is considered. The only way this policy can be cost effective is if the value of HDPE resin or the avoided cost of land disposal increases to unprecedented levels, or if there are substantial reductions in the cost of collecting, recycling, and processing post-consumer HDPE.

ENDNOTES

1. These estimates are based on the 1990 SRRE data for HDPE generation and extrapolations of US resin sales to California for HDPE containers.

2. Much of the information and data in this section is based on interviews with people involved in the plastic industry. To avoid disclosing sources of sensitive information, those interviewed are cited together: Tim Fangko, Rehrig Pacific, March 6, 1993; Todd Lovejoy, Rehrig Pacific, March 3, 1993; Terry Pace, Piper Case Pro, March 8, 1993; Caroline Reny, Envirothene, March 9, 1993; Dan Kilgor, Lindco Industries, March 8, 1993; Tom York, KAL Plastics, March 8, 1993; John Davis, Macro Plastics, March 8, 1993; Steve Kipp, Sonoco Fibre Drum, March 9, 1993; and John Malone, Society for the Plastics Industry, March 30, 1993.

3. A World Resources Institute Report "Green Fees: How a Tax Shift Can Work for the Environment and the Economy," November 1992, Calculates non-market disposal costs of $75 and $45 for high-and-low cost regions.

4. Modern Plastics U.S. Resin Sales, January 1993.

5. See references in Appendix A.

6. The multiplier for job loss was taken from "Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II)." U.S. Department of Commerce, Bureau of Economic Analysis, May 1992. Because the multipliers were calculated in 1989 dollars, the annual cost of the policy was adjusted to 1989 dollars before the multiplier was applied.

7. American Plastics Council, October 1992.

8. Modern Plastics U.S. Resin Sales, January 1993.

9. Modern Plastics U.S. Resin Sales, July 1992, Technoscope, .32.

10. Oil and Gas Journal, February 10, 1992, Industry Briefs.

11. Modern Plastics U.S. Resin Sales, January 93, p.58, "Resins 1993: What's in the Pipeline."

Chapter 7

APPENDICES

California FUTURES

Table 7-A.1 Cost-Benefit Analysis for Market Development Policies

40% Recycled Content in Plastic Industrial Containers - Reduced Cost of Recycling

		1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion									
CA Consumption (tons)		227,782	234,045	240,480	247,092	253,886	260,867	268,040	
Diversion resulting from Policy (tons)									
	Low	72,890	74,894	76,954	79,070	81,244	83,477	85,773	554,302
	Mid	91,113	93,618	96,192	98,837	101,555	104,347	107,216	692,877
	High	109,335	112,342	115,430	118,604	121,865	125,216	128,659	831,452
Price and Value of Material									
Market Prices (paid by end-users $/ton)									
	Low	$120	$120	$120	$120	$120	$120	$120	
	Mid	$140	$140	$140	$140	$140	$140	$140	
	High	$160	$160	$160	$160	$160	$160	$160	
Value of Material Diverted -- $									
	Low-Low	$8,746,821	$8,987,322	$9,234,436	$9,488,345	$9,749,235	$10,017,298	$10,292,732	$66,516,188
	Mid-Mid	$12,755,780	$13,106,511	$13,466,886	$13,837,169	$14,217,634	$14,608,560	$15,010,234	$97,002,774
	High-High	$17,493,642	$17,974,644	$18,468,872	$18,976,689	$19,498,469	$20,034,596	$20,585,484	$133,032,378
Costs									
Collection and Recycling Costs									
Cost per ton		$500	$500	$500	$500	$500	$500	$500	
Value of Avoided Land Disposal									
Per ton		$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs		$422	$416	$409	$402	$394	$385	$376	
Total Net Cost for collection and recycling									
	Low	$30,759,653	$31,605,416	$32,474,433	$33,367,345	$34,284,808	$35,227,498	$36,196,108	$233,915,261
	Mid	$38,449,566	$39,506,769	$40,593,041	$41,709,181	$42,856,010	$44,034,372	$45,245,135	$292,394,076
	High	$46,139,480	$47,408,123	$48,711,650	$50,051,018	$51,427,212	$52,841,247	$54,294,162	$350,872,891
Cost of Use by End-User $/ton									
	Low	$28	$27	$27	$26	$25	$24	$24	
	Mid	$72	$71	$69	$67	$66	$63	$62	
	High	$102	$99	$97	$94	$92	$89	$87	
Total addit. Cost to end-user									
	Low-High	$2,040,769	$2,040,769	$2,040,769	$2,040,769	$2,040,769	$2,040,769	$2,040,769	$14,285,385
	Mid-Mid	$6,602,489	$6,602,489	$6,602,489	$6,602,489	$6,602,489	$6,602,489	$6,602,489	$46,217,422
	High-Low	$7,442,806	$7,442,806	$7,442,806	$7,442,806	$7,442,806	$7,442,806	$7,442,806	$52,099,639
Job Impacts									
Jobs Created (Mid)		769	791	812	835	858	881	906	
CA Multiplier		1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created		1,077	1,107	1,137	1,168	1,201	1,234	1,268	
Jobs Lost, all industries		510	514	518	521	525	528	530	
Net Jobs		-202	-198	-193	-187	-182	-175	-168	
Average Value of Jobs		$30,000	$30,870	$31,765	$32,686	$33,634	$34,610	$35,613	
Net Value of Jobs Created		($6,055,319)	($6,097,252)	($6,121,908)	($6,126,772)	($6,109,059)	($6,065,682)	($5,993,231)	($42,569,222)
Capital Investment									
Capital Investment by Industry									
	Low	$2,040,769	$2,040,769	$2,040,769	$2,040,769	$2,040,769	$2,040,769	$2,040,769	$10,625,000
	Mid	$6,602,489	$6,602,489	$6,602,489	$6,602,489	$6,602,489	$6,602,489	$6,602,489	$34,375,000
	High	$11,164,208	$11,164,208	$11,164,208	$11,164,208	$11,164,208	$11,164,208	$11,164,208	$58,125,000
Administrative Costs									
	Public	$105,000	$108,045	$111,178	$114,402	$117,720	$121,134	$124,647	$802,127
	Private	$350,000	$360,150	$370,594	$381,342	$392,400	$403,780	$415,490	$2,673,756
Net Benefit or (Cost)									
	Low	($35,965,956)	($36,626,346)	($37,286,483)	($37,944,322)	($38,597,559)	($39,243,602)	($39,879,548)	($265,543,817)
	Mid	($38,806,593)	($39,568,194)	($40,332,325)	($41,097,017)	($41,860,045)	($42,618,898)	($43,370,758)	($287,653,829)
	High	($37,196,926)	($38,039,696)	($38,887,228)	($39,737,614)	($40,588,692)	($41,438,017)	($42,282,834)	($278,171,006)
Benefit or (Cost) per ton diverted									
	Low	($493)	($489)	($485)	($480)	($475)	($470)	($465)	($479)
	Mid	($426)	($423)	($419)	($416)	($412)	($408)	($405)	($415)
	High	($340)	($339)	($337)	($335)	($333)	($331)	($329)	($335)

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Table 7-A.2 Cost-Benefit Analysis for Market Development Policies

40% Recycled Content in Plastic Industrial Containers - Cost of Recycling to Create Net Benefit

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	227.782	234.045	240.480	247.092	253.886	260.867	268.040	
Diversion resulting from Policy (tons)								
Low	72.890	74.894	76 954	79.070	81.244	83.477	85 773	554.302
Mid	91.113	93.618	96.192	98.837	101.555	104.347	107.216	692.877
High	109.335	112.342	115.430	118.604	121.865	125.216	128.659	831.452
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$120	$120	$120	$120	$120	$120	$120	
Mid	$140	$140	$140	$140	$140	$140	$140	
High	$160	$160	$160	$160	$160	$160	$160	
Value of Material Diverted -- $								
Low-Low	$8.746.821	$8.987.322	$9.234.436	$9.488.345	$9.749.235	$10.017.298	$10.292.732	$66.516.188
Mid-Mid	$12.755.780	$13.106.511	$13.468.886	$13.837.169	$14.217.634	$14.608.560	$15.010.234	$97.002.774
High-High	$17.493.642	$17.974.644	$18.468.872	$18.976.689	$19.498.469	$20.034.596	$20.585.464	$133.032.376
Costs								
Collection and Recycling Costs								
Cost per ton	$225	$225	$225	$225	$225	$225	$225	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$116	$124	
Net collection and recycling costs	$147	$141	$134	$127	$119	$110	$101	
Total Net Cost for collection and recycling								
Low	$10.714.855	$11.009.469	$11.312.184	$11.623.222	$11.942.812	$12.271.190	$12.608.597	$81.482.330
Mid	$13.393.569	$13.761.837	$14.140.230	$14.529.028	$14.928.515	$15.338.988	$15.760.746	$101.852.913
High	$16.072.283	$16.514.204	$16.968.276	$17.434.833	$17.914.219	$18.406.785	$18.912.895	$122.223.495
Cost of Use by End-User $/ton								
Low	$28	$27	$27	$26	$25	$24	$24	
Mid	$72	$71	$69	$67	$66	$63	$62	
High	$102	$99	$97	$94	$92	$89	$87	
Total addit Cost to end-user								
Low-High	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$14.285.385
Mid-Mid	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$46.217.422
High-Low	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$52.099.639
Job Impacts								
Jobs Created (Mid)	769	791	812	835	858	881	905	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	1.077	1.107	1.137	1.168	1.201	1.234	1.268	
Jobs Lost, all industries								
Net Jobs	308	316	325	334	343	352	362	
Average Value of Jobs	*$30.000*	*$30.870*	*$31.765*	*$32.686*	*$33.634*	*$34.610*	*$35.613*	
Net Value of Jobs Created	$9.232.755	$9.761.730	$10.321.010	$10.912.334	$11.537.537	$12.198.560	$12.897.455	$76.861.382
Capital Investment								
Capital Investment by Industry								
Low	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$10.625.000
Mid	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$34.375.000
High	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$58.125.000
Administrative Costs								
Public	$105.000	$108.045	$111.178	$114.402	$117.720	$121.134	$124.647	$802.127
Private	$350.000	$360.150	$370.594	$381.342	$392.400	$403.780	$415.490	$2.673.756
Net Benefit or (Cost)								
Low	($633.085)	($171.416)	$318.684	$838.907	$1.391.033	$1.976.948	$2.598.648	$6.319.717
Mid	$1.537.477	$2.035.720	$2.563.405	$3.122.243	$3.714.046	$4.340.729	$5.004.318	$22.317.938
High	$8.158.344	$8.713.205	$9.299.084	$9.917.677	$10.570.898	$11.260.687	$11.989.118	$69.908.994
Benefit or (Cost) per ton diverted								
Low	($9)	($2)	$4	$11	$17	$24	$30	$11
Mid	$17	$22	$27	$32	$37	$42	$47	$32
High	$75	$78	$81	$84	$87	$90	$93	$84

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Table 7-A.3 Cost-Benefit Analysis for Market Development Policies
Without Job Loss -- 40% Recycled Content in Plastic Industrial Containers

	1994	1995	1996	1997	1998	1999	2000	Total
Consumption and Diversion								
CA Consumption (tons)	227.782	234.045	240 480	247.092	253.886	260.867	268.040	
Diversion resulting from Policy (tons)								
Low	72.890	74.894	76.954	79.070	81.244	83.477	85.773	554 302
Mid	91.113	93.618	96.192	98.837	101.555	104 347	107.216	692.877
High	109.335	112.342	115 430	118.604	121.865	125.216	128.659	831 452
Price and Value of Material								
Market Prices (paid by end-users $/ton)								
Low	$120	$120	$120	$120	$120	$120	$120	
Mid	$140	$140	$140	$140	$140	$140	$140	
High	$160	$160	$160	$160	$160	$160	$160	
Value of Material Diverted -- $								
Low-Low	$8.746.821	$8.987.322	$9.234.436	$9.488.345	$9.749.235	$10.017.298	$10.292.732	$66.516 188
Mid-Mid	$12.755.780	$13.106.511	$13.466.886	$13.837.169	$14.217.634	$14.608.560	$15.010.234	$97.002.774
High-High	$17.493.642	$17.974.644	$18.468.872	$18.976.689	$19.498.469	$20.034.596	$20.585.464	$133.032.376
Costs								
Collection and Recycling Costs								
Cost per ton	$750	$750	$750	$750	$750	$750	$750	
Value of Avoided Land Disposal								
Per ton	$78	$84	$91	$98	$106	$115	$124	
Net collection and recycling costs	$672	$666	$659	$652	$644	$635	$626	
Total Net Cost for collection and recycling								
Low	$48.982.198	$50.329.003	$51.712.841	$53.134.730	$54.595.714	$56.096.869	$57.639.300	$372.490.652
Mid	$61.227.745	$62.911.254	$64.641.052	$66.418.412	$68.244.642	$70.121.086	$72.049.124	$465.613.315
High	$73.473.294	$75.493.505	$77.569.262	$79.702.094	$81.893.571	$84.145.303	$86.458.949	$558.735.978
Cost of Use by End-User $/ton								
Low	$28	$27	$27	$26	$25	$24	$24	
Mid	$72	$71	$69	$67	$65	$63	$62	
High	$102	$99	$97	$94	$92	$89	$87	
Total addit. Cost to end-user								
Low-High	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$14.285.385
Mid-Mid	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$46.217.422
High-Low	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$7.442.806	$52.099.639
Job Impacts								
Jobs Created (Mid)	769	791	812	835	858	881	905	
CA Multiplier	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Jobs Created	1.077	1.107	1.137	1.168	1.201	1.234	1.268	
Jobs Lost, all industries								
Net Jobs	308	316	325	334	343	352	362	
Average Value of Jobs	$30.000	$30.870	$31.765	$32.686	$33.634	$34.610	$35.613	
Net Value of Jobs Created	$9.232.755	$9.761.730	$10.321.010	$10.912.334	$11.537.537	$12.198.560	$12.897.455	$76.861.382
Capital Investment								
Capital Investment by Industry								
Low	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$2.040.769	$10.625.000
Mid	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$6.602.489	$34.375.000
High	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$11.164.208	$58.125.000
Administrative Costs								
Public	$105.000	$108.045	$111.178	$114.402	$117.720	$121.134	$124.647	$802.127
Private	$350.000	$360.150	$370.594	$381.342	$392.400	$403.780	$415.490	$2.673.756
Net Benefit or (Cost)								
Low	($38.900.426)	($39.490.952)	($40.081.973)	($40.672.600)	($41.261.868)	($41.848.731)	($42.432.055)	($284.688.605)
Mid	($46.296.699)	($47.113.697)	($47.937.417)	($48.767.141)	($49.602.081)	($50.441.369)	($51.284.061)	($341.442.464)
High	($49.242.667)	($50.266.095)	($51.301.922)	($52.349.584)	($53.408.454)	($54.477.831)	($55.556.936)	($366.603.489)
Benefit or (Cost) per ton diverted								
Low	($534)	($527)	($521)	($514)	($508)	($501)	($495)	($514)
Mid	($508)	($503)	($498)	($493)	($488)	($483)	($478)	($493)
High	($450)	($447)	($444)	($441)	($438)	($435)	($432)	($441)

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APPENDIX A
DESCRIPTION OF THE COST-BENEFIT MODEL

INTRODUCTION

The cost-benefit model developed by California Futures provides a detailed analysis of the impacts of each of the six policies. This model can be applied to any solid waste policy, and could potentially be adapted to water and air pollution reduction policies as well. The model is reliant on data points which are, in some cases, rough approximations of reality. A full discussion of the assumptions that underlay the model allows readers to better understand the strengths and weaknesses of the model as a policy analysis tool. This Appendix provides a description of the cost-benefit model and the waste generation tables. Where they vary, specific data sources and assumptions are described in each chapter of the report.

THE WASTE GENERATION AND DIVERSION TABLE

This table summarizes and projects waste generation and diversion rates for each of the specified materials. The waste generation table is not essential for the analysis of recycled content policies, but provides a means of comparing the diversion from the policy with the existing and projected generation. Below, we describe the data sources and calculations used in the waste generation tables.

WASTE GENERATION DATA

Formulas:

Aggregate generation (tons) = (SRRE generation + Franklin Generation)/2.

Formula: Year N waste generation (tons) = Year N-1 generation X rate of change.

We rely on two primary sources of waste generation data: 1) the EPA's Characterization of Municipal Solid Waste in the United States, and 2) the Board's SRRE waste stream analysis data from 1990.[1] Data from the California Department of Conservation on beverage container sales was also used when appropriate. The U.S. data from EPA was adjusted for California based on California's share of the gross domestic product (GDP) (13.2% in 1991). GDP was found to be a more reliable indicator than population share because it could be broken down to individual sectors of the economy.

Both the EPA and SRRE figures were used in order to account for differences in their methodology and provide a more valid estimate of waste generation. The two sources determine waste generation from different approaches, and as a result, EPA and Board data on waste generation are not always consistent. The differences are due to the different methodologies applied, as well as differences in the way in which material categories are defined.

EPA data is based on a determination of consumption of products, while the SRRE data is based on waste characterization studies. Consumption data relies heavily on industry figures, and may be subject to some bias. Extrapolating downward from US figures to California adds additional uncertainty, and does not account for unique generation patterns in California. Waste characterization studies extrapolate from small samples of waste to large volumes, and cannot fully account for seasonal, geographical, and other variations in generation. As a result they also may also be misrepresentative.

The table shows generation data for both methodologies.. Then, an aggregate waste generation figure was calculated. This figure was used for the diversion calculations in the rest of the table. The aggregate data is simply the sum of the EPA and SRRE figures divided by two.

To extend the analysis beyond 1990, the last year for which waste generation data is available, an annual rate of change was determined and applied through the year 2000. The 1988 EPA report provides projections of waste discards to up to 2000 for each wastestream. EPA's annual growth factors for each material were applied to all three categories of generation data (SRRE, EPA, and aggregate) to predict generation to 2000.[2] For example, if the annual growth rate in the Franklin study was 2% and 1990 generation was 1,000,000 tons, 1991 generation would be (1,000,000*1.02) = 1,020,000 tons, and 1992 generation would be (1,020,000*1.02) = 1,040,400, and so on.

BASELINE DIVERSION AND PERCENT DIVERSION

Formulas:

Annual percentage point increase in recycling rate(%) = (Year 2000 estimated recycling rate - 1990 recycling rate)/11 .

Year N Percent diversion (%) = Year N-1 diversion rate + Annual percentage point increase.

Year N baseline diversion (tons) = Year N aggregate generation X Year N % diversion.

Baseline diversion represents the existing diversion level in tons. Baseline diversion simply provides a benchmark for the impact of each policy on diversion. Will implementing the policy divert substantially more than doing nothing? Is the impact significant? The SRRE diversion for 1990 and the 1990 recycling rate are used as the starting point for each material. This level is projected forward to 2000 using an annual percentage point increase in recycling rate.

The annual percentage point increase in recycling rate was determined by subtracting the 1990 recycling rate from an estimated recycling rate for 2000 and dividing by the number of years (11). The year 2000 recycling rate is based on industry projections or goals and AB 939 recycling goals for each material type. The result of this calculation is the annual percentage point increase in recycling rate. Generally, there was a small annual increase (1.5 to 3 percentage points) in the recycling rate for each material analyzed.

The recycling rate for each year was determined from the annual percentage point change, and this rate was multiplied by the aggregate generation to calculate the baseline diversion in tons for that year. For example, if the 1990 recycling rate was 25%, and the estimated recycling rate in 2000 is 50%, the annual percentage point increase is 2.27%. Thus, the recycling rate in 1991 is 27.27%, in 1993 is 29.5%, and so on. Baseline diversion, in tons, for 1993 is equal to 29.5% multiplied by the aggregate generation figure.

DIVERSION FROM POLICY AND TOTAL DIVERSION IMPACT

Formulas:

Diversion from policy (tons) = calculated from cost-benefit model.

Total diversion (tons) = diversion from policy + baseline diversion.

Total % diversion (%) = total diversion/generation for each material type.

% AB 939 diversion (%) = Total diversion/California Waste Generation.

California Waste Generation = 45,000,000 X 1.017 annual growth.

The estimated diversion from the policy is based on the Cost-Benefit Model calculation for diversion. For the purposes of this table, the mid-range estimate from the cost-benefit model is used. Total diversion is the sum of the baseline diversion and the diversion from the policy. Total percent diversion refers to the percent of that material diverted. Percent AB 939 Diversion is the percentage of total waste diversion for the material. The total waste generation is based on 45 million tons in 1990, with an annual increase of 1.7%. This increase is consistent with the annual increase in generation from the EPA characterization.

For example, if paper generation is 11 million tons, baseline diversion is 2 million tons, and diversion from the policy is 1.7 million tons, total diversion is 3.7 million tons, and the percent total diversion is 3.7 million/11 million, or 33.6%. Percent AB 939 Diversion would be 3.7 million/45 million, or 8%.

THE COST-BENEFIT MODEL

The Cost-Benefit Model is divided into seven sections. We describe each of these below in general terms, and where appropriate show the equations used to calculate the entries. The specifics that pertain to each alternative are described in those chapters. The model evaluates the impacts for the seven year period from 1994 through the year 2000.

CONSUMPTION AND DIVERSION

This section establishes the levels of consumption or production of the material in the state and the diversion level resulting from the policy. It provides the basis for further calculations in the model.

California Consumption

> *Formulas:*
>
> *California Consumption (baseline) = US baseline consumption X 13.2%.*
>
> *California Consumption in year N = California Baseline consumption in Year N-1 X Annual Growth Rate*

Consumption is defined in our model as the amount of the product sold in California. With the exception of beverage container data, sales figures for most products are not specific to California.[3] As a result, California consumption was derived from US data based on California's share of the Gross Domestic Product (GDP). California had 13.2% of the nation's GDP in 1991, and this figure was applied to national data to provide a state consumption figure.[4]

This provides a baseline consumption figure. Then, an annual growth rate in consumption for each material is applied. These growth rates are material specific, and are based on industry sales trends and predictions.

Consumption figures are the starting point for further calculations in the model. Because these are recycled content/utilization policies, it is essential to know how much of the material is used in the first place. This data is in most cases provided from industry sources, and like all such data is subject to potential bias. Where possible we checked industry figures against Department of Commerce or EPA statistics, although in many cases even these figures arise from the same industry numbers.

The following example illustrates the calculations in this section. Assume the national sales of a product in 1992 was 10 million tons. California's estimated share is 10 million X .132 = 1.32 million tons. The annual increase in sales of this product has averaged 2% over the last three years, and this trend is expected to continue. Then, the 1993 consumption in California is 1.32 million X 1.02 = 1.35 million, and 1994 consumption is 1.35 million X 1.02 = 1.37 million tons.

Diversion from the Policy

Formulas:
Mid-range diversion from policy (tons) = California Production X recycled content level.
Low range diversion (tons) = mid-range diversion X Z%, where Z is less than 100%.
High range diversion (tons) = mid-range diversion X Y%, where Y is greater than 100%

Here, we calculate the potential diversion that would result from the policy. Since recycled content mandates may divert materials from either California or out-of-state waste streams, we provide three estimates for potential diversion. These figures are intended to represent the actual quantity of material that is collected and diverted from the California waste stream. In most cases, it is unlikely that all the material that the policy diverts will originate in California. Many materials subject to these policies are manufactured out of state and imported into California.[5] Manufacturers located out-of-state will generally purchase secondary materials from close markets, which may not mean California. At the same time, however, the policy may result in greater than expected levels of diversion, represented by the high figures. In-state manufacturers may use the recycled content levels dictated by the policy for products that are shipped out of state, and out-of-state manufacturers located near the California border may export California secondary materials in order to meet the requirement.[6]

The diversion estimates are based on California production figures, and interviews with industry experts for each material type.

PRICE AND VALUE OF THE MATERIAL

Market Prices of the Material

The market price is the amount paid by end-users for each commodity or for its substitute.[7] The mid-range price is based on published prices in Recycling Times and other trade publications within the last year. Because market prices vary, the mid-range figure is based on current market prices, and the low and high figures are set at levels that have historically bracketed price changes that occurred when market conditions have changed. While the high and low figures should provide a range of prices, any large unforeseen changes could result in quite different prices. The model should be updated over time to accommodate shifts in prices that do occur.

Market prices of many recycled materials have fluctuated widely over the last several years, and thus predicting prices through the year 2000 is somewhat risky. Factors such as increased supply and demand for the material, substitutions, and the expected impacts of AB 939 and the policy being analyzed can all change the price of a secondary material. While a number of factors could result in changes in price over the seven year period, the model maintains prices at one level. The high and low prices should bracket most changes that could occur.

Value of Materials Diverted

Formula:
Value of material diverted ($) = Quantity of material diverted X Market price per ton.

The value of the materials diverted as a result of the policy is a multiple of the quantity of material diverted and the market price. This value represents the inherent value of the material that is being diverted, and is a benefit of the policy. The greater the value of the material, the greater the benefit to the economy from diverting rather than disposing of the material.

Except where noted, the model calculates three values: low, medium, and high. The low estimate uses the lowest diversion estimate and the lowest price. The mid range estimate uses the mid-range diversion impact and mid-range price, while the high estimate uses the highest diversion estimate and the highest price. Again, these figures in most cases provide a very wide range. This reflects the uncertainty in estimating and predicting these types of figures.

COSTS

This section quantifies a variety of costs and benefits related to collection and use of the secondary material. High values in this section, either positive or negative, can drive the net benefit (cost) of the policy.

Collection and Recycling Cost

The material specific collection and recycling cost figures are estimates based on existing data on collection, processing and recycling costs from a number of sources.[8] These are identified for each policy alternative. Where possible we used material specific costs. In many studies, curbside costs are aggregated across material types. These figures, usually in the range of $75 to $150 per ton, do not provide sufficient detail for this study. When the material specific cost figures in the literature covered a wide range, which was often the case, the model uses a figure that fit in the mid-range of the existing data.

Value of Avoided Land Disposal

The avoided cost of collection and disposal is a benefit of the policy. The model uses a total avoided land disposal cost of $124 per ton in the year 2000, adjusted to present value for each year in the model. This amount is equivalent to $115 in 1992, and is the sum of current waste collection cost of $50 per ton, based on existing literature on collection costs, and a land disposal cost of $65 per ton. The landfill cost approximates the current disposal cost at new landfills in the state. Every ton of material diverted by the policy represents one less ton disposed of, and thus results in a savings. This benefit accrues to local governments and rate payers that would normally pay for waste disposal.

This figure does not take into account the full environmental costs of land disposal, although it does include some accounting for closure costs and current land value. Studies of the full (environmental) cost of landfills generally arrive at higher costs. A World Resources Institute study calculated full disposal costs for high-cost and moderate-cost regions. The high-cost region had a non-market cost of $75 per ton and market costs of $120 per ton, for a total of $195 per ton. The moderate cost region had non-market costs of $45 per ton and market costs of $65 per ton, for a total of $110 per ton.[9] Using full environmental costs in the model would result in greater benefits for each policy.

Net Collection and Recycling Costs

> *Formula:*
>
> *Net collection and recycling cost ($/ton) = Collection and recycling cost - avoided land disposal.*
>
> *Total collection and recycling cost ($) = Net collection and recycling cost X diversion from policy.*

The net collection and recycling cost is simply the difference between the cost of collection and recycling and the cost of collection and disposal. If the cost of collection and recycling is less than the cost of land disposal, the result is a negative cost (i.e. a benefit) in recycling compared to disposal. If the cost is greater than the cost of land disposal, there is a cost resulting from the policy for collecting and recycling the material as compared to land disposal. The total collection and recycling cost is calculated by multiplying the net collection and recycling cost by the diversion from the policy. In most cases this is calculated for the low, mid, and high diversion estimates.

Cost of Use by End-Users

> *Formula:*
>
> *Total additional cost to end-user ($) = Quantity of material diverted X end-user cost/ton.*

Some manufacturers may face additional costs to use secondary materials as compared to virgin. The additional costs to industry will vary, depending on the existing degree of capitalization at the plant, existing utilization of secondary materials, and technology available. Some facilities may face no or little additional cost for complying with the policy, while others may require large new investments, and thus higher costs.

This entry in the model attempts to quantify these additional costs to end-users. In the model we provide three cost estimates. The low estimate is for minimal cost. This generally assumes a state-of-the-art manufacturing facility, close to markets, utilizing technology for which recycled content imposes little or no barrier. The James River plant in Halsey Oregon with high-tech de-inking facilities, or a newer Owens Brockway glass plant with high recycled content capability provide examples. In a best-case scenario, the low estimate is zero, meaning there is no additional cost to using recycled content. The mid-range figure represents a manufacturer that would have to make some additional investment, and the high range cost is for a manufacturer that would need to make a major investment to comply with the policy. The high costs are generally based on costs for an older facility distant from markets requiring major expenditures for retrofitting.

The total additional cost to the end user is based on the per ton additional costs to end-users and the quantity diverted through the policy. The low cost estimate in this case uses the low cost to the end-user and the highest diversion. This is a best-case scenario. The mid range estimate uses mid cost and mid diversion estimates, which is probably the most realistic average figure. The high cost estimate uses the highest cost and lowest diversion, assuming that if the cost was at the highest level, fewer facilities in California would be using the material.[10]

The total additional cost will depend on the distribution of investments that allow manufacturers to use recycled content, and whether or not the policy allows trading. The low, mid, and high figures are based on interviews with manufacturers.

JOB IMPACTS

Formulas:

Total jobs create = Jobs created X CA industry multiplier.

Total jobs lost = Jobs lost X CA industry multiplier.

Net jobs = total jobs created - total jobs lost.

Multiplier (indirect) jobs = total jobs created - direct jobs created.

Net value of jobs = multiplier jobs X salary.

The model determines and quantifies the job impacts for each policy. In general, jobs are created through:

- *Increased recycling, collection and processing.* AB 939 will already result in increased collection, recycling, and processing of a large quantity of material. Given the data available, it is difficult to distinguish between jobs that would result from the policy and jobs that would have resulted from AB 939, with or without the policy. However, to remain consistent with the rest of the analysis, the model counts all the jobs created to collect and recycle the material diverted as a result of the policy.

- *New manufacturing jobs created as a result of the policy.* These could be direct or indirect. For example, a recycled content paper policy may create new jobs in paper manufacturing, and in manufacturing equipment to make recycled content paper.

- *New administrative and professional jobs created as a result of the policy.* These jobs are based on the evaluation of administrative requirements, below. In most cases they are fairly insignificant.

- *Multiplier jobs.* Jobs created indirectly, through the infusion of net additional value into the economy -- the secondary effects of spending resulting from the above jobs, and from the enhanced supply of resources from recycling.

Jobs are lost due to:

- Reductions in manufacturing jobs.

- Reductions in jobs related to procurement of raw materials.

- Reductions that occur indirectly if the policy results in a net economic cost overall, and diverts funds from the private and public sector which might otherwise be put to more economically productive use.

For both job creation and loss we use the California Department of Commerce job multipliers for the appropriate industry to provide an estimate of the total job impact.

Jobs related to collection and recycling are based on the results of a survey of California Recycling Programs. See Appendix D for a description of this study.

The job value is determined by aggregating the average salary for each category of new jobs. In the model, an average salary of $25,000 or $30,000 in 1994 is used. This salary is increased at an annual rate of 2.9%, reflecting annual wage increases of production workers in manufacturing.

Only the net costs or benefits of the multiplier jobs are calculated at this stage of the model. New multiplier jobs resulting from increased employment due to the policy are counted as a benefit, while multiplier jobs resulting from jobs lost due to the policy are a cost.

Jobs that are directly related to the policy are not counted as a separate benefit or cost in the cost-benefit analysis. These jobs are already included in the cost of collecting and recycling or the end-user costs. A separate inclusion of these jobs would result in double counting. While these jobs are not counted as a direct benefit of the policy, the number of jobs created by the policy provides an additional means of assessing and comparing the impacts of the policy.

CAPITAL INVESTMENT BY INDUSTRY

In this section we evaluate the extent to which the policy will increase or reduce capital investment in the state. Like direct jobs, this category is not directly incorporated into the net cost or benefit of the policy, but provides a means of assessing the impacts of the policy. Capital investment depends on a number of factors beyond those related specifically to the policy, for example the economic climate in the state and permit requirements. Like material prices, these figures are difficult to determine. Capital investment within an existing plant is more easily quantified: a manufacturer will make the decision as to whether or not to invest in the new technology. The present value total capital investment for the seven year period was divided into annual "payments" based on an 8% annual interest rate.

The trading alternative in these policies provides some flexibility, and thus has a big impact on the expected level of capital investment. All other factors being equal, there will be less capital investment under a trading policy than under a policy without trading. At the same time, there will be fewer firms shutting down under a trading policy. With trading, a firm may choose not to make the investment, but to purchase credits instead.

Permit and siting issues are important if the policy is to encourage capital investment through the building of new manufacturing facilities in the state. However attractive a policy may be, it may not be enough to encourage firms to site in California given other disincentives such as permit requirements. While the reputation may or may not be justified, California is not viewed as an attractive location for many industries given issues such as taxes, workers compensation, and environmental regulation.

Capital investment figures are based on industry statistics, available data, and discussions with manufacturers in the field. Because these figures are subject to variation, we again provide a low, mid, and high estimate. As noted above, to avoid double counting, capital investment is not included in the cost-benefit calculation. These investments are already included in the costs to end-user and the cost of collecting and recycling.

ADMINISTRATIVE COSTS

Formulas:

*State administrative costs = $70,000 * number of staffpeople*
*Private administrative costs = number of regulated firms * 5% * $70,000*
(both of these increase at an annual rate of 2.9%)

Here, the model provides figures for the costs to administer and implement the program in both the public and private sector. These figures are based on administrative requirements for existing programs and interviews with government and industry employees involved with similar programs.

Existing government programs reveal a range of administrative requirements. Generally, one and one-half to two staff people can administer a program of at least 1,200 firms. Policies with less than 100 to 200 firms may only require one part-time staff person. The model assumes a salary plus overhead figure of $70,000 in 1994, increasing by 2.9% annually. This figure is based on the State Administration Manual salary and benefit cost for an Associate Waste Management Specialist.

Private sector costs may depend heavily on the size of the firm. Large firms already have staff to deal with environmental regulation, and this would simply be one more item on their agenda. A smaller firm that does not have the resources to deal with the policy might have to spend proportionally more time on the policy. For the private administrative costs, the model assumes that each regulated firm has one staff person that applies 5% of their time to the policy. This is equivalent to about one day per month. Because reporting requirements, either with or without trading are minimal, this represents a realistic assumption. The private salary and benefit is also assumed to be $70,000 a year in 1994 with a 2.9% annual increase.

NET (COST) OR BENEFIT

Formulas:
Net Benefit (Cost) =
value of materials
+ net value of jobs created
- net cost for collection and recycling
- total additional cost to end-user
- public administrative costs
- private administrative costs.

Benefit (cost) per ton diverted =
net benefit (cost) / diversion resulting from policy.

The policy impact model allows us to calculate the net cost or benefit of each policy alternative. A positive value for the net benefit or cost means that the policy results in a net benefit to the state, while a negative value means that the policy results in a net cost to the state. A high value, either negative or positive in any one of three key factors in the above equation, can serve to drive the end result of the equation. These factors are: 1) the value of the materials, 2) the net cost of recycling, and 3) the cost to end-users. In general, a net benefit will result when the value of the materials diverted is high or when the net cost of collecting and recycling is negative. This occurs when the value of avoided land disposal is greater than the cost of recycling. The policy will, in general, result in a net cost when the cost of collection and recycling and/or the cost to end-users is high. The other three factors in the above equation, the net value of jobs created, public administrative costs, and private administrative costs, prove to be *relatively* minor contributors to the net benefit or cost of the policy.

The net cost or benefit does not break down the costs and benefits to the different groups impacted by the policy. Benefits and costs will accrue differently to each sector and for each policy. For example, benefits related to avoided land disposal accrue to local governments and rate payers that would normally be disposing of the material and paying for new landfills in the future. The cost to collect and recycle will be incurred by local governments and private recyclers. It may be offset by the benefits these groups receive from the value of the material diverted. The cost to the end-user will be born directly by manufacturers that are impacted by the policy, as will private administrative costs.

The model evaluates the impacts of these policies over a seven year period, from 1994 through 2000. A net cost or benefit is calculated for each year as well as for the seven year period. Because low, mid, and high diversion and cost estimates are used for several of the categories in the model, the net cost or benefit is presented as a range rather than a single number. For most of the policies the mid-range figure represents the most realistic value given current conditions, while the low and high represent the range of results that might occur if those conditions change.

To provide a means of comparison, the net cost/benefit is also calculated on a per ton basis. Again, there are three estimates, based on the total net cost/benefit figures and the appropriate volume diverted.

ENDNOTES

1. Two EPA documents were used for this report: ***The Characterization of Municipal Solid Waste in the United States, 1960 to 2000 (Update 1988)*** *and* ***Characterization of Municipal Solid Waste in the United States: 1992 Update Executive Summary****. Both documents are by Franklin and Associates, Wichita Kansas, for EPA, and are referred to as either EPA or Franklin data. The 1988 update was used for projecting waste generation and determining trends in generation and recycling, while the 1992 update was used for 1990 generation and recycling figures. For the SRRE data, a February 5, 1993 and April 16, 1993 updates were used.*

2. The EPA generation projections did not always appear consistent, and in some cases were modified based on industry trends. Changes in generation and recycling patterns in the EPA data between 1988 and 1992 occurred in many cases. Often the figures that were predicted for 1990 in the 1988 report were quite different from the actual figures for 1990 in the 1992 report.

3. Where appropriate, container sales data from the California Department of Conservation, Division of Recycling were used. This data is obtained from beverage manufacturers in the state.

4. The 1991 GDP share represents a figure that is in the mid-range of GDP share in recent years, which has fluctuated from 12.4% to 13.6% since 1985. The 1991 figure is sufficient for the purposes of this study.

5. California's newsprint recycled content mandate has created a strong demand for old newspaper in Oregon, for example.

6. For example, the James River plant in Halsey, Oregon can consume up to 20% of California's mixed office paper wastestream.

7. Market prices are used for most commodities, including paper, metals, glass, and plastic. For the compost policy and the refillable policy, the price (value) of substitute materials are used. For the compost policy this means the price of soil amendments, and for the refilling policy, the price of glass and plastic containers.

*8. Sources for recycling cost data include: David H. Folz, University of Tennessee, Knoxville, "The economics of municipal recycling: a preliminary analysis.", Paper presented at the Southeastern Conference on Public Administration, Montgomery Alabama, October 7-9, 1992; National Solid Waste Management Association, "The cost to recycle at a materials recovery facility.", Washington D.C., 1992; Ron Perkins, "Collection economics for plastic recycling: a new methodology." **Resource Recycling**, May 1991, p.66.; Waste Management of North America, Inc., **Recycling in the 90s: A Shared Responsibility**, Oak Brook Illinois, 1993; Brenda A. Platt and David Morris, "The Economic Benefits of Recycling." Institute for Local Self Reliance, January 1993; Tellus Institute, **Disposal Cost Fee Study Final Report**, prepared for the Board, February 15, 1991; Pennsylvania Soft Drink Association, **Pennsylvania Municipal Recycling Costs: Eight Case Studies**, November 1992; Plastic Recycling Update, October 1992, Volume 5, Number 10; California Department of Conservation, Processing Fee Workshop, December 1992; Steve Apotheker, "Finding a formula for successful recycling." **Resource Recycling**, October 1992; Steve Apotheker, "Recycling in Canada's big cities." **Resource Recycling**, December 1992; Resource Recycling's Bottle-Can Update, January 1993; and a paper by Harvey Gershman, president, GBB Consulting, March 1992.*

9. Green Fees: How a Tax Shift Can Work for the Environment and the Economy, World Resources Institute, November 1992.

10. The worst-case scenario would be highest cost and highest diversion quantity. However we feel this is unrealistic in trading scenarios, given that industry will not make additional expenditures if it is not necessary. This worst case scenario is possible if trading is not allowed.

APPENDIX B
ISSUES RELATED TO TRADEABLE CREDITS, RECYCLED CONTENT, AND MANUFACTURER RESPONSIBILITY

ADMINISTRATION OF RECYCLED CONTENT AND TRADABLE CREDITS

While the concept of tradable credits for recycled content has been widely discussed in the past few years, there has been little evaluation of the practical implications of this policy. Such a discussion is necessary, however, if tradable credits are to move from a policy idea to an implementable policy. Because it is necessary to understand how a policy will be implemented in order to analyze its impacts, this section provides a discussion of administrative issues that apply more generally to recycled content with tradable credit policies. This section is divided into two parts: the first assesses the administrative requirements of recycled content and recycled content with tradable credits policies, and the second discusses features for a successful tradable credit policy. We discuss features specific to each policy in those sections.

ADMINISTRATIVE ISSUES

There are seven general areas or features that impact administration and implementation:

- The number of firms impacted by the policy.

The relationship here between number of firms and administrability is obvious -- it takes more resources and time to administer a program that includes a greater number of firms.

- The definition of who is regulated under the program.

This issue is critical for administration and enforcement, and in many cases may be decided in the legislation, before the impact of the decision is fully understood. Terminology in the legislation enacting a program may lock the agency into regulating a certain group when this is not the most efficient or effective approach. There are at least four levels where a recycled content policy can establish responsibility: manufacturers of a product, distributors, retailers, or consumers. Each of these has its advantages and disadvantages, and there is no one correct choice. The unique characteristics of the distribution system for each product may indicate the most efficient place to assign responsibility.

TABLE B-1 CHOOSING A RESPONSIBLE PARTY FOR RECYCLED CONTENT POLICIES		
Responsible Party	**Advantages**	**Disadvantages**
Container Manufacturer	Fewer regulated entities. Directly responsible for recycled content levels.	May be out of state, making enforcement more difficult. Less accountable to state and the public – often no name recognition.
Distributor or first importer in state	Number of regulated entities may be reasonable. Directly accountable to the state and public – name recognition.	Number of distributors in some cases may be large.
Retailers	Directly accountable to customers. Can demand compliance by manufacturers, or not sell the product.	Number of regulated entities is very large. Political strength of this group may make this infeasible.
Consumers	Can make the choice to purchase the material or not – directly accountable.	Number of regulated entities may be very high.

California's glass recycled content policy places responsibility on the glass container manufacturer. One DOR staff person feels that the policy is more difficult to enforce than some of the state's other content policies because it requires manufacturers, wherever they are located, to report and meet the standard. If distributors or importers into the state were responsible, there would be more direct accountability to the state. The fiberglass policy also requires manufacturers to report. In this case, there are only about a dozen manufacturers, and it is relatively easy to administer the policy.[1]

The newsprint recycled content policy requires consumers of newsprint -- printers and publishers -- to meet the content level. The number of potential regulated entities is high. Last year the Board sent out notification to 12,000 printers and publishers. They received forms back from about 1,200 firms. While most of the 10,000 non-reporting firms may not use newsprint, there is no practical way to determine how many additional firms should be reporting.[2] The plastic trash bag policy was requiring bag manufacturers and resin producers -- about 200 firms -- to meet the standard.

- The location of the firms -- in state or out-of-state.

This issue is important both to the administrability and enforcement authority of the state. There are two levels of concern: the legal ability of the state to regulate firms in other states, and the practical ability to do so. The extent to which regulating firms out-of-state with a California content policy can occur is uncertain. According to the one Board staffperson, going out of state to audit regulated firms and collecting fines and penalties should not be a problem.[3] The state has a "long-arm" statute that allows it to regulate out-of-state. In addition, firms may be required to send their records to the Board, rather than the Board auditor traveling to the facility.

DOC considers out of state regulation to be more of a gray area. This may be related to the fact that the agency is already implementing a recycled content law that regulated out-of-state glass manufacturers. A case in New York related to wildlife protection provides a basis for regulating firms out of state, however the glass industry has a case on the other side. To date, there has been no regulation of out-of-state firms for recycled content policies by either agency.[4]

- Reporting requirements for regulated firms.

Reporting requirements, if extensive, may discourage firms from participating in the program. The Board, in their newsprint and trash bag programs, is making a strong effort to minimize the amount of reporting required, and also to be sensitive to issues related to trade secrets. In both these programs, firms are, or will be required to report very little to the state. They are required to maintain records that verify their content levels. The requirements of the policy must achieve a balance between requiring enough information to make the report a useful tool in evaluating the firm's compliance and the effectiveness of the policy, and requiring so much information so as to be burdensome to both industry and the state, or to neglect trade-secret or privacy issues of the firm.

- Coordination of the policy with existing programs and recycling infrastructure.

There are already myriad laws and regulations related to solid waste and recycling in the state, as well as federal laws. No new recycled content and/or tradable credit policy will be implemented in a vacuum. It is essential to evaluate how each policy will mesh with existing programs. For example, will a recycled content policy for corrugated result in price increases for newsprint that allow publishers to exempt themselves from the law. Does a policy simply shift diversion from an existing material? For example, tissue manufacturers are currently a major market for mixed paper. A corrugated policy might simply switch use of mixed paper from tissue to corrugated without creating a demand for additional secondary materials. One alternative for paper recycled content, discussed in more detail in Chapter 5, is to implement a single paper recycled content standard, require all paper grades to comply, and allow trading between paper grades.

- Auditing and enforcement requirements.

With any new regulation or policy, there will be some firms that do not comply. The number of firms that violate a law will depend on the motivation to cheat, the ability of the regulatory agency to detect cheating, and the penalties that occur if they do. If firms do not feel like there is a chance their violations will be detected or penalized, and they can save money by not complying, they may. Studies of regulatory enforcement have shown that there are a small number of entities that will comply no matter what, a small number that will violate, no matter what, and a large majority that will comply if they feel there is some chance they will get caught if they violate.[5] The table below summarizes issues related to enforcement of recycled content and trading policies. The discussion of the EPA's lead trading program also provides insight into enforcement requirements (See box, below). Potential tools for enforcement include:

- Random sample audits with severe penalties, as with IRS audits.
- Audits and inspections targeted towards suspected violators (targeted through reports, complaints, etc.).
- Cross-checking records on reports.
- Penalties at least equivalent to potential gain through noncompliance.
- Publicity about violations when a firm is caught.

Noncompliance with recycled content policies does not pose a public health threat, as does noncompliance with many other environmental regulations. This reduces somewhat the urgency in enforcing these laws. Trading policies, however, offer the potential for illicit profit, and thus should be more heavily enforced.

TABLE B-2 ENFORCEMENT ISSUES FOR RECYCLED CONTENT AND TRADABLE CREDIT POLICIES		
Violation	**Motivation**	**Solution (Detection/Penalty)**
Failure to report. (With or w/out trading)	Remain out of regulatory loop.	Outreach to firms, audits of potential regulatees, cooperation with industry groups.
Reporting false recycled content levels. (Without trading)	Avoid paying costs of using secondary materials. Avoid penalty for noncompliance.	Audits of selected firms, severe penalty for blatant violators.
Reporting false recycled content levels. (With trading)	Potential to profit through sale of false credits.	Audits of selected firms, severe penalty for violators. Penalty must exceed revenue gain of noncompliance. Other tools to detect include: ■ Compare records of other trades. ■ Evaluate price of trades (low price may indicate cheating).
Not meeting the content requirement. (With or without trading)	Avoid paying the costs of using secondary materials.	Reports and audits to check content levels, penalty for noncompliance.
Sale of excess or false credits. (With trading)	Profit	Same as for reporting false recycled content levels (with trading).
Purchase of false credits. (With trading)	Profit	Same as for reporting false recycled content levels (with trading).
Holding onto credits or inflating price of credits. (With trading)	Profit, eliminate competitors.	Evaluate prices of trades, complaints from other firms. If potential for monopoly on credits exists, possible provide an "out" through landfill credits.
Collusion with another end-user to purchase or sell false credits. (With Trading)	Profit	Same as for reporting false recycled content levels (with trading). Detection may be more difficult if firms are colluding. Severe penalty would be necessary. Collusion could potentially violate anti-trust laws, which would be a strong decentive.

EPA'S LEAD TRADING PROGRAM

EPA's lead trading program for gasoline is widely viewed as the most successful example of a tradable permit policy. It is also the system that is most similar to a tradable credit policy. Lead in gasoline was phased out between 1979 and 1988, from a lead concentration standard of 1.10 gplg (grams per leaded gallon), to 0.10 gplg. Between 1985 and 1987, up to 20% of the lead that was consumed passed through trading deals. The savings that resulted from the program is estimated to be as much as $226 million.[6]

Refiners were required to meet a certain lead content in gas, with the amount decreasing each year. Some firms were already below the limits, or could easily obtain them, while others needed to make more extensive production changes in order to do so. Under the policy, refiners that were below the lead level could trade lead content credits with other firms, or bank them for future use.

About 900 refiners reported trades to EPA each quarter. Because refiners were already buying and selling lead and other commodities amongst each other, lead credits were relatively easy to implement. In addition, there are only two manufacturers of lead in the US, so the EPA knew the total amount of lead available for trading.

Because the sale of lead credits provided an opportunity for generating an illicit profit, there was also a great incentive to cheat the system, most often by over-reporting volumes to increase the number of credits available for sale. Initially, without audits or other enforcement activity, there was a significant amount of cheating going on. After the first year, the statute was amended to allow for enforcement, and the EPA's Enforcement Division took over some aspects of the program. In addition to the 1 to 1 1/2 staffpeople that handled the trade reports, the EPA hired a full time auditor with a CPA background to conduct thorough on-site visits at selected refiners. Those refiners that were most likely to be violating, based on volumes and information from other refiners, were targeted for enforcement. About 20 on-site audits were conducted a year. According to the director of EPA's enforcement office, only a small percentage of firms were violating. Most blatant violations were conducted by low profile and low profit firms. Publicity and the large fines that were involved helped create an incentive for firms to comply. The large, well known refiners also had some violations, but most of these were mistakes, not willful violations.

There are several features that contributed to the success of the lead program. With the exception of knowledge of the total number of credits available, all of these features could potentially apply to a tradable content policy:

- *Administration was relatively easy.*
- *Lead trading fit in with existing commodity markets.*
- *Strong auditing and enforcement presence by EPA.*
- *Adequate penalties.*
- *EPA knew the total amount of lead available for trading.*

CONSIDERATIONS IN THE DESIGN, ADMINISTRATION, AND EFFECTIVENESS OF TRADING POLICIES

Developing a consensus among industry and environmental groups on a recycled content/tradable credit policy during legislative and regulatory processes may be crucial to the success of the program. Such a consensus can influence how the policy is implemented and how effective the policy is in increasing recycled content. Industry cooperation and compliance will be much higher if they have participated in the policymaking process.

The success of a trading policy depends in large part on the ability and motivation of regulated firms to conduct trades. There is considerable literature on tradable permit programs for air pollution and lead, and what factors encourage trading.[7] While these studies provide some insights into tradable credits for recycled content, there are many fundamental differences between trading in these programs that may affect the ability to trade.

- *Make trades easy.* If trading credits requires a large number of forms, approval by legal experts, approval by the state agency, or other types of certification, they are unlikely to occur. For tradable credits, it is reasonable to require minimal record keeping and approval, and then follow through with audits if the required records are not provided. There should be no requirement for prior approval. Firms should be allowed to negotiate the trade amongst themselves, with outside assistance from a broker or the state if necessary, and report those transactions that are made. One related issue is how often to require firms to report. Glass manufacturers submit monthly reports to DOC, refiners submitted lead reports quarterly, and newsprint consumers submit annually. While an annual form may be simpler, it may not encourage trading, while more frequent reporting would.

- *Information on potential trades.* Firms need to know about prospective buyers and sellers in order to make the trade. With tradable credits, the secondary materials are already a commodity, although, for some materials the markets are relatively new. Depending on the material, there may be relatively few information barriers to finding trading partners. Both the state and private brokers could also play a role. The state, through CALMAX and DOC's Marketwatch already provide lists of secondary materials available. Tradable credits could be added to the list with little additional cost. Computer bulletin boards could also provide information for trading. Private brokers that deal with stock sales could also handle tradable credits for secondary materials. This is most likely to occur for larger trades.[8]

  The Chicago Board of Trade and several other groups, including the State Market Development Roundtable, organized through EPA, are evaluating the feasibility of commodity trading markets for secondary materials.[9] Such a system would facilitate tradable credits. For air pollution credits, the necessity of a third party in trading permits decreases with the number of trades. The more trades are completed, the less need for a broker. Relatively few air pollution trades are made. There have been about 10 trades in the South Coast Air Quality Control District (SCAQMD) in the last year and a half. The number is small, in part, because of the recession. For administrative purposes, the SCAQMD prefers trades that do not involve the broker purchasing the material because this tends to confuse the trade.

- *In-state vs. out-of-state trading.* The goal of these policies is to stimulate demand for secondary materials in California, as well as to increase diversion of those materials. Many of the products to which recycled content policies are applied are manufactured out-of-state. As a result, much of the market stimulus and diversion will also occur out-of-state. While out-of-state manufacturers should receive credit for their recycled content levels, even if the material diverted is not from the state, it does not seem reasonable to allow them to sell additional credits. Thus, we would suggest that only in-state end-users, or end-users that could prove they were using California secondary materials would qualify to sell credits.

- *Provide incentives to the decision-maker.* One theory, proposed by John Polizano of AER-X, a broker of air pollution credits, is that it is the microeconomics of the decision maker that dictates whether or not a trade will succeed.[10] His theory is that it is the individual decision maker, not the dynamics of the firm or the trading market, that will make a trade happen. According to this idea, then, the key issue is what will make the person in each firm that has the responsibility for trading, make the trade. For recycled content trading, this person could be the purchaser, a mid-level manager, an environmental compliance person, or, for a smaller firm, the company owner or manager. Incentives to this person, then, may be important for a successful trading program. Below, we list several factors which may either encourage or discourage trading at this level.

Reasons to Trade

- *The "warm fuzzy feeling"/doing an environmental good.*
- *Belief in the program and market-based mechanisms.*
- *Good publicity.*
- *Chance of promotion, recognition in the firm.*
- *Monetary benefit to the firm and any self-gain that may result.*

Reasons Not to Trade

- *Too complicated or difficult, results in extra work.*
- *No direct benefit to the individual.*
- *Disdain for the program, regulations, or state agency.*
- *Lack of information on trading opportunities.*
- *Unable to come to an agreement on price and conditions of trade.*

MARKET AND PRICE IMPACTS

While market-incentive based policies such as tradable credits in theory result in a more efficient marketplace, policies such as tradable credits have the potential to create inequities in the market. It is important to understand these potential impacts and the situations where they may be most problematic.

To help illustrate some of these market impacts, we compare three tradable credit scenarios Each involves ten firms producing 1 million tons of a product. The content level is 50%. The production and content levels of the ten firms vary in the three examples.

Table B-3. Tradable Credits – Scenario 1

Manufacturer	Production	Sec. Mat.	% Rec. Cont.	Credits - Sell	Credits - Buy
A	100,000	40,000	40%		10,000
B	100,000	50,000	50%		
C	200,000	150,000	75%	50,000	
D	50,000	10,000	20%		15,000
E	50,000	0	0%		25,000
F	200,000	50,000	25%		50,000
G	50,000	25,000	50%		
H	50,000	50,000	100%	25,000	
I	100,000	70,000	70%	20,000	
J	100,000	10,000	10%		40,000
Total Credits				95,000	140,000
Diversion Impact		45,000	Credits needed		

B-123.XLS

Table B-4. Tradable Credits – Scenario 2

Manufacturer	Production	Sec. Mat.	% Rec. Cont.	Credits - Sell	Credits - Buy
A	500,000	500,000	100%	250,000	
B	50,000	0	0%		25,000
C	100,000	25,000	25%		25,000
D	50,000	0	0%		25,000
E	60,000	30,000	50%		
F	40,000	0	0%		20,000
G	20,000	0	0%		10,000
H	40,000	0	0%		20,000
I	40,000	10,000	25%		10,000
J	100,000	40,000	40%		10,000
Total Credits				250,000	145,000
Diversion Impact		105,000	Credits unused		

B-123.XLS

Table B-5. Tradable Credits – Scenario 3

Manufacturer	Production	Sec. Mat.	% Rec. Cont.	Credits - Sell	Credits - Buy
A	500,000	0	0%		250,000
B	50,000	20,000	40%		10,000
C	100,000	60,000	60%	10,000	
D	50,000	25,000	50%		
E	60,000	30,000	50%		
F	40,000	0	0%		20,000
G	20,000	20,000	100%	10,000	
H	40,000	40,000	100%	20,000	
I	40,000	40,000	100%	20,000	
J	100,000	50,000	50%		
Total Credits				60,000	280,000
Diversion Impact		220,000	Credits needed		

B-123.XLS

Trading Scenario #1

In Scenario #1, the production and content levels are distributed fairly evenly among the ten firms. There is no one firm that dominates the market, either in production or in recycled content credits. Under the trading policy, five firms will need to purchase credits, and three firms will have credits available to sell. There is a shortfall of 45,000 tons, meaning that the ten manufacturers will have to increase their recycled content use by 45,000 tons to comply with the policy. We would expect that those firms that could increase their use of recycled content for the least cost would do so, and at the same time these firms would generate credits which they could sell. While the policy would create an increased demand for secondary materials, given the volumes in the example, the increased demand is relatively low. In this case, a higher content level might be desirable.

Trading Scenario #2

Here, production and content levels are not evenly distributed. There is one large manufacturer that produces half of the total market, and is at 100% recycled content. The remaining production and content is distributed relatively evenly among the other nine firms. Because the largest firm is at 100% recycled content already, the policy will not create any additional diversion. There are over 100,000 tons of extra credits available. Here, none of the other firms need to increase their use of secondary materials, as long as they can purchase credits from Manufacturer A.

Because Manufacturer A is the only firm with credits to sell, they can control the market for credits, and potentially exclude smaller firms from the market by manipulating the price, or withholding credits from the market. In this case, small firms that could not afford to increase the use of secondary materials could potentially be shut down.

If a recycled content with trading policy was implemented in a scenario such as this, the content level would have to be carefully established. Based simply on the feasible content level and the number of credits available, a much higher standard would be necessary. Such a high standard, however, might place an excessive burden on smaller businesses that did not or could not meet the high levels, and would be at the mercy of the large firm to purchase credits. Small firms that increased their recycled content levels would probably not be able to move into the credits market because the large firm would be dominant. In this case, trading might not be appropriate for the recycled content policy. This situation is somewhat analogous to that of recycled content newsprint in California.

Trading Scenario #3

This scenario is the opposite of #2. Here, the large manufacturer has no recycled content, and the nine smaller firms have content levels ranging from 0% to 100%. There is a shortfall of content credits of 220,000 tons, meaning that manufacturers will need to increase their usage of secondary materials by at least 220,000 tons to meet the standard. The firms at the greatest disadvantage in this scenario are the two small firms that do not meet the content standard. They would be forced to compete with the large firms for the few content credits that are available. There would be a strong incentive for firms to increase their use of recycled content, especially if they could sell credits to the large manufacturer. The large manufacturer might decide to use secondary materials at their facility, to avoid the need to buy credits. Such a change might eliminate the need to trade credits, however it would create a stronger demand for secondary materials.

While purely hypothetical; these three examples help to illustrate some of the complexities that may result with a trading policy. They highlight the importance of understanding the existing marketplace for the product before the policy is developed. Such an understanding can help to avoid surprises when the policy is implemented.

There are other issues related to pricing and markets that should be evaluated before a recycled content with trading policy is established:

- *How will the policy impact prices for secondary materials?* When there is more than one product in which the secondary material can be used, the content policy may discourage the use of secondary materials in the other products. Secondary paper provides an example. A content policy for corrugated would increase the demand for secondary paper of all grades, potentially resulting in price increases for secondary paper. While this is a desirable market response, it could also result in less secondary paper use in other paper products. Tissue manufacturers currently use a relatively high level of secondary materials. If the price of secondary paper became too high, they might reduce their usage and switch back to wood pulp, to the extent possible. If this type of price and material shift occurs, there is a possibility that overall use of secondary materials could actually decrease as a result of the policy. As noted earlier, one solution to this problem for paper is to place recycled content policies on all paper products, not a single grade of paper.

- *Will the policy result in substitution for non-regulated products?* There may be situations in which the policy will induce consumers or manufacturers to substitute other materials or products to avoid the regulation. The plastic industrial containers policy may create such problems. If it becomes more costly to manufacture plastic industrial containers, or if manufacturers perceive that it will be more difficult, they may switch to other materials such as steel or wood. To the extent that these materials are recycled or reused, the result would be beneficial for overall diversion. The policy could result in greater amounts of waste if the materials are not recycled or re-used -- if wooden pallets are discarded after one use, for example. In addition, the policy would not have the desired impact on the demand for recycled plastic.

ENDNOTES

1. Source: California Department of Conservation staff interviews, February 1993.

2. Source: Personnel communication with Charlotte Sabeh, California Integrated Waste Management Board, February 1993.

3. Source: Personal communications with Maureen Morrison, California Integrated Waste Management Board, Legal Office, February 1993.

4. Source: Personnel communication with Dale Will. Department of Conservation. Legal Office. February 1993.

5. Kieth Hawkins and John Thomas. ***Enforcing Regulations****. Klawer Nijhoff Publishing. Boston. 1984; John S. Diver; "A Theory of Regulatory Enforcement"* ***Public Policy****. Vol. 28 No 3. 1980. p. 257-299; Clifford S. Russel. "Monitoring and Enforcement" in* ***Public Policies for Environmental Protection****. Pant Portney, ed. Resources for the Future. Washington. D.C. 1990. p 243-274.*

6. Sources: Mark Haillson, EPA enforcement division, personal communication, February 1993; Lily Whiteman, "Trades to Remember: The Lead Phase Down," ***EPA Journal*** *May/June 1992. p. 28-39; and Robert W. Hahn & Gordon L. Hester, "Marketable Permits: Lessons from Theory and Practice,"* ***Ecology Law Quarterly****. 16 (1989) p. 361-406.*

7. A few include: Project 88 - Round II: Incentives for Action: Designing Market-Based Environmental Strategies. Robert Stauns, Project Director, Washington D.C., May 1991; Timothy Tregarthen, "The Market for Dumping Rights"; ***The Margin****, December 1985 p.6; Robert N. Stauins, "Harnning the Market Place,"* ***EPA Journal****, May 15 1992, p. 21-25; Terry M. Dinan, "Increasing Recycling Through Marketable Permits Implementation Issues." Submitted to Project 88 - Round II and South Coast Air Quality Management District, Emission Permit Trading, Workshop Series. May 1990 through January 1993.*

8. Sources: Personal communications with John Polrtano, Aer-X, February 3, 1993; Ambrose Lamb, SCAQMD, February 8, 1993.

9. Cite: EPA office of Solid Waste and Emergency Response, State Market Development Roundtable. June 4, 1992.

10. Source: Personal communication on February 3, 1993.

APPENDIX C
AGRICULTURAL COMPOST MARKET DEVELOPMENT IN CALIFORNIA

BACKGROUND INFORMATION

The development of a viable composting industry in California is a crucial component of the effort to achieve the mandates of AB 939. The state will not be able to achieve a 50 percent reduction in the quantity of materials disposed of in California's landfills without composting a significant amount of the organic waste stream. There are many technical, economic and regulatory issues associated with the development of composting on a large scale in California. Many of these issues can be overcome through careful scientific research, responsive engineering and well thought out regulations and product standards. However, if the demands of potential compost product users are not understood and addressed thoroughly, large scale compost production may never get off the ground in California. Agriculture is by far California's largest *potential* market for compost products. If compost products can meet farmer's specifications and the potential benefits for soils and crops become widely accepted within this industry, then the future of compost should be bright in California.

This document provides an overview of the quantity of organic materials that could potentially be composted in the state, the estimated size of the various compost market sectors and a rough breakdown of the major agricultural market sectors. An overview follows of the potential benefits of compost use in agriculture in terms of soil characteristics and crop yields, as well as environmental and economic factors. In addition, the barriers to widespread use of compost in agriculture are discussed, including issues such as cost, quality, logistics, established practices and information availability. These background sections are followed by several alternative strategies for the California Integrated Waste Management Board to consider to help reduce barriers and develop this essential market.

ORGANIC MATERIAL QUANTITIES IN THE WASTE STREAM

The vast majority of compostable materials such as yard waste, food waste and mixed paper are still landfilled in California. According to data compiled by the Board from SRREs submitted by Cities and Counties, less than 10 percent of the yard waste generated annually in the state was diverted from landfill disposal in 1990. Food waste and other potentially compostable organic materials also have very low diversion rates. The amount of compostable organic materials in the disposal stream provides a major opportunity to reduce the solid waste disposal rate and to produce a valuable source of organic matter. Table C-1 below summarizes the quantities of potentially compostable material in California's waste stream. As of 1990, these organic materials contributed almost 15 million tons to California's dwindling landfills, or about 40 percent of the total quantity of waste disposed.

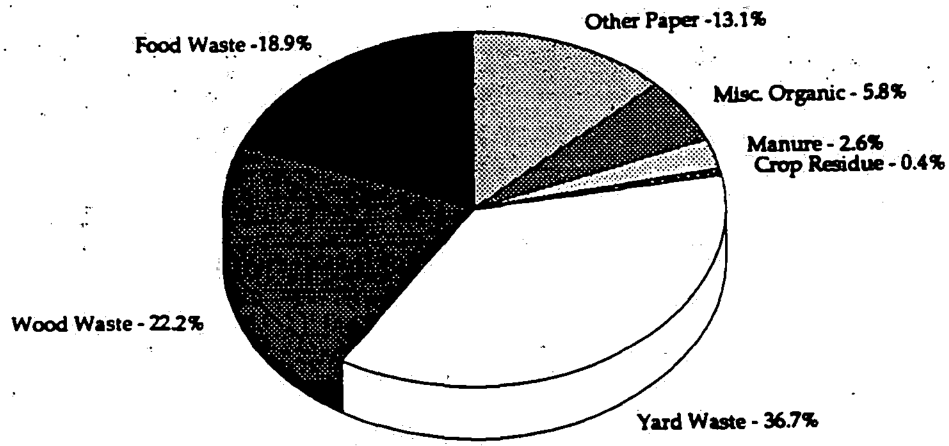
TABLE C-1 POTENTIALLY COMPOSTABLE MATERIALS IN CALIFORNIA'S WASTESTREAM, 1990		
Compostable Materials	**Quantity Disposed (TPY)**	**Percent of Disposed Wastestream**
Yard Waste	5,629,539	14.4%
Wood Waste	3,399,882	8.7%
Food Waste	2,898,114	7.4%
Other Paper	2,015,511	5.2%
Miscellaneous Organic	902,476	2.3%
Manure	406,577	1.0%
Crop Residues	61,525	0.2%
Total	**15,313,624**	**39.0%**

Source: CIWMB Interim Database Project, March 19, 1993 Revision

Figure C-1 below shows the relative contribution of various waste types to the total potentially compostable wastestream. Yard waste is the largest contributor, comprising 36 percent of total compostable organic waste. In 1990, approximately 5.5 million tons of yard waste are estimated to have been disposed of in the state. This number may be significantly higher in future years due to the fact that the current figure was calculated in the midst of a prolonged drought which has now apparently ended.

Wood waste, food waste and other paper are the second, third and fourth largest sources of organic material. A significant portion of the wood waste stream is not suitable for inclusion in compost operations due to contamination, composition and other factors. "Other paper" includes various mixed grades of moisture- or food-contaminated fibers as well as tissue and towel paper. Although all of these materials are compostable, the emphasis of most composting operations around the nation has been on yard waste; it is relatively easy to segregate from other material for collection and requires relatively simple technologies for processing into organic soil amendment products such as mulch and compost. However, if cities and counties are to achieve the 50 percent disposal reduction goals of AB 939, organic materials such as food waste and other paper will also have to composted.

FIGURE C-1
CALIFORNIA'S COMPOSTABLE WASTESTREAM



The amount of compost that will be produced in the state by the end of the decade is uncertain. According to the Board Interim Database Project, over 15 million tons of compostable materials are disposed of annually. Based on 1990 figures, if 70 percent of these materials are recovered for composting, between 4 and 6 million tons of compost could be produced in the state.[1] This figure will increase as waste generation increases as a result of population growth and other factors.

THE IMPORTANCE OF AGRICULTURAL COMPOST MARKETS

Although agriculture is by far the largest potential market for compost products in California, there is very little quantitative data on demand. Some research has been conducted at the County level to assess the potential demand. For example, a 1983 report written for Santa Cruz County found that 90 percent of farmers in the County already used some type of organic material (such as manures) in their soil management efforts because of the nature of the soils, the presence of high value crops (improving the economics of organic material application), and an exceptional awareness of the benefits. The study also found that Santa Cruz County farmers could consume all of the compost that could be produced locally from organic materials in the waste stream.[2] Another study is currently underway to estimate the potential demand for compost in all agricultural sectors in Santa Barbara County.

A 1992 study by Battelle on the practical potential applications for compost in the U.S. found that as much as 500 million tons of compost could be used annually within a 50-mile radius of urban centers with populations over 100,000. Of this quantity, 450 million tons could potentially be used by agriculture.[3] In California, the study estimated the total potential compost application to be about 14.5 million tons per year. As shown in Table C-2 below, the study estimated that potential agricultural use is over 10.5 million tons per year, comprising 72 percent of the estimated total potential application level in the state.

TABLE C-2
COMPOST APPLICATION BY MARKET IN CALIFORNIA

Market	Tons	Percent of Total Market
Landscape	190,612	1.3%
Topsoil	234,951	1.6%
Peat/Bark	75,918	0.5%
Landfill	14,662	0.1%
Nurseries	491,097	3.4%
Sod	393,267	2.7%
Silviculture	2,632,940	18.0%
Agriculture	10,615,500	72.5%
Total	**14,648,947**	**100.0%**

Source: Slivka, et al., Potential U.S. Applications for Compost

The data in Table C-2 must be interpreted very carefully because it is highly generalized and assumes potential applications of compost, not potential demand. The distribution of markets may be very different on the local level. However, this data does illustrate the importance of developing the agricultural compost market sector in California. Cities and counties considering developing their own composting systems should, of course, not rely on this data as an assurance that there will be a market for compost. The Battelle study divides the agriculture industry into three sectors: harvested cropland; pasture/grazing land; and land for cover crops, legumes and soil improvement grasses. In addition, the study estimates physical application rates to be 26 tons per acre for harvested cropland, 22 tons per acre for pasture and grazing land, and 51 tons per acre for cover crops, legumes and soil improvement grasses. Compost application would occur every five years. Table C-3 illustrates by sector the potential physical application of compost in California.

TABLE C-3 POTENTIAL AGRICULTURE COMPOST APPLICATION IN CALIFORNIA		
Type of Cropland	**Application Area (Acres)**	**Potential Application (Tons)**
Harvested Cropland	1,616,734	8,407,000
Pasture/Grazing	403,506	1,775,400
Cover Crops, Legumes, and Soil Improvement Grasses	43,458	433,100
Total	**2,063,698**	**10,615,500**

Source: Slivka, et al., Potential U.S. Applications for Compost

BENEFITS OF COMPOST USE IN AGRICULTURE

Although compost produced from components of the municipal solid waste stream typically contains nitrogen and phosphorous levels higher than most agricultural soils[4], there is a common misconception that its main value is as a fertilizer. Although compost does have nutrient benefits, the primary benefit of compost use for agricultural soils is its ability to enhance the physical and chemical properties of soil.[5] In addition to these soil benefits, there are also potential environmental and economic benefits for agriculture.[6]

BENEFITS FOR PHYSICAL, CHEMICAL AND BIOLOGICAL PROPERTIES OF SOILS

The primary benefit of compost for agricultural soils is derived from the presence of organic matter. Organic materials increase water retention and cation exchange capacity, which enables the soil to retain nutrients and avoid leaching by irrigation or rainfall. Organic materials also reduce soil bulk density and serve as a source of plant nutrients that are made gradually available.[7] Compost application to agricultural land potentially provides the following physical, chemical and biological benefits.

- Physical Properties of Soils: Compost improves soil texture, increases water holding capacity, improves soil aeration capacity, improves structural stability, provides resistance to water and wind erosion, improves root penetration, and stabilizes soil temperature.

- Chemical Properties of Soils: Compost increases macro- and micro-nutrient content, increases availability of mineral substances in soil, increases pH in acid soils[8], regulates mineral input (particularly nitrogenous compounds), serves as a buffer in making minerals gradually available to plants.

- Biological Properties of Soils: Compost affects the development of fauna and microflora, reduces vulnerability to attack by parasites, promotes faster root development, can produce higher yields, and inhibits weed growth[9] and soil-born diseases.

ENVIRONMENTAL BENEFITS

In addition to the obvious benefit of reducing the quantity of organic materials disposed of at solid waste landfills throughout the state, compost use by agriculture offers several other potentially significant environmental benefits including:

- Reduced Nonpoint Source Pollution: Nonpoint source pollution generally consists of discharges carried by run-off or leachate to nearby surface or groundwater, such as sediment, nutrients, pesticides, metals and pathogens.[10] Agricultural run-off sources are considered to be the major contributor to non-point source water quality problems.[11] The ability of compost to reduce both surface runoff and leaching into groundwater (particularly nitrates) could substantially mitigate this environmental problem. Research conducted in Connecticut indicates that organic nitrogen in compost is less likely to leach into groundwater because it is released more slowly than nitrogen in inorganic fertilizer.[12]

- Water Conservation: Compost application increases the water holding capacity of soils and reduces water loss as a result of percolation, evaporation and runoff. Compost application rates of 10 to 15 tons/acre can increase water holding capacity by 5 to 10 percent; higher rates of compost application can potentially further increase this savings (Shiralipour et al., 1992). This is a particularly important benefit in California, due to the pressure on agricultural water resources as a result of drought, pollution and urban expansion.

- Energy Conservation: A benefit directly related to the water conservation benefits of compost use is the potential energy savings resulting from the reduction in pumping from groundwater irrigation sources. The increased water holding capacity of the soil reduces the frequency of irrigation. Although this benefit is likely to be highly variable due to factors such as differences in well depths, the statewide energy savings of wide-spread compost use in agriculture is likely to be substantial.

- Reduced Need For Pesticides, Herbicides and Fungicides: Compost can potentially suppress soilborne diseases due to the presence of beneficial microorganisms. Highly mineralized soils, where organic matter is low, tend to have serious soilborne disease problems.[13] Research in Ohio found that, under the proper conditions, beneficial micro-organisms found in compost out compete disease-causing pathogens for vital nutrients. These micro-organisms can suppress a variety of pathogens that cause damping off and root rot as well as other diseases such as Pythiums, Phytophthora, Rhizoctonia and Fusarium.[14] Some favorable microbes contained in organic matter can also release a chemical that is toxic to soil pathogens.[15]

- Reduction in Soil Erosion: Loss of topsoil due to wind and water erosion is a major problem facing agriculture. Although this problem has been reduced by agricultural practices such as laser planing, contour plowing, cover cropping and incorporation of organic materials such as crop residues and manures, compost use could further reduce the loss of valuable topsoil in California.

- Farm Worker Health and Safety: To the extent that compost use can potentially reduce reliance on pesticides, farm laborers have a decreased exposure to these chemicals which are typically toxic to humans.

ECONOMIC BENEFITS

The economic benefits associated with agricultural use of compost are potentially substantial. Although the dollar value of the nutrients in compost are relatively simple to calculate (nutrient availability versus the price of inorganic fertilizer), the economic benefits of non-nutrient effects are difficult to calculate, so they are often ignored altogether.[16] This is partly because the non-nutrient benefits occur over the long-term. The potential economic benefits from the use of compost by farmers in California include:

- Increased crop yields and fruit quality due to improved tilth, disease suppression and plant vigor benefits.

- Cost savings resulting from water conservation--both in terms of reduced water demand and energy cost savings from reduced well pumping.

- Cost savings from reduced reliance on pesticides/fungicides as a result of soilborne disease suppression and chemical fertilizer use due to diminished leaching and improved nutrient availability.

- Avoided costs of potential nonpoint source pollution management and remediation.

BARRIERS TO COMPOST USE IN AGRICULTURE

There are several barriers to the development of compost markets in the agriculture industry in California. Although not insurmountable, they will have to be addressed systematically over the next to 3 to 5 years if agriculture is to serve as a major market for compost by the year 2000. CEC, in conducting research in Santa Barbara County and statewide, has found five basic interrelated categories of barriers to agricultural utilization of compost. These categories include: cost; quality; logistics; current practices; and availability of information. The following list summarizes each of these categories.

COST

Cost barriers to the use of compost in the agriculture industry are affected by a variety of factors such as product cost, transportation cost, cost of application and the availability of alternative organic amendments. Costs must also be considered in relation to the value of the crop. The cost of compost may be less of a barrier for farmers that grow high-value crops, such as fruit and vegetables, because the high return on these crops would allow them to increase the cost of their inputs. However, farmers that grow lower-value crops such as cotton, alfalfa and wheat would be less likely to increase the cost of their inputs because they are less likely to realize benefits in crop value.

- *Product Cost:* Farmers currently pay very little, if anything, for organic material. It is either purchased in small quantities or generated on-site from crop residues and poultry and livestock manures. CEC research in Santa Barbara indicates that chicken and steer manure, typically applied at rates of 1 to 5 tons per acre, costs between $10 to $20 per ton delivered. Compost will have to be competitively priced for farmers to consider using it.

- *Transportation/Distribution:* High transportation costs constitute a barrier to the development of markets for compost material by increasing the product cost. This is a result of the low-bulk density of compost, and transportation distances from compost facilities. Truck transportation costs for compost depend primarily on the distance to market and the shipping weight. According to a study conducted for Santa Cruz County, transportation costs could range from a low of $2.60 to a high of $36.80 per ton, depending on the distance travelled and the quantity of material. Costs will be higher for shorter distances and smaller quantities.[17]

- *Application:* Farmers currently contract out for the application of organic material such as manures because they do not have either the equipment or the time to apply it themselves. Established application rates for manure range from 1 to 5 tons per acre. Application costs range from $4 to $10 per ton, depending on whether the cost of the material is included. Farmers' reluctance to pay for compost is in part due to the lack of economic data to compare crop yield with application costs.[18]

QUALITY

Quality is probably the most important issue for the agriculture industry because farmers will only apply high quality material that provides benefits in terms of crop yield and pest control. Some farmers perceive that compost produced from organic materials in the municipal solid waste stream poses problems due to the potential presence of chemical and physical contaminants, particularly when combined with sewage sludge.

- *Product Specifications:* Product specification demands by the agriculture industry include low salt concentration, nitrogen content, a pH range of 6.5 to 7.5, low moisture content and consistency. Soluble salts in the compost could reduce the availability of other nutrients and adversely affect the soil structure. Knowledge of nutrient content and pH will allow farmers to incorporate compost into their farm management plans. Moisture content is important when compost is purchased and transported because farmers will not pay for material that has a high water content. Consistency in quality is key to the use of compost in the agriculture industry because farmers will want to be assured of the consistency in terms of quality and benefits over time.

- *Perception of potential risks:* Some farmers perceive unnecessary risks with using compost. These risks typically relate to potential physical, biological and chemical contaminants. Physical contaminants include high salt concentration and the presence of inert material such as plastic and glass. Biological contaminants include plant diseases that could reduce crop viability and yield. The perception that compost would contain chemical contaminants, such as high concentrations of heavy metals, is specific to compost with sewage sludge feedstocks. Additional potential risks from concentrated use include: the presence of pathogenic organisms; nitrate accumulation; accumulation of toxic organic compounds such as PCBs in soil; and excess salts.[19]

LOGISTICS

- *Availability:* Compost must be consistently available for farmers when they need it and if they choose to self-haul, it must be in accessible locations. Farmers may not use compost if they have to wait for it to become available.[20]

- *Timing:* The application of compost may increase the time needed to prepare fields for planting. The timing of field applications is also potentially affected by the availability of material. However, field preparation may only be a barrier for farmers that do not currently use organic material. If farmers substitute compost for other materials such as manures, this barrier may not be as significant.

- *Equipment:* Farmers do not typically own equipment for compost field application. Farmers are not likely to purchase expensive equipment that is only used once a year. Farming operations that use organic soil amendments typically contract manure spreading to specialized companies that sell, deliver and apply the material.

- *Field accessibility:* Field accessibility is a potential barrier for tree crops such as avocados. Trees can be planted on steep slopes that are inaccessible to spreading equipment. In addition, although tree rows range in width from 15 to 20 feet, avocado trees eventually grow together.

ESTABLISHED PRACTICES

- *Unfamiliarity:* Currently, there is relatively little use of compost products by the agricultural industry in California. As a result, farmers are often not familiar with the economic and environmental benefits of compost application.

- *Unwillingness to change:* Farmers often have established practices that have been proven over time, many through UC Cooperative Extension Service and the practices of their colleagues. Farmers need confirmation that compost provides economic benefits in the form of increased crop yields, soilborne disease suppression, water savings and fertilizer savings.

- *Competing products:* Compost will have to compete with existing organic agriculture inputs such as crop residues, manures and mulches. Farmers have a tradition of using these materials and will need information on the superior benefits of compost use. In addition, it is unlikely that compost could replace the use of crop residue since farmers typically incorporate crop residue to avoid disposal costs.

AVAILABILITY OF INFORMATION

- *Lack of data on economic benefits*: There is very little data on the economic benefits of compost application in terms of pathology, quality of fruit, water conservation or increased yield. Scientific research identifies the agronomic benefits of applying different organic materials but does not quantify the economic benefits for farmers.

- *Dissemination:* Currently there are limited sources of information on compost use in California. This is particularly true for potential non-nutrient economic benefits and application practices. Information in the agriculture industry is disseminated by government agencies and organizations such as the USDA Soil Conservation Service and the UC Cooperative Extension Service. The only handbook available on the use of organic materials was recently published by the UC Division of Agriculture and Natural Resources, Sustainable Agriculture Research and Education Program.[21] The handbook provides information on organic amendments for use by farmers and agricultural advisors but does not quantify potential long-term economic benefits.

STRATEGIES FOR EXPANDING AGRICULTURAL COMPOST MARKETS IN CALIFORNIA

This section focuses on action items that the Board can carry out to help overcome barriers to agricultural compost markets. The Board has already identified several potential action steps in the 1992 Compostables Market Development Action Plan. The recommendations of this report are designed to complement those activities the Board has already identified. The following list summarizes the actions the Board has already identified to advance agricultural compost markets in California:

1. Promote the development of product quality standards.

2. Establish a promotional campaign for compost use that targets agricultural markets.

3. Compile detailed information about viable alternative uses of compost, such as for weed abatement and water conservation.

4. Investigate special financial incentives, such as tax credits for compost transportation/application equipment or a system of tradeable water credits for farmers who apply compost.

5. Encourage USDA and the California Department of Food and Agriculture to carry out the Federal Farm Bill provisions which require the Composting Research and Extension Program to inform farmers about the benefits and uses of compost.

6. Conduct educational programs to reduce contaminants in source-separated yard waste such as plastic and glass.

7. Prepare a comprehensive compost research and development agenda.

8. Fund research in new technologies to adapt existing farm equipment for use in applying compost.

9. Demonstrate the performance and safety of compost through research on comparative growth, soil erosion and water conservation.

10. Develop a statewide Composting Information Clearinghouse and Database, including data on how to project market demand by sector.

If carried out in a timely fashion, the activities the Board staff have identified in the Action Plan will address a variety of barriers to agricultural compost, particularly those related to lack of information, incorrect perceptions, established practices and product quality issues.

In addition to the above measures, the following recommendations are based on the barriers to compost use in agriculture, compost market research at the local level, published information and interviews with experts on agricultural compost in government and the private sector. Although they are listed generally in order of priority, all of these actions are important to the development of agricultural compost markets.

Recommendation #1: Convene Agricultural Compost Use Workshop(s)

Description: The Board should convene a workshop or series of workshops that bring leaders from agriculture, compost companies, government and universities together to disseminate information on the benefits of compost use in agriculture, discuss barriers to agricultural compost use in the state, and develop strategies for expanding compost use. This will provide a forum for communicating interests, identifying issues that will require research, and creating an opportunity for farmers to help guide the development of the compost industry in the state so that it meets their future needs. Workshops could be held in a series at different locations around the state and involve representatives from growers associations, individual farms, organic farms, regional Soil Conservation Service, Farm Bureau, UC Cooperative Extension, compost companies and others.

Barriers Addressed: This potentially addresses the entire range of barriers to agricultural compost use.

Time frame: In order to maximize effectiveness, the workshops will have to occur as soon as possible. This action should precede any of the other action steps and be used to inform and guide further steps.

Recommendation #2: Create a Model Strategy for Agricultural Compost Market Assessment and Development

Description: Since most agricultural markets are local, the Board should create and disseminate a model strategy, or How-To manual, for identifying and developing agricultural compost markets. The Board could incorporate this model into the local technical assistance they currently provide Cities and Counties who are planning to develop a composting facility in their community. The model should include methods for involving the local agricultural community in the planning process, research methods for measuring local compost demand and quality specifications, and techniques for developing agricultural compost markets. The model strategy would have to be compiled from a variety of sources and designed to be generalizable across the state. This should allow cities and counties to get a clearer picture of the agricultural compost market situation in their area.

Barriers Addressed: This could address several barriers by providing communities with information on product specifications, perceptions of potential risks, timing issues, competing products and established practices.

Time frame: This should be developed and made available within two years, given the lead time needed for compost facility planning, siting, permitting and construction.

Recommendation #3: Conduct Research to Quantify the Economic Benefits of Compost Use for Agriculture

Description: The Board should conduct a study to quantify the economic benefits of compost use, such as the long-term non-nutrient benefits to physical, chemical and biological properties of soils, increased yields over time as a result of improved soil tilth, increased water holding capacity, enhanced nutrient cycling and disease suppression. This study should also evaluate other economic benefits such as water cost savings, energy cost savings due to reduced well pumping, reduced need for agricultural chemical inputs, and nonpoint source water pollution avoidance. Conversion factors and simple formulas could be developed to allow farmers to assess the potential savings of various compost application rates in terms of energy costs, water and other factors.

Barriers Addressed: This primarily addresses barriers related to lack of information on costs and benefits of compost use.

Time frame: Due to the length of time needed to gather this data, this research should begin as soon as possible.

Recommendation #4: Promote and Support Research that Compares the Benefits of Compost Use to Other Organic Soil Amendments

Description: The Board should promote and support research and demonstration projects that compare the benefits of compost use to other more commonly used organic soil amendments, such as crop residue and manures. Farmers need comparative data in order to determine the relative advantages and disadvantages of these materials. This information will allow farmers to evaluate compost use in terms of more established practices. This study should compare both agronomic and economic benefits.

Barriers Addressed: This study should address barriers related to product specifications, perception of potential risks, competing products and established practices.

Timing: This study could be conducted over a period of two years and should begin as soon as possible.

Recommendation #5: Promote and Support the Development of Compost Maturity Standards and Methods of Determining them Reliably

Description: Compost maturity standards for specific uses need further development. Research has shown that compost can pass seed germination tests but still inhibit plant growth, due to subsequent elemental release, elemental complexing or oxidation causing settling and compaction.[22] Farmers need to be sure that compost is consistently mature before they will use it in large quantities. Although assurance of compost maturity is the producer's responsibility, the Board should be aware that this is a critical issue and actively promote and support the establishment of such standards.

Barriers Addressed: This primarily addresses barriers related to lack of information on compost product quality and reliability.

Time frame: Some research is already underway in this area. The Board should promote this research as a short-term priority.

Recommendation #6: Promote and Support Long-Term Studies to Determine the Fate of Trace Elements and Other Potential Toxicants in Soils Amended with Compost

Description: The Board should support studies to determine the long-term (five years or longer) impacts of applying compost products to soils. Short-term experiments of one crop cycle are of limited value, since phytotoxic levels of elements may be absorbed by plants from soils amended with compost over a considerable time period.[23]

Barriers Addressed: This primarily addresses barriers related to lack of information on compost product quality.

Time frame: This study could take several years to complete, due to the need to assess benefits over 5 years or more. Due to the length of time needed to gather this data, this research should begin as soon as possible.

Recommendation #7: Explore Ways to Work with the State Water Resources Control Board to Encourage Use of Compost to Control and Mitigate Nonpoint Source Water Pollution from Agriculture

Description: Board members from the CIWMB and the SWRCB should identify ways in which agricultural use of compost can be incorporated into research and demonstration projects related to control and mitigation of nonpoint source water pollution. Agriculture is the single largest source of nonpoint source water pollution. A joint SWRCB/CIWMB venture would be consistent with the State's efforts through CALEPA to take multi-media approaches to pollution prevention and mitigation. Since both agencies are under tight financial constraints, there may be ways to leverage existing resources under Federal Clean Water Act grant programs.

Barriers Addressed: This addresses barriers related to information, costs, current practices and other issues.

Time frame: This dialogue could happen at anytime; but, due to the urgency of both agricultural market development for compost and the severe problems created by nonpoint source water pollution, this should be started as soon as possible.

Recommendation #8: Promote Recognition of Compost Use as a Soil Conservation Practice by USDA

Description: The Board should work with state and national policy makers to require the USDA Soil Conservation Service to recognize the use of compost in agriculture as a soil conservation practice. Policies are already in place to support the stabilization and regeneration of agricultural soils to mitigate erosion of topsoil, but the practice of using compost produced from municipal organic waste in agriculture is not currently explicitly recognized as a soil conservation practice. Although the 1990 Farm Bill recognized on-site agricultural composting as a soil conservation practice, the use of compost produced from other sources is still not recognized in this way. This policy change should be combined with including compost utilization in the Agricultural Stabilization and Conservation Service cost-sharing program (to help fund expanded agricultural compost use), and USDA Cooperative Extension Service-sponsored training.[24]

Barriers Addressed: This primarily addresses barriers related to the dissemination of information, established practices and application costs.

Time frame: This type of change could take a long time to bring about and could be done in stages beginning this year.

Recommendation #9: Promote and Support Research to Determine the Best Methods of Applying Composts

Description: The Board should promote research to determine the best methods of applying composts (surface applied, disked, buried, trenched, vertical mulched, etc.). This information will be very important in terms of controlling the costs of application. This could potentially be carried out by the UC Davis Agriculture Engineering Department, UC Cooperative Extension, or the UC Sustainable Agriculture Research and Education Program. This could also be tied in with other research on economic benefits of compost use and long-term impacts, and recommendations from CIWMB Action Plan to study potential adaptations to existing equipment.

Barriers Addressed: This primarily addresses barriers related to the dissemination of information, established practices and application costs.

Time frame: This research could be completed in one or two years.

Recommendation #10: Promote Amending ASCS Specifications to Encourage Compost Use for Soil Conservation Practices that are Cost-Shared

Description: The Board should promote the USDA ASCS to encourage compost use in specifications for soil conservation practices that are cost-shared. For example, the specifications for natural filter strips used to collect run-off could be amended include compost.[25]

Barriers Addressed: This primarily addresses barriers related to the dissemination of information, established practices and application costs.

Time frame: This type of change may require a rule-making procedure and could take a year or more to accomplish.

ENDNOTES

1. At a reduction rate between 45 to 60 percent by weight, composting 10.7 million tons of compostable material could produce between 4 and 6 million tons of compost.1.

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4. Shiralipour, et al., 1992, "Physical and Chemical Properties of Soils as Affected by Municipal Solid Waste Compost Application", *Biomass and Bioenergy*, Vol. 3, Nos. 3-4, pp. 261-266.

5. *Ibid.*, p. 261.

6. Chaney, David, E., et al., ***Organic Soil Amendments and Fertilizers***. *UC Sustainable Agriculture Research and Education Program, University of California, 1992. p.11.*

7. *Shiralipour et al., p. 262.*

8. *Ibid., pp. 262, 264.*

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10. Kashmanian, Richard, et al., "Where Will All The Compost Go?", *Biocycle*, 10/90, p. 39.

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14. *Ibid.*, p. 54.

15. Chaney, David, et al., p. 5.

16. *Ibid.*, p.11.

17. Cal Recovery Systems, *Feasibility Evaluation of Municipal Solid Waste Composting for Santa Cruz County, California*, December, 1983, pp. 103-105.

18. Collins, Alan, R., "How Much Can Farmers Pay For Compost?", *Biocycle*, October 1991, p. 66.

19. Chaney et al., p. 22.

20. Cal Recovery Systems, 1983, p. 34.

21. Personal communication with Ben Faber, Farm Advisor, UC Cooperative Extension Service, Ventura County, April 1993.

22. Shiralipour, et al., p. 277.

23. *Ibid*, p. 277.

24. Based on discussion with Richard Kashmanian of the U.S. EPA Office of Planning, Policy and Evaluation, April 22, 1993.

25. Based on discussion with Richard Kashmanian of the U.S. EPA Office of Planning, Policy and Evaluation, April 22, 1993.

APPENDIX D
JOBS RELATED TO THE COLLECTION AND PROCESSING OF RECYCLABLE MATERIALS

Generally, most people assume that recycling creates jobs at least to some extent, but quantifying the actual number is often very difficult. Job creation is itself a vague term which is used by some to refer to any job related to the broad realm of recycling activities or by others to refer to a net gain or loss in the number of jobs within a defined type of industry or geographical region.

In some broader interpretations, recycling activities do not result in creation of more new jobs in the society as a whole, but serve only to redirect the ways society handles its waste materials. In an overall sense, some claim that recycling and waste reduction probably result in fewer jobs in the long term due to the handling of lower volumes of wastes.

However one interprets the job creation concept, there are jobs associated with the collection, sorting, hauling and processing of recyclable materials. Also, there are jobs associated with the use of recyclables in manufacturing new products. Jobs associated with re-use of discarded materials or products are considered a form of materials processing in this report in that the materials are not recycled, but re-processed to be used again.

In manufacturing, recyclables can be used to substitute for virgin feedstock in making new products with "recycled content," or they can be used as feedstock for entirely different products - some of which are designed to be made of only recycled materials, such as cellulose insulation or reflective glass beads. When recyclables such as waste paper substitute for virgin feedstock to make a pulp which is then used to make paper, no new jobs are created in the manufacturing process. The overall process may require new jobs for de-inking or contaminant removal, but those procedures are considered part of the processing steps to prepare the waste paper for use in manufacturing new products.

On the other hand, it may be the case that new jobs are created within a new industry in the region by using recovered materials such as waste newspaper (ONP) or other grades to manufacture cellulose insulation. However, within the broader insulation industry as a whole, jobs may have been lost in fiberglass wool or plastic foam sub-industries. Also, because it is difficult to predict where the recovered newspaper will be sold in the future, it is difficult to determine whether recovery and processing of recyclables will add or create new jobs in the manufacturing sector. Some recovered materials may be sold to newspaper mills while other quantities could be sold to insulation makers or used for some other entirely different purpose such as animal bedding or composting.

Since job creation in the manufacturing sector is difficult to assess, for the reasons discussed, they are not included in this report. Also, this report does not attempt to quantify a 'net' job loss or gain for the collection or processing of recyclables, but focuses on job needs for the collection and processing of secondary materials.

One reason why it is difficult to determine net job gain through collection of recyclables is that the relationship between jobs in garbage collection and those in recycling is not documented or clear. For example, the California Refuse Removal Council (CRRC) claims there is job loss occurring in California, but it is not clear how much of the loss is due to the economic recession, the switching to automated collection where fewer people are required, or due to the need of fewer trucks and crew because recycling has lowered the volume of garbage for disposal.

The current situation at this time seems to indicate that implementing curbside recycling programs requires the hiring of new people which are for the most part not being taken from the ranks of existing garbage haulers. This phenomenon is probably the case since new curbside recycling programs do not have an immediate impact on garbage reduction which can be compensated for by cutting back on trucks and drivers for garbage collection. In fact, since curbside recycling generally reduces the residential waste stream by only 10 to 20 percent, it often takes years before the garbage company can redesign routes and buy fewer trucks to compensate for the lower volumes of garbage to collect.

METHODOLOGY

Two approaches were used in this report to determine the number of jobs associated with the collection and processing of recyclables. The first was a survey of California programs which included both residential and commercial recycling as well as processing facilities for these materials.

The second approach was to survey other programs and reports around the country to gather any data to compare with the results of the California survey. The country-wide search for reports and studies of recycling-associated jobs found none that have examined the number of jobs associated with the quantities of individual types of recycling. A few (Ref. 4,6,13,14, and 21) have estimated overall jobs required to collect, process and administer usually municipal recycling programs, but there was not a clear distinction of job categories and job functions in the program, or even whether every identified job was a full time equivalent position. These are important distinctions, since it was often found in the California survey, that program operators were not always aware of the exact number of positions in their programs or what everyone did. In particular, where recycling is part of the garbage collection program, it was not known how much time some workers spent on recycling, collection, processing or garbage collection.

CALIFORNIA SURVEY

The purpose of this survey was to determine the approximate or range of tonnage of materials that could be handled by one job. For example, one collector, on average, can be expected to handle 1,229 tons-per-year of OCC. This number (or range) can then be used to project the number of jobs required to collect an additional statewide tonnage figure, for example, 100,000 new tons-per-year. Since many of the recyclables can be imported, new collection jobs may not necessarily be located in California.

Likewise, since large volumes of some commodities, such as waste paper, are exported each year, requiring the use of 100,000 new tons-per-year of OCC may require fewer new jobs to collect since some of the export tonnage already collected could be diverted to domestic use. These latter calculations are made in another part of this report.

About 75 programs were selected which represented a broad cross-section of size, type and handling procedures. They were divided into residential, which included curbside, drop-off and buy-back programs, and commercial, which included various forms of office paper, business recycling and separate route collection programs. The resulting programs used in the survey were selected mostly on the availability of data that could be provided in the short time frame allowed for conducting the survey.

A survey form was prepared which sought information about the quantities of different materials collected and processed in the different types of programs. The second part of the survey tried to determine the number of full time employees (FTE) associated with each procedure or activity and for each material, if possible.

The total number of jobs reported by the operator is divided into three major categories, administrative, collectors, and processors. Administrative includes managerial, clerical, bookkeeping, education and promotion positions. Collection includes drivers, collectors and a portion of the supervisor positions(s) devoted to collection.

Processors include all of the sorting, baling, transport and other activities related to preparation of materials to be sold to their next market, whether its another processing facility, MRF or actual end-user. As one may expect from this definition of processing, the amount of employee time devoted to "processing" will and does, vary considerably from one program to the next even for the same quantities of recyclables, due to the fact that different types and levels of processing are done for the same volume of materials. For example, a program only dumping mixed glass containers into a shipping bin and hauling them to a glass processor is doing less work per ton than a program, such as a MRF, which color-sorts and crushes the glass to furnace-ready cullet.

CALCULATION OF TONNAGE PER JOB

Job per volume rates were calculated as much as possible for each material type. With one exception, where recyclables were collected commingled, no material breakout was calculated. On first approximation in the case where one FTE worker spends all of his time picking up, packing and hauling OCC, it is straight forward to calculate the number of tons handled by one job. However, in the case where one worker collects a variety of recyclables on the same route and in the same truck, the calculation becomes more difficult. And further, when the collection procedures vary in different programs, the calculation is further complicated.

This report makes five calculations of the following quantities per job activity.

- Quantity of all types of recyclables collected in residential (curbside) programs.
- Quantity of all types of recyclables collected in commercial program.
- Quantity of all types of recyclables processed (originating from residential and commercial programs).

- Quantity of plastic bottles (mixed) collected in residential programs.

- Quantities of OCC, office paper and glass collected and processed in commercial programs.

For all calculations, except the plastic bottle case, the calculation of tons per job was based on dividing the total number of tons by the total number of FTE as found in the surveys. In cases where all recycling types were mixed together (commingled), the total tonnage was used. For OCC, office paper and glass collected in commercial areas, only those programs with regular route collection were surveyed. There are many individuals who collect irregularly, particularly in urban areas, who were not included.

For the plastic bottle case a different procedure was used. Table D-6 summarizes data from five programs which collect both number 1 and number 2 plastic bottles commingled with other containers. The weights of these bottles were recorded by each program (column 2) and the total FTE for collection of all recyclables was known. However, since the plastic bottles are collected in the same motion and process as the glass and metal containers, the question arose about the best way to proportion the amount of labor devoted to the plastic bottle portion of the process.

One way to proportion the labor is based on the comparative weight of plastic to the other containers. A second approach is based on the proportion of the plastic per unit or per time handled. Since some time motion studies have been conducted (Ref. 5 and 25), an average time per material type of container has been calculated (Ref. 11 and 12) which attributes 17 percent of the collection time (0.17 FTE) to collection of plastic bottles in programs that collect newspaper, mixed glass, mixed cans (tin and UBC) and mixed plastic bottles.

Because this data was available, the calculation for plastic bottles was based on the assumptions that the average portion of plastics is 3.0 percent by weight and the average time of total FTE is 17 percent. By dividing the weight by the total FTE, a total of 162 tons of plastic bottles is collected by one job.

All of the remaining calculations are based on the Volume (by weight) of materials handled by the type or function of the job. While tonnage of materials was usually easy to identify, much of the survey time focused on isolating by job function and by material type the proportionate amount of labor or time devoted to each category.

The results of these surveys of California programs are summarized in Tables D-1 through D-6.

TABLE D-1
JOBS FOR COLLECTION OF RECYCLABLES FROM RESIDENTIAL WASTES
A SURVEY OF CALIFORNIA PROGRAMS

Community	Population Served	Recycled[1] (TPY)	Jobs[2](FTE)	Tons/Job
Berkeley	40,000	6,942	10.0	694
Calistoga	4,400	300	0.4	750
Claremont	36,550	2,900	2.4	1,208
Culver City	40,960	1,920	2.1	914
Davis	44,250	2,300	2.5	920
El Cerrito	23,000	1,920	2.6	770
Gilroy	29,600	940	1.8	522
Los Angeles	720,000	62,000	88.0	705
Los Altos	27,350	2,420	2.2	1,100
Napa	63,000	4,087	6.0	681
Palo Alto	57,000	5,520	3.8	1,450
Piedmont	10,400	1,920	2.8	685
Redding	75,000	4,392	4.0	1,098
San Diego	221,400	24,000	19.5	1,230
San Francisco	731,000	60,000	63.0	952
San Jose	738,400	28,000	28.5	982
Santa Cruz	49,800	2,940	3.6	816
Santa Monica	91,300	2,940	4.4	668
Santa Rosa	111,600	3,540	3.8	932
Sunnyvale	116,700	6,460	8.2	788
Union City	49,900	2,040	2.5	816
Walnut Creek	62,600	3,120	3.5	890
Watsonville	30,250	1,410	2.6	542
TOTALS:	**2,614,460**	**232,011**	**268.2**	**865 (avg)**

Notes:

1. *Tonnage reported by program operator which is collected in curbside and drop-off recycling programs. Programs, such as Palo Alto's, with large-volume drop-off centers tend to have higher tons/job ratios.*

2. *Number of jobs are calculated in full-time-equivalents and represent only those positions directly related to the collection procedures and do not include administrative or other support activities. Employees who worked in other functions were prorated for time spent on collection only.*

TABLE D-2 CARDBOARD COLLECTION JOBS IN COMMERCIAL RECYCLING PROGRAMS			
Program	Volume (TPY)	Jobs[1]	Tons/Job
Los Altos Garbage	1,044	2.00	522
Napa Garbage Recycling	1,296	.7	1,851
Oceanside Disposal	180	0.60	300
Palo Alto	960	0.45	2,133
Redding Recycles	191	0.80	239
San Francisco, Collector A	3,000	4.6	652
S an Francisco, Collector B	2,160	1.4	1,543
Scotts Valley	480	1.20	400
Watsonville	400	0.40	1,000
TOTALS:	**9,711**	**7.90**	**1,229 (avg.)**

Note:

1. *Number of jobs required for collection of corrugated cardboard from commercial establishments within the community. Only jobs directly related to collection are included-nonadministrative or other support activities are included.*

TABLE D-3 OFFICE PAPER COLLECTION JOBS IN COMMERCIAL RECYCLING PROGRAMS			
Program	Volume (TPY)	Jobs	Tons/Job
Los Altos Garbage	120	0.6	200
Napa Garbage Recycling	360	.3	1,200
Oceanside Disposal	217	0.4	543
Palo Alto	192	0.25	768
Redding Recycles	66	2.0	33
San Francisco Collector A	1,200	1.8	667
San Francisco Collector B	1,800	1.4	1,286
Watsonville	15	0.15	100
TOTALS (AVERAGES):	**3,970**	**6.9**	**575 (avg.)**

TABLE D-4 COLLECTION JOBS FOR GLASS IN COMMERCIAL RECYCLING PROGRAMS			
Program	**Volume (TPY)**	**Jobs**	**Tons/Job**
Collection Los Altos	36	.35	103
Oceanside Disposal	100	0.25	400
Redding Recycles	125	0.20	625
San Francisco Collector A.	600	1.8	333
San Francisco Collector B	2,280	1.3	1,754
TOTALS (COLLECTION):	**3,141**	**3.90**	**805 (avg.)**
Processing Golden State	Prop.	-	4,200
Allwaste	Prop.	-	3,400
AVERAGE (PROCESSING):	-	-	**3,800**

Note:

1. Number of jobs required for collection of glass bottles and jars (sometimes referred to as bars and restaurants programs) from commercial establishments in the community.

TABLE D-5 JOBS REQUIRED FOR PROCESSING RECYCLABLES (COMMERCIAL AND RESIDENTIAL)			
Community	**Volume (TPY)**	**Jobs**	**Tons/Job**
Berkeley	6,942	5.0	1,388
Culver City	1,920	1.9	1,011
Napa	5,743	6.0	957
Oceanside	180	.15	1,200
Palo Alto	•9,120	2.0	4,560
San Diego	6,600	3 .35	1,970
San Diego (MRF)	63,120	25.0	2,525
Santa Cruz	3,240	6.0	540
Santa Rosa	29,600	16.0	1,850
Scotts Valley	480	1.0	480
Sunnyvale	6,460	2.0	3,230
Watsonville	2,551	.85	3,001
TOTALS:	**135,956**	**69.25**	**1,963 (avg.)**

TABLE D-6 PLASTICS COLLECTION JOBS (RESIDENTIAL)						
Community	Wt. Collected (lbs/mo)	Total Labor (FTE)	Portion of Labor		lbs/job	
			by wt (.03)	by time (0.17)	(a)	(b)
Culver City	1,200 (lbs) (.37% x 160 TPM)	2.0	0.06	0.34	20,000	3,530
Los Altos	2,200	3.6	0.108	0.612	20,370	3,595
Wastsonville	3,600	2.0	0.06	0.34	60,000	10,588
Santa Cruz	6,000	6.0	0.18	1.02	33,333	5,882
Claremont	5,000	2.4	0.072	0.408	69,444	12,255
TOTALS:	**18,000 lbs (9.0 tons)**	**16.0**		**2.72**	**37,500**	**6,620**

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