

Contracted Report to the Board

An Analysis of Subsidies and Other Options to Expand the Productive End Use of Scrap Tires in California

November 2002

Produced under contract by:

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Acknowledgements

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Preface

In 1989 the California Legislature enacted Assembly Bill (AB) 1843. This bill, titled the California Recycling Tire Act, was designed in part to reduce the flow of California scrap tires to landfills and stockpiles through the further development of recycling/diversion markets in the state for scrap tires. AB 1843 was scheduled to originally expire in 1999, but through the passage of AB 117 in 1998, the Legislature postponed this first sunset date until January 2001. With the passage of Senate Bill (SB) 876 in 2000, the California Recycling Tire Act was permanently renewed and expanded. Throughout this legislative history, the California Integrated Waste Management Board (CIWMB) has been in charge of the management of scrap tires in the state and has worked to reduce their detrimental impacts through the offering of grants and loans to public and private tire recyclers in California.

This report is indirectly the result of AB 117 and its requirement that the CIWMB submit an evaluation of the state's handling of waste tires before the second sunset date of January 2001. The resulting report, *California Waste Tire Program Evaluation and Recommendations: Final Report* (2001), suggested further sustainable market development for recycled waste tires, but explicitly came out against the use of per-tire subsidies to do this. A summary of this recommendation is provided in the CIWMB's *Five-Year Plan for the Waste Tire Recycling Management Program* (2001, p. 32):

If an end-use incentive or subsidy program were developed, all segments of the market would have to be supported, making the program very expensive to implement. Such incentives foster the creation of marginal businesses that compete with and threaten the viability of established businesses. Further, end-use incentive programs created in other states have not provided sustainable markets for used tires and, to the contrary, have actually damaged the existing permanent market development infrastructure.

This report is a direct response to stakeholder input at CIWMB meetings that asked for a further reevaluation of end-use incentives as tools that the Board could use to decrease the number of California's scrap tires that continue to go to landfills or stockpiles.

Background

The research contract for this evaluation of end-use incentives was awarded to the Graduate Program in Public Policy and Administration at California State University, Sacramento in August 2001. Under the direction of Professor Rob Wassmer, a group of eight master's students researched this issue throughout the fall of 2001 in a classroom setting designed to result in the production of their master's theses. As of this writing, six of these students have completed their theses on various issues related to this topic. This document, though produced by Professor Wassmer, represents the cumulative work effort of all the students involved.

The report has also benefited from the advice and knowledge of experts who were kind enough to visit the class. These include Martha Gildart (Branch Manager for Waste Tires, CIWMB), Terry Gray (President, T.A.G. Resource Recovery), Terry Leveille (President, TL and Associates), Mark Hope (President, Waste Recovery West), Randal Roth (Vice President, Lakin Tire West), and Denise Kennedy (Vice President, Waste Recovery West). Valuable feedback was also received from participants in two briefing sessions that were held at the California Environmental Protection Agency in the fall of 2001.

We also need to thank participants at the Western Regional Tire Recycling Conference on March 21, 2002 in Indio, Calif., where a draft version of this report was presented and helpful comments received. Written comments on the draft version were also received from Michael Blumenthal

(Technical Director, Rubber Manufacturers Association), Mark Korte (General Manager, Tri-C Manufacturing), Michael Paparian (Member, California Integrated Waste Management Board), Lindsay Smith (Rubbersidewalks, Inc.), Rick Snyder (President and CEO, U.S. Rubber Recycling, Inc.), and Rosemary Sutton (Consultant, PwC). The report reads better due to the editorial expertise of Rebecca LaVally.

Problem Statement

The problem statement that acted as the basis for the students' research and this report is as follows:

If stockpiles and landfills are not considered acceptable alternatives, the supply of scrap tires generated in the State of California in 2001 exceeds the uses for these tires by about 25 percent. Are there solutions to this problem of excess supply, including subsidies or other end-use incentives, which are different than what the CIWMB is currently pursuing?

This report tackles this problem statement through the use of a policy-driven benefit/cost assessment. In other words, we offer various options to reduce the number of scrap tires that are currently not being recycled in the state. These options are then evaluated through a listing of the relevant benefits and costs that they are likely to generate. Regarding the implementation of an end-use incentive program, this method allows consideration of the costs alluded to in the AB 117 report (expensive, creation of marginal businesses that threaten existing businesses, non-sustainable, etc.), but also allows for the equal consideration of potential benefits.

Our final recommendations regarding the problem statement are developed through six sections in the following report. Section 1 further defines and clarifies the California scrap tire problem. Section 2 is intended to be an informative review of the complex environment surrounding the problem. The alternatives that we suggest to deal with the problem of an excess supply of scrap tires in California are in Section 3, while Section 4 lists the criteria we use to evaluate the desirability of these alternatives. In Section 5 we offer an analysis of the alternatives based upon the chosen criteria. Finally, Section 6 contains our conclusions and policy recommendations.

Executive Summary

Background

Given that California has the largest number of registered vehicles of any state in the United States, it also generates the largest number of scrap tires that annually enter the waste stream. In the year 2001 alone, Californians disposed of more than 31 million tires and generated in excess of 300,000 tons of scrap tire waste. This number can only be expected to increase with the state's population growth and will reach an estimated 46 million waste tires generated annually by the year 2020. (Note: This is a straight-line extrapolation and could be less if the capacity of California's roads does not increase or mass transit use in the state increases.)

In the late 1980s California enacted its first tire recycling/diversion legislation by granting authority to the California Integrated Waste Management Board (CIWMB) to manage the State's waste tire program. The primary goal of the program is to reduce illegal stockpiling and landfill disposal of waste tires through the promotion and development of new and existing recycling/diversion markets and the expansion of the regulatory environment governing scrap tire storage, processing, and disposal.

The program was initially funded with revenues from a \$0.25 fee on the sale of new tires. Fees were originally collected only from retail tire dealers and deposited in the California Tire Fund for annual appropriation by the state Legislature. The fee has since increased to \$1.00 per tire and now is collected on retail tire sales and all tires that enter the state on new vehicles. The only planned change in this collection scheme is that the per-tire fee will fall to \$0.75 in 2006. Based on current projections, and if funded with all the revenues collected in California's Tire Fund, the annual budget for California's waste tire management program could be as high as \$30 million for fiscal year 2001-02 and increase to as much as \$34 million by the end of fiscal year 2005-06.

Throughout the tire program's 12-year history, the CIWMB has used a combination of research, market development incentives, public information campaigns, and regulatory activities to effectively manage the state's waste tire problem. These strategies have contributed to major reductions in existing waste tire stockpiles and considerable improvements in rates of recycling statewide. Since the program's inception, waste tire diversion rates have increased from 34 percent in the early 1990s to 72 percent by the year 2000.

In the current market, approximately 10 percent of the waste tires generated within the state are resold on the domestic used-tire market or are exported for resale, while 65 percent of tires in the waste stream are recycled or otherwise diverted from landfills or stockpiles. The leading recycling and diversion industries using scrap tire material in their production processes include crumb rubber manufacturing (21 percent), tire-derived fuel (14.9 percent), landfill construction (11.8 percent), retreading (6.9 percent), and civil engineering projects (4.6 percent). The majority of these emerging industries have benefited from the financial and technological support of CIWMB program activities.

For the purpose of this report, the term "productive end use" means the tires were combusted for fuel or energy supplement, recycled or otherwise reused whereas "disposal" means the tires were landfilled. In this report, the use of scrap tires as fuel is considered a productive end use.

Despite the demonstrated success of government efforts to expand and develop alternative uses for California waste tires, recycling/diversion markets continue to lack the capacity to consume all of the waste tires generated. The supply of scrap tires from present flows exceeds demand for raw tire material. As a result, more than 8.7 million tires continued to be deposited in landfills or stockpiles last year, representing 25 percent of the annual waste tire stream.

The problem this report addresses is how to further reduce the percentage of California's scrap tires that are just disposed of and not put to any socially beneficial use. Solutions to this problem are proposed in the form of six policy alternatives that include an expansion of two of the Board's current activities and four market-intervention strategies that have been tried in other states, but not California. A description of the first five sections of the report follows.

Review of the Report

By defining the waste tire management problem in California, summarizing the history of scrap tire legislation within the state, and outlining the programmatic approach of the CIWMB to address the tire issue, the first section of the report offers the needed background to understand the issue before solutions can be offered. Section I also includes an examination of the history of other states' tire management initiatives and programs in an attempt to gather lessons from others' experiences.

Section 2 of the report identifies the environmental factors and conditions that have shaped California's waste tire experience. These factors include social, political, economic, and legal issues that have influenced the current policy environment. Together these factors make up the larger context surrounding program implementation that will ultimately support or diminish the feasibility and effectiveness of any proposed strategy.

In the third section of the report we identify several key variables that exert significant impacts on the number of scrap tires recycled in California. These include the tipping fee, rules governing landfill disposal of tires, technology limitations in tire processing, public perceptions regarding use of tire-derived fuel (TDF), lack of demand for products produced from crumb rubber, and transportation costs for tire transporters.

Based on these variables, policy alternatives that could be considered as potential program options are offered. The policy options encompass an expansion of two strategies (information campaigns and capital subsidies) already employed by the CIWMB, as well as four new strategies that have been tried in other states, but not in California. These include the increased regulation of landfill disposal, per-tire subsidies to processors of scrap tires, per-tire subsidies to consumers of goods produced from scrap tires; and per-tire, per-mile subsidies to transporters of scrap tires away from landfills.

The identification of specific policy alternatives in Section 3 is followed in Section 4 by a discussion of the methodology used to analyze the potential effectiveness of each alternative and to ultimately determine the "best" policy option. This methodology involves the establishment of a set of five criteria for evaluating the benefits of each policy. These criteria are efficiency, equity, sustainability, political/legal feasibility, and administration/improvability. To determine the degree that each of the six proposed policy alternatives satisfies each of the five stated criteria, quantitative and qualitative criterion-alternative matrixes are used. This is intended to be a transparent process that allows readers to substitute their own evaluations if they disagree with the assessment offered here.

Section 5 is really the "meat" of the analysis. After including a review of the CIWMB's policy objectives regarding scrap tires, it details the specifics that make up each of the six proposed policy alternatives. A large qualitative alternative-criterion matrix then lists in narrative form how we assess each policy alternative in terms of the five criteria previously determined to be relevant to its evaluation. These narratives are then turned into a numerical-based evaluation that appears in a quantitative version of an alternative-criterion matrix. Our final recommendations and conclusions, which appear in Section 6 of the full report, are summarized next.

Recommendations

The following recommendations serve as the findings of this study. The recommendations rely on staying within the dollar confines of the proposed budget for fiscal year 2002–03 outlined in the CIWMB Five-Year Plan (2001).

Recommendation #1: Understanding the fact that the Board has already made great strides in increasing the number of tires recycled in California, and that the difficulty in recycling and/or diverting each additional tire increases as more have been recycled (diminishing marginal returns), we recommended that the CIWMB begin some form of a per-tire reimbursement program. We suggest either: (1) a \$0.17- per-tire subsidy paid at the processor level, or (2) a subsidy of \$0.10 per tire for TDF and \$0.50 per tire for content in end-use products. Evaluations detailed in the report indicate a preference for the \$0.17 per-tire subsidy paid to processors, but based upon our evaluation either of these per-tire subsidy programs is acceptable.

Recommendation #2: We recommend that further regulation of the size that tires need to be processed before being placed in landfills, or the outright banning of tires from landfills, **not** be implemented as part of the CIWMB's short-term scrap tire management strategy. Instead we suggest that it be tabled for later reconsideration once the market development incentives just suggested are operational and end-use markets for California's scrap tires have significantly matured so they can effectively absorb the scrap tires that once went to piles or landfills. Upon consultation with industry experts, we believe that the Board would need to require processing down to a minimum 2.5-inch chip to exert any significant diversion of tires from landfills based upon increased processing cost alone.

Recommendation #3: We further recommended that the CIWMB expand its funding of capital subsidies at \$2 million annually. With a maximum funding level of \$250,000 per grant, a minimum of eight grants could be offered in a year for purchase of equipment to process scrap tires. Because the grants require matching expenditures by the firms that receive them, these eight grants would result in the purchase of \$4 million worth of equipment each year the program is place. If each of these pieces of machinery must process 250,000 tires a year to retain the funds' status as a grant (rather than a loan to be repaid), this alone would result in 2 million tires being recycled annually. To achieve greater efficiency in the use of capital subsidies we also suggest that the Board hire a full-time expert capable of evaluating the operations and viability of companies applying for grants. The person would also be responsible for follow-up and enforcement of the stipulations necessary to convert the loan to grant. We believe that statewide demand for these grants will increase if the suggested expansion is done at the same time as per-tire subsidy program is put in place.

Recommendation #4: The final recommendation from this study is that the Board spends the remaining \$1 million of its anticipated \$8 million market development budget for 2002–03 on information gathering and disseminating campaigns. In the interest of equity, and to increase the political feasibility that this recommendation is adopted, we suggest that money spent on these campaigns be equally divided among exploring the further use of tire derived fuel, the further use of crumb rubber in general, and the further use of rubberized asphalt in particular. To achieve greater efficiency in these information campaigns we also suggest that the Board hire a permanent liaison to the California Department of Transportation to promote and assist Caltrans in evaluating the further use of rubberized asphalt. In addition we suggest the greater use of marketing experts from the business sector to help craft an information campaign that can be truly effective.

Though not a formal recommendation, we also step out of the parameters given us for this study—that being that the budget for market development activities remain at the levels provided

in the Board's Five-Year Plan (2001)—and suggest an overall increase in these planned budgets. After the increases in revenue guaranteed from the new \$1 per-tire fee, the Board has significantly more resources available, and to achieve the desired goal of keeping all of California's scrap tires out of landfills and piles, more of these resources may be needed. If more than the \$8 million to \$8.6 million budgeted for market development through fiscal year 2005–06 becomes available, our suggestion would be to allocate the new money in the same ratios suggested above: five-eighths to per-tire recycling/diversion subsidies, two-eighths to capital subsidies, and one-eighth to information campaigns.

1. Waste Tires in California

Amid a growing recognition of the environmental and safety hazards of unregulated tire stockpiles and declining landfill capacity, the disposal of waste tires emerged as a public policy concern in the United States in the late 1980s. Policymakers in California and other states responded to this concern by passing legislation that assisted in the cleanup of existing scrap tire stockpiles and the development of new alternatives to the landfill disposal of used tires. In many ways the effort in California can be deemed a success. In 1990, about two-thirds of the scrap tires generated in the state went to aboveground stockpiles or landfills (CIWMB, July 2001). Ten years later, less than one quarter of the scrap tires generated in California in 2001 went to these “nonproductive” uses.

The yearly decreases in the percentage of California scrap tires disposed of in stockpiles and landfills throughout the 1990s came about because of increases in the percentage reused on autos (from 3.7 percent to 4.9 percent), the percentage turned into crumb rubber products (from 2.2 percent to 29.4 percent), and the percentage used as tire-derived fuel (14.8 percent to 24.3 percent). It is safe to say that these increases in the productive use of California’s scrap tires over the last decade would not have occurred without the market development, information dissemination, and research and technology efforts of the California Integrated Waste Management Board (CIWMB).

Despite these major gains, the issue of scrap tire waste persists as a California public policy concern. Recycling/diversion markets in the state lack the capacity to consume all of the waste tires generated in California. The supply of scrap tires from current and projected future flows exceeds the beneficial uses by roughly 25 percent. In the year 2001, about 9 million scrap tires ended up in above-ground piles or landfills. Since this represents a squandering of what could be a productive resource, it would be useful to consider some new ideas on how to divert this remaining 25 percent of California’s annual scrap tires to alternative uses. To this end, the purpose of this study is to evaluate alternatives to the current approach that the CIWMB uses to encourage scrap tire recycling/diversion. This evaluation is done through a simple assessment framework that considers the important economic, political, and environmental issues that surround it.

The remainder of the background discussion on California’s tire problem is divided into three parts. The next part provides an overview of California’s recent experiences in dealing with waste tires. This includes a brief history of relevant legislation, revenue available to the program, and the current approach to managing California’s waste tire program. Next we look for lessons from the experiences of other states in managing their scrap tire waste. An outline of the remainder of this report, including a description of each step in the policy analysis, concludes the background information.

California’s Recent Experience

California has led the nation in the number of registered vehicles since the mid-twentieth century. Consequently, it has also been the largest generator of scrap tires. Prior to 1990 a vast majority of the waste tires from passenger and commercial vehicles in California ended up in stockpiles and landfills throughout the state. Estimates indicate that California stockpiles in the late 1980s contained over 45 million waste tires. The combined gravity of storing this number of tires above ground, projections that the state would run out of landfill space for the waste needs of its expanding population, and the fact that some of these tire piles caught fire and caused visible environmental damage generated legislative action on this issue in 1989.

Legislation

Formally titled Assembly Bill (AB) 1843, the goal of the 1989 California Tire Recycling Act was to reduce the further stockpiling and landfill disposal of California's waste tires through the promotion and development of new and existing recycling and/or diversion markets. In addition, the act strengthened the regulatory environment that governs the storage, processing, and disposal of scrap tires in the state. Specific provisions of the Act authorized the CIWMB to offer grants and loans to private and public organizations to support and encourage recycling and diversion activities. AB 1843 also introduced new regulations to ensure safe storage of waste tires, and created a permitting system for waste tire facilities. These regulatory provisions were extended through legislation passed in 1993 that instituted a registration program for transporters of scrap tires. Funding to support these legislative mandates was first generated through a \$0.25 "return fee" on scrap tires that were left for disposal. This was later modified under 1996 legislation (AB 2108) that shifted the collection point of the fee to the retail sale of new or used tires.

Additional state legislation (AB 117) enacted in 1998 amended the California Tire Recycling Act to lengthen its original sunset clause from June 1999 to January 2001. This legislation also mandated that the CIWMB conduct a comprehensive study of California's waste tire problem and offer policy recommendations focusing on several key issues: reducing waste tire stockpiles, protecting public health and safety, preserving the environment, and identifying viable markets for recycled waste tires in California. The recommendations proposed in the AB117 report were later embodied in new legislation (SB 876) enacted in 2000.

The major provision of SB 876 was an increase in the California tire fee from \$0.25 to \$1.00 through the year 2006, and \$0.75 thereafter. The tire fee levy was also expanded to include tires on new motor vehicles. In addition, SB 876 directed the CIWMB to plan for greater funding of scrap tire recycling, diversion, and recovery activities, to increase the enforcement of waste tire hauling and facility permitting, and to produce a five-year plan to implement the bill's provisions. This legislative initiative also outlined some of the major funding priorities for the CIWMB: allocations of funds for continuing stockpile cleanup and abatement, regulatory enforcement, development of new markets and technologies, implementation of a waste tire tracking system, and ongoing environmental and market research. SB 876, and its predecessor, the California Tire Recycling Act, established the framework for current waste tire activities in California.

Revenue for Waste Tire Management

The California Legislature has authorized the CIWMB to implement and maintain a statewide, comprehensive waste tire management program. As discussed above, this activity is supported through funding from the California Tire Recycling Management Fund. Collected at a rate of \$1 per tire sold at retail, and \$1 per tire that enters the state on a new automobile, this fee is expected to generate about \$31 million in 2001.

Annual expected tire fees are based on the observed relationship that a state in a given year generates scrap tires equivalent to about 90 percent of its population. California's population in 2001 was nearly 35 million. Ninety percent of 35 million Californians yielded at least 31 million scrap tires generated in the state in 2001. If these scrap tires were replaced with new ones, either on existing vehicles or on brand-new vehicles, a dollar on each replacement would be paid into the California Tire Fund.

Since demographers in the California Department of Finance anticipate that California's population will grow to about 38 million by 2005, annual revenue in the Tire Fund will have grown to about \$34 million by then. California's population is projected to be 40 million in 2010, but since SB 876 requires that the tire fee fall to \$0.75 per tire in 2006, annual revenue deposited

in the tire fund will fall to about \$27 million in 2010. Even so, these annual dollar amounts are significantly larger than the \$6 million to \$8 million that was yearly deposited into California's Tire Fund during the late 1990s when the per-tire fee was \$0.25 and not levied on new automobile tires.

Activities of the Waste Tire Program

In 2001 the CIWMB waste tire management program supported two broad functions: (1) the regulation of scrap tire cleanup, transport, and disposal activities, and (2) the promotion of the productive end use of tires. Regulatory and environmental cleanup activities initiated under the program include permitting of waste tire facilities, enforcing tire facility regulations, sponsoring local cleanup and education programs, and providing cleanup matching grants and enforcement grants to local governments.

The CIWMB emphasis on regulating the waste tire environment to ensure safe transport, storage and disposal and on expanding the capacity of alternative-use markets through supply- and demand-side market incentives has led to substantial progress in improving California's waste tire management problem. According to CIWMB estimates, 52.9 million scrap tires have been diverted from California landfills. This has saved 1.8 million cubic yards of landfill space and an estimated \$27.6 million in tipping fees that otherwise would have been paid to solid waste disposal facilities. In addition to increases in waste tire diversion rates; CIWMB activities have resulted in successful cleanup efforts that have reduced illegal stockpiles of tires throughout the state. An estimated 13.1 million waste tires, 77 percent of which were used as raw material in recycling processes, have been removed from 50 sites in California since 1995 (CIWMB, 2000).

Although cleanup and diversion programs have had demonstrated successes, tire flows in California continue to exceed recycling or diversion capacity. The result has been the continuing use of landfills as a method of tire disposal. Market development activities to encourage tire reuse and to increase diversion from landfill disposal include:

- Providing grants and loans to processors and manufacturers of recycled materials.
- Implementing demonstration projects.
- Developing business plans and conducting market studies.
- Developing a research program on the productive end use of tires.
- Sponsoring conferences and workshops.

From fiscal years 1990–91 through 1997–98, revenue deposited into the California Tire Recycling Fund totaled \$34.1 million. In 1998, \$29.7 million of these deposits had been spent. Approximately \$13.3 million, or 45 percent of funds, was allocated to regulatory enforcement and stockpile cleanup, while \$11.4 million, or 38 percent, had been channeled to market development activities. According to the Five-Year Plan (CIWMB, 2001, p. 39), it is anticipated that \$8.2 million in revenues is available to fund new and ongoing market development and new technology projects in the 2001–02 budget year. Assuming that the money spent on market development staff, tire recycling conferences, tire care brochures, public service announcements, a “buy recycled” conference, and this study will not change, the CIWMB will spend about \$7.5 million in 2001–02 on activities designed to encourage market development and new technologies. The corresponding dollar amounts for 2002–03, 2003–04, 2004–5, and 2005–06 are approximately \$8.0 million, \$8.1 million, \$8.6 million, and \$8.6 million.

Table 1 offers a description of current CIWMB plans on how to spend these dollar amounts in each fiscal year. The entries in the table represent the total planned expenditure in a category and the percentage of total fungible (exchangeable or substitutable) budget that planned expenditure amount represents. (Note: Michael Papparian, CIWMB member, mentioned in an e-mail dated March 23, 2002, that the Board has set aside additional fungible research money that is not included in the figures presented in Table 1.)

As Table 1 indicates, the CIWMB plans to nearly triple the percentage of its fungible market development and new technology budget spent on civil engineering uses—from 6.7 percent in fiscal year 2001–02 to 17.4 percent in fiscal year 2005–06. Civil engineering projects can include highway applications, fill, drain fields, and levee reinforcement. Playground cover, track cover, other recreational surfaces, retail mats, and commercial flooring are made from scrap tire crumb rubber. The CIWMB plans to continue to offer a constant dollar level of grants to local governments to help them purchase these California-derived scrap-tire products.

Product Commercialization Grants target California enterprises that need assistance to expand scrap-tire-based products to a commercial scale. This CIWMB activity is one of the largest in scale in 2001–02 and, based upon projections in Table 1, will continue to be. Alternatively, the Green Building program is small in scope and offers grants for the purchase of building products containing California recycled tires. The Rubberized Asphalt Concrete Technology Center (RATC), also a CIWMB program, offers information to local governments on how to best use rubberized asphalt for paving. The two RATC centers in the state are funded annually at a half-million dollars. To promote rubberized asphalt, the CIWMB will also help defer the cost of signs announcing its use on major California paving projects. Funding for this is relatively minimal and expected to decline over time.

Table 1: Planned Budget Allocation for Fungible Market Development and New Technology Activities

Program Area	FY 01–02	FY 02–03	FY 03–04	FY 04–05	FY 05–06
Civil Engineering Uses	\$500,000 6.7%	\$1,000,000 12.5%	\$1,000,000 12.3%	\$1,500,000 17.4%	\$1,500,000 17.4%
Playground Cover	\$800,000 10.7%	\$800,000 10.0%	\$800,000 9.9%	\$800,000 9.3%	\$800,000 9.3%
Track and Other Recreational Surfaces	\$1,000,000 13.3%	\$1,000,000 12.5%	\$1,000,000 12.3%	\$1,000,000 11.6%	\$1,000,000 11.6%
Product Commercialization Grants	\$2,000,000 26.7%	\$2,000,000 25.0%	\$2,000,000 24.7%	\$2,000,000 23.4%	\$2,000,000 23.4%
Green Building	\$300,000 4.0%	\$400,000 5.0%	\$500,000 6.2%	\$500,000 5.8%	\$500,000 5.8%
RACTC	\$500,000 6.7%	\$500,000 6.3%	\$500,000 6.2%	\$500,000 5.8%	\$500,000 5.8%
Signs for Caltrans RAC Projects	\$130,000 1.7%	\$30,000 0.4%	\$30,000 0.4%	\$30,000 0.3%	\$30,000 0.3%
RMDZ Loan	\$2,000,000 26.7%	\$2,000,000 25.0%	\$2,000,000 24.7%	\$2,000,000 23.3%	\$2,000,000 23.3%
Capital Improvement State Parks	\$200,000 2.7%	\$200,000 2.5%	\$200,000 2.5%	\$200,000 2.3%	\$200,000 2.3%
CalMAX and WRAP (Miscellaneous)	\$20,000 0.3%	\$20,000 0.3%	\$20,000 0.2%	\$20,000 0.2%	\$20,000 0.2%
Total	\$7,450,000	\$7,950,000	\$8,050,000	\$8,550,000	\$8,550,000

The RMDZ Loan program allows direct loan assistance for waste-tire-related businesses in specified zones within California. Like the Product Commercialization Grant Program, it is funded at \$2 million annually. These two grant programs make up more than half of the annual fungible budget allocations described in Table 1. Finally, the Capital Improvement State Parks program, expected to compose less than 3 percent of future budgets, is designed to help California state park personnel identify options for the further use of products from scrap tires.

The CIWMB-planned levels of fungible dollars spent on market development and new technology activities, and the distribution of these dollars to specific categories given in Table 1, represent the scenario expected to occur if the policy options discussed later in this report are not implemented. The incremental benefits and incremental costs of each proposed new policy option will always be considered relative to this baseline. In addition, all new policy proposals will remain with the fungible allocations described above (between \$8 million and \$8.6 million between fiscal years 2002–03 and 2005–6). To better frame the policy options analyzed later in this report, we next offer an overview of what other states have done to encourage the further recycling/diversion of waste tires within their borders.

Other States' Programs

Mirroring the California experience, scrap tire legislation throughout the United States gained momentum in the 1990s in response to growing environmental and space concerns over what to do with a tire once it is no longer desired for vehicular use. In 1989, only five U.S. states regulated the flow of waste tires; by 1998 that number had increased to 48. Although California exceeds all other states in regard to the number of scrap tires generated each year, most states face waste tire problems similar to California's.

The following review of waste tire management programs in the United States and one Canadian province illustrates the variety of alternatives and approaches to addressing an annual generation of scrap tires that is greater than the market-based demands for their productive use. Concerning revenue generation to fund these different programs, the vast majority have established per-tire fees to collect funds for both the cleanup of tire piles and to create incentives geared to diverting the flow of tires away from tire piles or landfills. In most states, fees are assessed on the retail sale of new tires. But selected states collect fees at the time of vehicle registration or title transfer in an attempt to reduce accounting and collection costs. As described next, most states impose a fee of \$1 per tire or its equivalent, though variation does exist. In several states, waste tire fees that once were in place already have expired based upon on a sunset date established in the originating legislation.

Different states utilize different forms of incentives to encourage tire recycling, diversion, and reuse. As in California, the most common forms of incentives include grants and loans to develop and support recycling/diversion markets, price preferences for purchase of recycled products, tax credits for purchase of equipment used in recycling processes, and state mandates for government purchase of recycled products. A select number of states have employed reimbursement programs that offer per-ton subsidies on processed tire material to offset production costs. These end-use programs differ from the California design that emphasizes front-end market development. Program designs vary across states that have decided to employ end-use subsidies. In the upcoming paragraphs, we offer for comparison a brief description of some of the important aspects of waste tire programs in Arizona, Florida, Louisiana, Minnesota, Nevada, Oregon, Texas, Utah, Virginia, Washington, Wisconsin, and British Columbia.

Arizona

The state of Arizona established its waste tire fund in 1990. Revenue for this fund is raised through a 2 percent sales tax (not to exceed \$2 per tire) on the retail value of new tires. When a new motor vehicle is purchased and the tire cost is not listed separately, a fee of not more than \$1 per tire is collected. A 1997 amendment to Arizona's tire legislation extended the program through 2002. Tire retailers or new car dealers are required to collect the fee and forward it to the Arizona Department of Revenue on a quarterly basis. From there it goes to the Arizona Department of Environmental Quality (ADEQ) for redistribution. The ADEQ keeps 3.5 percent of the total in a statewide waste tire fund. The remainder is appropriated to each county in proportion to the number of motor vehicles registered there. The funds received by the counties pay for private enterprise contracts for waste tire processing and/or collection services.

Arizona state law mandates that each county establish at least one site for retail tire dealers and citizens to dispose of waste tires. Counties are also responsible for ensuring that the tires are properly disposed of, though each county can determine its own best methods of collection and disposal. State-funded collection sites must accept up to five tires per person, per year from county residents with no fee assessed. These sites must also accept waste tires from retail sellers of new tires with no fee. However, if a county can demonstrate that the funds it receives from the waste tire fund are insufficient to manage its program, it may then charge a fee for disposal. Since January 1992, whole tires have been banned from disposal in Arizona landfills. Chopped or shredded tires can be mono-filled (dumped exclusively into a landfill) or used as alternative daily cover at solid waste landfills.

In the late 1990s about 4 million scrap tires were annually generated in Arizona. About three-fourths of these found their way to crumb rubber facilities that produce raw material for Arizona's roads. Important to note is that much of the remaining one-fourth of Arizona's scrap tires travel to California. Most of these ends up in the Azusa landfill near Los Angeles.

According to Terry Gray, a nationally recognized expert on tire recycling, Arizona's program has suffered from some real problems that he attributes to its reliance on county level decision-making. This includes a pyrolysis proponent that won a major county contract for tire disposal, and accumulated tires on a Native American reservation that subsequently caught fire and has created a cleanup liability that is now being litigated in the courts. As well, the state's major crumb rubber producer has been through two major reorganizations and is currently shut down while going through its third.

Florida

The state of Florida enacted its tire program in 1988 through the authorization of a \$1 fee on the retail purchase of each new tire. The money is used to assist in the legal transportation and disposal of waste tires in a manner that is environmentally sound and addresses public health concerns. Under Florida law, tires can be disposed only at permitted solid waste facilities. Anyone storing more than 1,500 tires is required to obtain a permit every five years. No facility is allowed to stockpile more than three months' worth of tires for which it actually has contracts. If more tires are stored, the facility must provide evidence that the tires are actually being stored and not disposed of. In addition, storage facilities must post financial assurance that covers any disposal costs of tires or tire-derived product larger than minus one-inch shred.

Similar to California, Florida tire haulers are regulated and must have a permit to transport tires. Anyone contracting with a tire hauler to remove more than 25 tires per month is required to maintain records reflecting those transactions. In order to haul scrap tires, the vehicle being used must be permitted to do so. Anyone contracting with a tire transporter to haul more than 25 tires per month must maintain records of the transaction with information such as date, number of tires, registration number of hauler and name of hauler. This information is vital so that any unauthorized dumping may be traced to the point of origin and places accountability on the generator.

Tire-derived fuel (TDF) is the largest market for scrap tires in the state. State grants have been used to encourage the use of material from scrap tires for playground resurfacing. A playground program lasted for one year offered a 50 percent reimbursement of expenses for projects that use 100 percent crumb rubber manufactured from Florida waste tires. Overall, the Florida scrap tire program has been seen as a success. In 1988 the state had aboveground stockpiles of nearly 18 million tires; this has fallen to less than 200,000 tires in 2002 (Terry Gray, e-mail correspondence, April 12, 2002).

Louisiana

Between 1983 and 1993, over 40 million tires were discarded in Louisiana. In 1989, with the passage of Act 185, the state Legislature took action to encourage the uses of these tire discards in a more socially desirable manner. The act required all tire collectors to register with the state, and to notify the Louisiana Department of Environmental Quality (DEQ) of the location of, and approximate number of tires in, the stockpiles where they collect tires. In addition, a \$2 fee was imposed on all tires at the time of retail purchase. Retail tire dealers keep half of this and the remaining dollar is sent to the DEQ. The dollar retained by the dealer is intended to pay for the transport of discarded tires by state-permitted collectors and processors. In addition, Act 185 requires every scrap tire shipment to have a detailed manifest, made possible by additionally required cradle-to-grave records on all tires sold in the state.

In 1992, Act 185 was extended with the passage of Act 664, which encouraged local governments to become more active in waste tire processing and allowed DEQ to provide incentives for doing so. Where localities did not take up this role, Act 664 permitted DEQ to assign a licensed waste tire processor to handle the processing in designated regions. Each regional processor is required to set up a main tire-processing facility and a transfer facility in each locality within its region. The state of Louisiana pays each processing facility (whether operated privately or by a local government) \$0.70 for each 20 pounds of waste tire material generated, or \$70 per ton. The facility also receives \$0.20 per 20 pounds (or \$20 per ton) of waste tire material that it has successfully marketed and shipped. If a processor can market an entire waste tire, it will receive \$0.90 for the tire.

Louisiana has drawn praise by some for rewarding the successful marketing of shredded waste tires, which typically are purchased by out-of-state companies for use as TDF for heating boilers or kilns. In 1998, the Louisiana DEQ boasted that more than 86 percent of the state's waste tire sites had been successfully remedied through the contributions of this program. But Terry Gray (in an e-mail correspondence dated April 12, 2002) notes that Louisiana's high subsidy levels have led to the flooding of neighboring states markets with tire derived products from Louisiana and hurt surrounding states' tire recycling efforts.

Minnesota

Unlike some states that have come to view scrap tires as a potential resource, Minnesota has viewed them as a hazard. Minnesota's Department of Pollution Control manages waste tires, batteries, and diapers. All are designated by the state as hazardous materials. Until 1995, a \$4 fee was collected on the transfer of automobile ownership and went into a fund that specifically addressed all three of these hazards. Minnesota required strict documentation to be kept on all transactions involving tire haulers, processors, end-users, and retailers. Counties were responsible for the cleanup of tire piles, but the Department of Pollution Control handled enforcement. The state reimbursed counties for up to 85 percent of the cost of cleanup, contingent on adherence to guidelines, and counties had to submit detailed plans before beginning an abatement project.

Currently, state statute 115A.913 allows Minnesota to make capital loans to businesses that use waste-tire-derived products in manufacturing. The state also offers loans and grants for collection and transportation, feasibility studies, and public education programs. However, the emphasis in Minnesota has been on regulation rather than fostering a market for tire recycling.

Nevada

Nevada takes a far less-than-comprehensive approach to managing scrap tires. Legislation adopted in 1991 created a \$1-per-tire recycling fee to be charged on the sale of each retail tire. Nevada law requires that the money be used for solid waste management and divided as follows:

- Department of Conservation and Natural Resources, 44.5 percent.
- Clark County Health District, 30 percent.
- Washoe County District Health District, 25 percent.
- Department of Taxation, 0.5 percent.

Most interesting is that none of the funds are allocated to a distinct waste tire program. Even though the funds are collected as a tire-recycling fee, they are used to support all of the state's solid waste programs. Only one state employee devotes 10 percent of her time to scrap tire issues. Nevada does not publish any estimates as to the amount of waste tires generated annually. Also, there is no statewide tracking of waste tires. Nevada is one of the few states that allow whole tires to be placed in landfills. This is surprising given the technical issues associated with whole-tire landfill disposal—they tend to work their way to the surface and penetrate the cap, thereby destroying cap integrity and permitting continuing water penetration. Because landfilling is legal, the tipping fee to dispose of a tire at a Nevada landfill is so low that the state has no tire processing or recycling/diversion industry.

Oregon

Oregon's waste tire program, established in January 1988 and administered by the Oregon Department of Environmental Quality (DEQ), was designed to prevent problematic storage and disposal of tires by regulating how they are collected and stored. It was also designed to encourage alternatives to disposal. The 1988 law established a permitting system for waste tire carriers and storage sites and imposed a landfill ban on disposal of whole tires. Key elements that existed in these programs are listed below:

- **Waste Tire Carriers**—Common carriers and others hauling for hire that transport more than four waste tires over Oregon roads are required to obtain a Waste Tire Permit.
- **Storage Sites**—Storage site permits are required of tire dealers with more than 1,500 scrap tires on site, retreading facilities with more than 3,000 tires on site, and any other facility that stores more than 99 tires on site.
- **Landfill Ban**—Since July 1991, whole tires have been banned from landfills (SB 66). Tires must be coarse-shredded (with an average chip size of no greater than 64 square inches) before going into landfills. There are three landfills in Oregon that take the bulk of the state's waste tires.

Prior to sunset in 1992, Oregon's waste tire program included direct market subsidies of \$20 per ton. Oregon had an existing base of TDF consumers but its subsidy program did not result in development of any significant new customers for tire-derived products. According to industry consultant Terry A. Gray, a few historical TDF customers increased or resumed usage, but it is difficult to assess whether this was motivated by the incentive, higher fuel-oil prices, or a combination of both. In addition Gray notes that the primary benefit of the Oregon subsidy was that it led to the export of Oregon tires to fuel users in neighboring states (e-mail correspondence, April 12, 2002). Subsequent sunset of Oregon subsidies resulted in a relapse to previous free-market transportation and supply patterns but did not cause any significant cessation of TDF usage by any customers.

In Oregon there is currently no tax/fee assessed on the purchase of new tires. A \$1-per-tire disposal tax on the sale of new tires, with the monies used to clean up tire piles, took effect on January 1, 1988, and ended on October 1, 1992. In 2000 the Oregon DEQ estimated that about 6.4 million waste tires were generated in the state. Of those, approximately 1.6 million tires were recovered (recycled or burned for fuel) and about 4.7 million were disposed in landfills. This rate of three out of four Oregon waste tires going into landfills contrasts with the national situation in which two out of three tires are recovered.

The dismal status of tire management in Oregon prompted Oregon Governor John Kitzhaber to sign HB 3909 on June 27, 2001. This bill established a Task Force on Tire Recycling, consisting of 13 members jointly appointed by the Governor, the Speaker of the House of Representatives and the President of the Senate. The task force is charged with the goal of finding sustainable market solutions for the recovery of resources contained in waste tires. The task force will deliver its recommendations to the appropriate interim legislative committee by September 30, 2002.

Texas

Texas offers an example of a state tire-recycling program that has not met its intended objectives. Like California, Texas generates a large number of scrap tires each year (about 24 million in 2001). In 1992 the state began a waste tire program known as the Waste Tire Recycling Fund (WTRF). Reaching its sunset date in 1997, the program ended after five years and a restructured program designed to correct major deficiencies was caught up in an unrelated political battle and has never been implemented. The WTRF imposed a \$2-per-tire fee on the purchase of new tires. In exchange for collecting the fee, generators of scrap tires were provided with a free collection of scrap tires. The WTRF also reimbursed the processors of scrap tires for the costs associated with the collection, shredding, and recycling of tires.

The Texas tire subsidies were given to the processors of the tires. They just had to crumb or shred the scrap tires delivered to them and they received the subsidy. A provision for a guaranteed end-use was written into the original program, but was continually deferred by political pressure exerted by processors who did not want it. As a result, stockpiles of processed tires accumulated. In 1997 the amount of stockpiled shredded tires reached nearly 60 million. Many of these stockpiled tires still remain in Texas and a good percentage of them are simply not usable and will likely need to be landfilled.

Utah

The state of Utah funds its tire-recycling program with a \$1 fee on all new tires sold at the retail level. All tire fees are put into the state's Waste Tire Recycling Expendable Trust Fund. This fund is used for waste tire recycling reimbursements, the cleanup of waste tire piles, the funding of local health departments and other non-tire-related Department of Environmental Quality appropriations. Regarding waste tires, Utah focuses on encouraging the alternative use of waste tires. It does not offer any reimbursement for shredding or landfilling tires. In the past, the Utah program contained a subsidy in which transporters of scrap tires received reimbursement for the number of miles the tires were hauled to a processor. The result of this program was not that more tires were being recycled, but that tires were being hauled to other states and stockpiled there. The hauler received the subsidy, but little progress was made in the ultimate recycling of tires.

Virginia

In 1991, less than 10 percent of all of Virginia's waste tires were recycled; in 2001 this figure stood at nearly 100 percent. The Virginia Waste Tire Management (WTMP) began with a \$0.50-per-tire tax enacted in 1989 for the transportation and management of all waste tires in the state. To better mobilize public funds to manage the waste tire problem in Virginia, in 1995 the Virginia Department of Environmental Quality adopted an end-user reimbursement program that subsidizes the use of waste tire material in manufacturing processes. The current reimbursement rate is \$22.50 per ton of tire material (or about \$0.225 per tire) produced from current tire flows and \$50 per ton from material (or about \$0.50 per tire) generated from certified tire piles. Eligibility for the end-use reimbursement requires that reused material be generated from within the state.

Since Virginia's end-user reimbursement program began in 1995, its DEQ has processed 650 applications from eligible end-users representing about 450,000 tons of tire material for a total dollar subsidy of about \$14 million. This is equivalent to the recycling and beneficial use of about 50 million tires at an average subsidy of \$0.28 per tire. The largest categories of end uses in the Virginia program are tire-derived fuel (31 percent), landfill daily cover (30 percent), septic drainfields (11 percent), and landfill drainage media (12 percent).

Washington

In contrast, the state of Washington currently does not have a waste tire program. At one time the state did levy a fee on the retail sale of tires, but this program ended in 1994. The fee was put into place in an effort to clean up unsightly tire piles. After the cleanup was done there was no effort to reinstate the tire fee. Washington has never had a grant program in place to encourage the use of scrap tires. Grants for capital expenditures to help encourage a market for scrap tires were considered but found cost-prohibitive and not likely to yield sustainable markets.

The state of Washington does have an administrative code that addresses the storage of scrap tires and haulers' permits. Similar to California, a permit is required for piles of more than 800 tires. The owner of the site must develop a fire plan with the local fire department and comply with local authority requirements. The site owners must also document the delivery of all scrap tires received. The documentation includes information such as the number of tires (weight), place of origin, and the hauler's permit number. Haulers pay a \$250-per-year license fee and are required to document all deliveries of scrap tires. In addition they must have a \$10,000 performance bond on file with the Department of Ecology. There are currently about 1.8 million tires in the state that are stored legally, but estimates indicate that about double that amount are being dumped illegally in parts of eastern Washington (R. Martin, personal communication, September 26, 2001).

Wisconsin

The state of Wisconsin employed an end-user reimbursement program funded by a \$2-per-tire levy on first-time vehicle registration from 1988 until a sunset in 1997. Wisconsin's Waste Tire Removal and Recovery Program used the \$2 levy to offer a \$20-per-ton reimbursement rate to eligible businesses for energy recovery, construction, or manufacture of products made from recycled tires. This reimbursement program was later expanded to provide an equivalent reimbursement for tire processors as end-users and was increased to \$40 per ton on scrap-tire-based raw materials if used in recycled-content products. End uses that were eligible for subsidy under Wisconsin law included energy recovery, pyrolysis, highway improvements, and the manufacture of new products. Not eligible for rebates were landfill disposal, reuse as a vehicle tire or for erosion control, or other uses of a split tire. Through the six years of the program, Wisconsin spent approximately \$4.5 million on end-use rebates.

British Columbia, Canada

In 1991 British Columbia became the first Canadian province to subsidize the processing of scrap tires. This program is funded through a \$1.88-per-tire (U.S. dollar value based upon U.S. to Canadian dollar exchange rate of 0.60) retail tax on all tires sold in the province. The subsidy is based on two elements. The first, or proof of sale element, pays the tire recycler a per-tire equivalent (PTE/8.2 kg) that varies from \$0.31 PTE up to a maximum of \$0.94 for tire-derived product and is dependent on the level of processing incurred. For tire-derived fuel the recycler is paid a per-tire equivalent (PTE) of \$0.44 for whole tires and \$0.56 for shredded tires. The second element is a transportation subsidy that on average works out to \$0.32 PTE based upon a complex calculation using weight and distance traveled. Primarily used to encourage crumb rubber production, the total British Columbia subsidy in 2001 was on average \$1.14 PTE. This program is of special concern to California producers of crumb rubber because British Columbia producers are allowed to export their subsidized products provided no provincial purchaser for the product is available. Subsidized crumb rubber is currently finding its way into California markets and many California producers are crying foul (Gunderson letter, January 25, 2002).

Remainder of Report

The remainder of the report is organized into five more sections. The next section focuses on the economic, social, political, and legal environments that have shaped the history of public tire management in California and discusses the implications of these environmental influences on alternative incentive program proposals. The third section of the report introduces the policy alternatives under consideration. It analyzes the origins of the problem under study here, defines

the variables inherent in the alternatives, and simplifies the number of alternatives. The subsequent section presents the criteria used in evaluating the policy alternatives with justification for their inclusion. Section five is dedicated to the analysis of alternative policy proposals. It projects outcomes of all alternatives, analyzes outcomes in terms of previously established criteria, summarizes and contrasts alternatives relative to a baseline scenario, and assesses the tradeoffs among various alternatives. The report concludes with recommendations and conclusions, including discussion of long-term versus short-term issues and issues of implementation.

2. The Environment Surrounding California's Waste Tire Management

Public policies and the government programs they generate operate within a complex environment of influences and constraints that impact the feasibility of their implementation and resulting outcomes. The success of any proposed policy alternative requires consideration of these limitations and careful weighing of their importance in determining the policy's outcomes. The following section examines the social, economic, and legal/political constraints that shape the public management of scrap tires in California. These constraints ultimately contribute to the development of the criteria used for evaluating the various policy alternatives introduced in subsequent sections.

In this section on the environment surrounding scrap tire management in California; we first examine the social and environmental aspects that have led to the public management of waste tires. This includes a discussion of the basic reasons why individuals and governments pursue recycling as a solution to the solid waste problem. The section also looks at some of the environmental issues that have placed tire management on the public agenda and the health and safety concerns that have shaped current recycling activities. Following this is a brief discussion of the economic structure of waste tire disposal, including the various market forces that influence the supply of waste tires and the demand for some recycled tire products. Finally, we describe the political constraints that constitute the framework for waste tire management in California and the impact it exerts on the feasibility of implementing policy alternatives.

Social and Environmental Issues

The recycling movement in the United States and California gained much of its momentum in response to the social and environmental conditions that mobilized individuals and government to action. In the 1970s and early 1980s, emerging concerns over the long-term capacity of landfills and the ability to accommodate future solid waste streams in existing landfill space stimulated broad interest in recycling initiatives and research supporting recycling technologies and markets. Closer scrutiny of the issue in later years, however, revealed that in the majority of American communities existing landfill capacity has proven sufficient. Despite changing perceptions on the future capacity of U.S. landfills, by the early 1990s household and governmental recycling programs had grown rapidly across the nation. Ackerman (1997) notes that by 1994 more than 40 percent of the U.S. population was served by curbside recycling programs and that of the 7,200 programs in operation, nearly all had been established over the previous six-year period.

Public participation in the recycling movement throughout the 1980s and '90s was further encouraged by a growing environmental consciousness that promoted conservation over consumerism. A component of this broadened environmental awareness was a widely shared belief in the social benefits of recycling. Ackerman (1997) describes individual participation in the recycling effort as a "pure form of altruism" and an "organized expression of widely held ecological values." Furthermore, the ease of household participation in recycling programs allowed individuals to actively contribute to environmental preservation efforts on a manageable scale. The motivating factor underlying the recycling movement is the simple public recognition that conserving landfill space, saving energy, and reusing materials are beneficial for the environment and a commitment to the public good.

In addition to the above-described social influences, a major impetus for the expansion of tire recycling legislation in California has been a growing concern over the environmental and safety hazards posed by stockpiling scrap tires. A widely recognized safety issue associated with large tire piles is the potential for fire. Tire contents are highly flammable and their low bulk density provides sufficient airflow to fuel flames. When large piles are ignited they are extremely difficult to extinguish. Moreover, the open-air burning of tires releases chemicals into the surrounding environment that impact air quality and contain known carcinogens.

In addition to the potential for harmful emissions, the extreme temperatures of tire burns produce a chemical change known as pyrolysis that produces large quantities of petroleum oil and contaminates groundwater (Snyder, 1998). Several states have experienced major tire pile fires that have imposed large costs on the environment and significant cleanup costs on state and local governments. In California, the 1998 Tracy and 1999 Westley tire fires served as major triggering events that led to the passage of SB 876, California's most sweeping tire recycling legislation.

Another major health concern stemming from tire stockpiling is the potential for disease transmission from vermin (most notably mosquitoes and rats) that live and breed in stockpiles. The loose structure of tire piles and the shape of individual scrap tires allow for water to collect away from direct sunlight, creating a perfect breeding ground for mosquitoes. In several instances the presence of tire piles has been linked to outbreaks of mosquito-borne diseases in surrounding populations (Snyder, 1998).

Economists refer to the environmental and health concerns that naturally arise in dealing with scrap tires as "externalities." This term is appropriate because these concerns are largely external to the market economy and will continue to persist without some form of government intervention. For instance, the private businessperson who owns a tire stockpile will charge a per-tire fee for disposal that equals the per-tire cost to cover his or her private cost to maintain the stockpile into the future. Left to his or her own calculation, the businessperson is highly unlikely to factor in the social and environmental costs (unsightliness, disease generation, toxic fire potential, etc.) that the tire pile imposes upon neighbors. Unscrupulous stockpile operators will actually fail to charge enough in tipping fees to reflect even their ultimate disposal costs because of no intention of ultimately and properly disposing of the accumulated tires. Thus, from a social perspective, the stockpile operator charges too little for tire disposal and too many tires accumulate in stockpiles.

Economic Environment

Beyond the social and environmental aspects of waste tire management activities just discussed, economic factors need to play a critical role in shaping a state government's tire recycling and landfill diversion strategies. Economic factors include the highly competitive markets that suppliers of scrap tires operate in and the economics surrounding the industries in which the large-scale demanders of scrap tires exist. In California these industries include generators of crumb rubber, users of TDF, and cement kilns. Each of these economic factors is discussed next.

Scrap Tire Supply

Any policy alternative that is proposed to further California tire recycling or scrap tire diversion must operate within the state's market structure of scrap tire disposal and reuse. This structure is best characterized as a free-market system with a high degree of competition among many suppliers and demanders of scrap tires.

The supply of California's scrap tires primarily begins at retail tire dealers when consumers purchase new tires and leave tire casings for disposal. In addition to paying for their choice of tires, retail customers are now required to pay \$1 per tire into California's Tire Recycling Management Fund and may also pay the retailer a "disposal fee." Customer disposal fees help defer the cost borne by the retailer to get rid of a discarded tire. Tire dealers are then dependent on tire transporters, or "tire jockeys", to convey their cast-off tires from the retail location to an appropriate disposal point or end-user.

Tire transporters of used tires are required by the CIWMB to hold a valid waste-tire hauler registration, obtain a performance bond, and observe the requirements of the Waste Tire Hauler Manifest System (CIWMB, 1998). In 2000, the CIWMB reports there were 827 licensed waste tire transporters in the state of California using 8,944 vehicles. A major source of revenue for the tire transporter is the sorting of discarded tires into ones that may be retread or resold to domestic or export markets. High-volume retailers, more likely to produce a larger number of such tires, may pay no disposal fee to tire transporters. Other retailers have to pay transporters to haul their discarded tires away.

The tire transporter's choice to take discarded tires to a landfill/stockpile or to offer them to a more socially beneficial user is driven only by economics. Tire transporters move waste tires to a place of disposal that offers the lowest overall cost to them to do so. These overall costs include time and miles to get to a disposal site and the "tipping fee" paid once there. A tipping fee is the cost to the transporter for tipping his truck's contents at a disposal site. In 2000, the average tire-tipping fee for a landfill in California was \$67.00 per ton. Since a ton contains approximately 100 tires (at 20 pounds each), this works out to about \$0.67 per tire.

The average for all other types of disposal facilities was slightly higher at \$71.00 per ton or \$0.71 per tire (CIWMB, 2001). Some landfills, such as the Azusa Land Reclamation Company's in Southern California, charged only \$42.00 per ton of tires, while others like the Ben Lomond Transfer Station in Santa Cruz County charged almost seven times as much. However, as industry consultant Terry Gray notes, the "best" customers at a landfill may pay rates that can be significantly less than quoted in the CIWMB survey.

Reasons for variation in landfill tipping fees across California are usually local. The city of Azusa wishes to fill in an enormous open-pit landfill within its city limits and has decided that waste tires would best serve this purpose. The low tipping fee encourages tire transporters to bring their waste tires to Azusa. (Recall from above that this transportation of scrap tires is occurring from as far away as Arizona.) On the other hand, the community of Santa Cruz does not wish to encourage the importation of waste tires and charges a very high tipping fee to dissuade tire transporters from traveling to its landfill.

Tipping fees, and distance to disposal site, determine where transporters take their tire flows and therefore dictate the supply of tires within specific recycling industries. For example, a producer of crumb rubber may command a tipping fee of \$0.45 per tire in one community and receive all the scrap tires needed for desired production levels. Alternatively, a producer of crumb rubber in another California community may try to charge the same \$0.45 per tire and find no tire transporters showing up at their processing facility. One likely difference may be that the second producer is located near a landfill that charges less than \$0.45 per tire to tip, while the first is not.

Snyder (1997) argues that the tipping fee is the most critical cost component in end-use recycling processes. Brown et al. (2001, p. 16) also note that:

“The most policy-relevant economic characteristic of [tire] chip processors is the second revenue source, the tipping fee. Over recent years tipping fees have averaged approximately \$0.65 PTE [per-tire equivalent], compared to \$0.10 received for recycled product. ...However, the tipping fee is not only the processor’s primary source of revenue, it is also her primary source of uncertainty.”

In many industries, like the tire chip industry, that rely on scrap tires as input, the price structure for the end product is not sufficient to cover operating costs associated with processing the hard-to-recycle tire material. For example, producers in the TDF industry, despite enjoying low costs associated with minimal processing requirements, only earn a few cents per pound for their product. Similarly, leading producers in the crumb rubber industry have indicated that although prices for end products are high relative to other industries, substantial processing costs limit profit margins to only 1 to 2 cents per pound (Phillips, 2001).

This disparity between market prices for end-use products and costs of production increases reliance on tipping fees to extend profit margins in industries that rely on scrap tires as the crucial input. This reliance on tipping fees as a revenue source is an important factor that prohibits the full diversion of waste tire streams from landfill dumping. Although restrictions on landfill use have increased the market cost of landfill disposal, tipping fees at landfills remain low enough to successfully encourage tire transporters to take their product there.

Understanding this, state regulators have traditionally relied on a variety of market intervention strategies to counteract the socially inappropriate signal that market-based tipping fees can send. Several of these strategies have involved subsidizing tire processing operations to lower costs, either through front-end market capital investment assistance or through end-use per-ton reimbursements for processed tire material. These types of intervention strategies, designed to raise or lower the prices faced by suppliers or demanders, are a typical form of intervention in a free-market system to correct the social and environmental externalities discussed above (Bardach, 2000).

Finally, Snyder (1998), in his examination of scrap tire reuse and disposal, outlines a socially desirable hierarchy of uses for scrap tires based on the market value of alternative uses. In such a scheme, retreading is at the top of the hierarchy based on the relatively high consumer value of retreads on the resale market. The next best use of scrap tires is in crumb rubber processing. The highest quality, finely ground crumb rubber used in the production of molded rubber and blended plastics, has an estimated market value of \$250 to \$500 per ton. By contrast, larger particle-sized crumb used in other applications such as an asphalt extender is priced at a considerably lower \$100 per ton and is thus positioned just below more highly processed products. The next lower layer in Snyder’s hierarchy is the use of tires as fuel, with estimated value at approximately \$40 per ton or less depending on the specific use. Though lower in the social hierarchy, TDF is the most accessible end-use due to low processing requirements. Landfilling and stockpiling occupies the bottom of the hierarchy because it carries a negative economic value due to burying of a resource that has economic value and the environmental costs it can impose. A better understanding of this hierarchy is obtained through the review of the various uses for scrap tires offered next.

Crumb Rubber Industry

Within California, the crumb or granulated rubber industry is the leading user of scrap tire waste and currently accounts for nearly 30 percent of volume from tire flows. Crumb rubber is a

material produced from processing scrap tires or other rubber into uniform granules after reinforcing material such as steel and fiber and natural contaminants (dust, glass, or rock) are removed. The two sources of tire-derived crumb rubber are tire buffings and whole processed scrap tires. On the U.S. market, approximately 45 percent of total crumb rubber volume originates from tire buffings, while the remainder is obtained from whole processed tires (STMC, 1999). The processing of a single scrap tire produces approximately 10 to 12 pounds of crumb rubber (TNRCC, 1999).

Crumb rubber is used in the production of a wide array of recycled consumer products and applications. North American markets for crumb rubber include asphalt modification, molded products, tires/automotive, sport surfacing, rubber/blended plastics, construction, surface modified/reclaim, animal bedding, and other similar uses. Recent technological advances in crumb rubber production have enabled the manufacture of smaller particle sizes, resulting in expanded applications in molded rubber and composite products (CIWMB, 1996). This improved production capacity has resulted in supply increases and consequent cost reductions that are anticipated to improve competitiveness in pricing with virgin rubber products.

Mesh size, or number of pieces per square inch, dictates pricing for crumb rubber. The price for larger 10-inch mesh is approximately 10–18 cents per pound, compared to 25–52 cents per pound for finer 80-inch mesh (CIWMB Waste Tire Marketing Guide, 1999). Though there have been ASTM standards for crumb rubber products for several years, most crumb rubber producers do not abide by them due to the cost of installing quality control laboratories that would allow them to utilize these standards. The total market demand for crumb rubber in the U.S. in 1998 was estimated at 460 million pounds. This represents a 187 percent increase over the demand of 160 million pounds in 1992. Industry projections suggest that markets will continue to experience sustained growth rates of roughly 10 to 15 percent annually (Scrap Tire Management Council, 2000).

Despite substantial market growth, the supply of crumb rubber has continued to outweigh demand. Many of the U.S. crumb rubber processing facilities came into operation in response to anticipated legislation at the federal level requiring the U.S. ISTEA (Intermodal Surface Transportation Efficiency Act of 1991) to increase the percentages of crumb rubber in federally funded asphalt road construction (Gray, 2000). This legislation was never implemented; however, several states, including Florida, Arizona, and California, have voluntarily expanded the use of rubberized asphalt in state and local road projects. The current levels of crumb rubber use nationally have failed to match the earlier anticipated demand and the result has been an excess supply of producers on the market.

In addition to excess production capacity created by the federal highway act, the crumb rubber industry has faced several additional market challenges. The Market Status Report on Waste Tires (CIWMB, 1996) has identified four major barriers to the development of crumb rubber markets in California and the U.S. These barriers include:

- High costs associated with the collection, sorting, and processing of waste tire material.
- The underdevelopment of emerging markets for crumb rubber products and applications.
- Public health concerns regarding the use of rubberized asphalt.
- Consumer perceptions of poorer quality in recycled products.

In addition to barriers present in domestic markets, a growing concern for California crumb rubber producers has been the recent influx of highly subsidized crumb rubber from Canadian producers imported for use in California rubber asphalt projects (California Tire Report, 2001). High end-use reimbursement rates for recycled tire processing have artificially lowered Canadian prices, creating “unfair” competition for California firms. Further, subsidies lowering production costs have increased the number of suppliers, allowing Canadian producers to capture a share of the crumb rubber industry. Though most of the Canadian producers are small due to the limited quantities of tires available in sparsely populated Canadian provinces (Gray, 2000). Even so, some have proposed that the State of California or the federal government adopt countervailing tariffs to counteract the market distortions caused in California by the influx of subsidized Canadian-produced crumb rubber.

In its market status report, the CIWMB offered two broad strategies for overcoming recycling-market barriers, one of which included a focus on crumb rubber markets. Specific recommendations included (CIWMB, 1996):

- Developing funding criteria granting preference to crumb rubber market development for tire grants and loans.
- Improving information dissemination on new technologies and enhancing networking between crumb rubber suppliers and end-users.
- Encouraging the industry-wide adoption of quality standards for crumb rubber producers.

Others argue that offering grants and low-interest loans to new crumb rubber producers when markets are saturated will reduce capital and operating costs for new enterprises, creating unfair competition for existing producers (Gray, 2000).

TDF Users

Tire-derived fuel accounts for nearly 25 percent of the current use of scrap tires in California. Fuel derived from scrap tires comes in the form of shredding or chipping these tires, as well as using them whole. As a fuel, TDF generates between 13,000 and 15,000 BTU per pound—roughly the amount of energy found in superior quality coals. In industry applications, TDF is generally used to supplement traditional fossil fuels such as coal or wood waste.

If tires are burned in a proper furnace, combustion of the tire is complete and the smoke containing hydrocarbons is avoided. Though even the proper burning of tires does emit some sulfur dioxide, experts note that it is significantly less than the sulfur dioxide emitted from burning most of the common coal used as fuel in the U.S. (Snyder, 1998, p. 48). When tires are placed in landfills, we are burying a better fuel than we are mining. The industries that have used TDF with the most success include cement kilns, paper/pulp mills, utilities (including cogeneration plants) and general industrial boilers. TDF can successfully supplement traditional fuels, but its use is generally limited to 10 to 15 percent of the total fuel used depending on application. As discussed below, cement kilns are the only industrial application that can burn scrap tires whole and do so without generating an ash that must be disposed of.

Environmental (emission) issues are part of the reason that TDF has not achieved a greater level of use, but other factors include temperature control and the generation of ash byproducts. The efficient burning of TDF requires a uniform heat that is produced through a mixture with coal that can be technically demanding. Among other things, tires also contain significant amounts of zinc.

Zinc in small quantities is not considered hazardous, but like any metal, in high and concentrated quantities it can be. Once burned a tire's zinc remains in the bottom ash of a boiler and must be disposed of in a manner consistent with other hazardous materials. Disposal of ash with concentrated zinc is costly and sometimes can outweigh the benefits of using TDF.

The economics of why it is usually beneficial for cogeneration plants to use TDF is related to production costs. As long as the cost of supplementing with TDF is less than coal, cogeneration plants are likely to utilize this resource as a secondary fuel. While expansion of TDF use in California is a very real possibility, it could only occur in boiler systems designed to burn coal, wood chips, or other solid fuels. California, unlike much of the country, has far more electricity producers that run on natural gas than on traditional fossil fuels. This fact limits the number of currently operating systems that could potentially convert to accept TDF.

California currently has only one cogeneration plant that is utilizing TDF regularly (1.5 million tires per year) and four others (Posdef, Rio Bravo-Jasmine, Jackson Valley, and Rio Poso) that are in the process of system conversion or permitting. If and when the other four come on line using TDF, it is estimated that all the plants combined could use roughly 7.5 million tires per year. The only way that the currently operating cogeneration plants could use more than the 7.5 million would be by obtaining a "variance" from the California Department of Toxic Substance Control (DTSC). The variance would have to allow for increased zinc levels above 5,000 parts per million in the ash byproducts (T. Heller, personal communication, November 8, 2001). But based on an e-mail received from Randall Ward (August 16, 2002), the DTSC has recently granted such a variance for use of TDF in California's cogeneration facilities as long as ash byproducts are not used as a soil amendment and instead used for applications that benefit from the pozzolanic qualities of the ash (e.g., the creation of rubber pads used on dairy farms).

Cement Kilns

At more than 73 million tons of annual product, the manufacture of Portland cement is one of the largest mineral industries in the United States. Energy costs account for approximately 40 percent of the total cost of this manufacturing (Thornberry, 2001). Therefore consumption of coal by cement kilns is enormous, and the use of scrap tires as an additional fuel source is an attractive opportunity for TDF.

Gabbard and Gossman (1990) conclude that the very nature of the cement kiln operation is an ideal way to dispose of waste materials like tires. Cement plants have massive particulate scrubbers that almost completely eliminate the production of unwanted air contaminants. Yamaguchi (2000) cites studies that have shown that the emission level of pollutants from cement plants utilizing scrap tires as a supplemental fuel are lower than from other coal-fired facilities. Using TDF as a fuel source for cement kilns reduces the emissions of metals such as zinc, thallium, cadmium, lead, nickel, and chromium.

In addition, dioxin, fluoride, CO, SO_x, NO_x, and HCL remain at the same levels as in traditional facilities. The use of scrap tires as fuel can also reduce stack emissions of carbon dioxide by 20 percent or more. A report by Cadence Environmental Energy Incorporated (2001) found that NO_x emissions are reduced by as much as 37 percent when tires were used in the manufacture of Portland cement. A study in the Environmental Building News (1993) discusses the major components that lead to increases and decreases of air pollution in the operation of a cement kiln. The research indicates that a high temperature level, approximately 3,000 degrees in the kiln's burning zone, causes high NO_x emissions. However, the use of tires as a supplemental fuel

allows part of the energy the cement kiln requires to be consumed at lower temperatures, thereby lowering the overall NOx emissions. Most view this as a positive tradeoff because NOx is generally considered worse for the environment.

Many are concerned that the use of tires in cement kilns increases the amount of dioxins they release into the air. The Cement Kiln Recycling Coalition (2001) contends that this is not the case. It reports that since 1990, kilns that have used tires have reduced their amount of dioxin release on average by 97 percent. The finding was corroborated by the U.S. Environmental Protection Agency and is based upon the fact that the formation of dioxins is a process that occurs after combustion. Dioxins are not dependent on the use of waste tires or some other solid waste fuel.

Even so, not all groups consider the use of scrap tires as a secondary fuel source acceptable. The National Citizens Alliance (NCA) is a grassroots coalition of environmental groups that opposes the burning of hazardous materials, including tires, in kilns. (National Citizens Alliance, 2001) The NCA believes that cement kiln operations were allowed to begin their incineration of hazardous materials without public participation or knowledge of the potential impacts of such incineration. The NCA contends that the 23 hazardous waste-burning cement plants minimized what they were doing by calling it “recycling” or “co-processing” and labeling the waste “supplemental fuel.” The organization is worried that since the cement kilns were not designed for fuels such as waste tires, they cannot safely burn them. Citizen groups like the NCA are worried that burning scrap tires in kilns will later lead to the burning of more hazardous materials.

Use of tires as a secondary fuel source in cement kilns is recognized by the CIWMB. Of the six cement-production facilities that are permitted to store scrap tires for burning in California, three are doing so. These include Lehigh/Calaveras Cement in Redding, California Portland in Colton, and Mitsubishi in Lucerne Valley. The three remaining facilities that are permitted to store tires for fuel, but are not currently burning scrap tires, include California Portland Cement in Mojave, Cemex California Cement, and TXI Riverside Cement in Victorville (California Portland, 2001). Since cement kilns that accept tires can be paid tipping fees, why are three of the six cement facilities, permitted to store scrap tires for burning, not taking full advantage of such a fuel source? The major reason is that public opinion and opposition of some community groups has thwarted the use of tires as a fuel source (Bennett, 2001).

An example of such community opposition to burning tires in a local cement kiln comes from Santa Cruz, California. The local plant passed the required rigorous air testing. However, once tire burning became likely, community groups put pressure on elected officials to prevent it. In the San Jose area, the Hansen cement kiln at Cupertino met a similar fate. The initial testing of the plant’s emissions produced poor results. So far, community outcry has prevented this plant from using tires in the production of cement even after final air emissions tests proved successful.

Successes with waste tires as fuel in cement kilns do exist in California. The California Portland cement plant has actually been required by the South Coast Air Quality District (SCAQMD) to use waste tires as fuel to lower the NOx emissions of the facility (Bennett, 2001). SCAQMD believes that by utilizing the tires as a secondary fuel, the Colton facility will realize a 20 to 40 percent reduction in NOx emissions (California Portland, 2001). Secondly, Lehigh/Calaveras Cement in Redding has been using tires for the past 10 to 12 years as a fuel source. Unfortunately for California tire diversion efforts, up to one-third of the scrap tires used in this plant have come

from Oregon. The Mitsubishi cement plant has also demonstrated significant NOx emissions as a result of their tire use.

As the National Citizen's Alliance will strongly attest to, one cannot say with 100 percent certainty that burning scrap tires in cement kilns produces no worse air pollution than burning the alternative fuels. It is our reading that the preponderance of evidence points in this direction. To mitigate this continuing controversy, independent federal and State regulatory agencies, like the CIWMB, need to continue gathering, producing, and assessing the best available information on emissions generated through the burning of scrap tires for fuel.

Political Environment

In addition to the social and economic environment surrounding the issue of waste tire recycling/diversion in California; there is the very important political environment to consider as well. Politics is important, because as described next, decisions regarding the course of government intervention into scrap tire markets are made by the CIWMB.

Responsibility for overseeing California's waste management efforts is granted by the State Legislature to the CIWMB that serves as branch of the California Environmental Protection Agency (Cal/EPA). The CIWMB was established in the late 1980s through the California Integrated Waste Management Act (IWMA). The IWMA created new mandates for waste disposal, including an agency goal of a 25 percent landfill-diversion rate for cities and counties by 1995 and a 50 percent diversion rate by 2000. In addition to establishing clear goals for waste disposal, the 1989 act outlined steps to ensure the environmentally safe disposal of waste. A major role of the Board is to assist and support local jurisdictions in their efforts to meet State diversion mandates. The Board is also responsible for developing and expanding recycling and diversion markets and establishing and enforcing regulations to protect public safety and health.

The CIWMB consists of six members. The Governor appoints four of these members and the California Legislature appoints the remaining two. Of the current six Board members, two represent the public at large, one is experienced in solid waste, one is experienced in environmental issues, one was appointed by the Speaker of the Assembly, and one was appointed by the Senate Rules Committee. Due to the fact that CIWMB members are political appointees and terms last only four years, the Board's political composition and member philosophies can change with each new administration and political majority in the Legislature. In order for an action to be taken by the CIWMB, the proposed action must receive at least four votes. But given the Board's composition, such a majority consensus can be difficult to achieve if a proposal is too far from center.

The political environment influencing the CIWMB is both internal and external. Outside interests and lobbying forces could pose a significant political constraint to finding a simple solution to the excess supply of scrap tires in the state. Given the nature of the problem, any action taken by the Board is unlikely to be looked upon favorably by everyone involved. The reason: a new scrap tire policy adopted by the Board will not make all scrap tire stakeholders in California better off, and may even make some worse off. Even though such a policy may be in the best social interest of all Californians, those made worse off will naturally lobby for non-adoption.

An example of the importance of these political pressures and their ability to defeat socially optimal solutions comes from the national level. As part of reauthorizing the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 it was proposed, as mentioned previously, that

the use of rubberized asphalt occurs as a certain percentage of all federally funded highway projects. Though this would have solved the tire recycling/diversion problem throughout the entire United States, this proposal was ultimately rejected in part because of the opposition it generated from state and local highway departments and private contractors that pave highways using traditional techniques, as well as those that provide the materials used in conventional asphalt (Snyder, 1998).

Though as CIWMB member Michael Paparian pointed out in a March 23, 2002, e-mail communication, the Board has recently managed to raise the tipping fee for waste disposal over the strong objection of California waste haulers and landfill operators. The important point is that politics exists in the world of tire recycling at the national and State levels; any alternatives proposed to current CIWMB policies on scrap tires must take this into account.

3. Waste Tire Management Alternatives

Previous sections of this report have provided an overview of the waste tire situation in California, including a discussion of the problem source and development, a history of legislative action, and an overview of current strategies employed to manage the issue. Also offered was a discussion of the problem context including the social, environmental, and political constraints that have shaped the issue and its proposed policy solutions. This next section introduces potential policy options that are later considered as alternative strategies for California's waste tire management effort. While the specific focus of this report is to examine the impact of end-use subsidy programs on California markets, the strategies presented represent a continuum of alternatives that include subsidies. A later section of the report focuses on the criteria that are used to evaluate the impact of each policy alternative.

The section is organized into three parts. The next part re-examines the causes and magnitude of the waste tire management program in California. The section specifically discusses the failures in the market system that propagated the problem. The second part discusses the variables inherent in the alternatives that could be altered to facilitate policy change. The final part summarizes the alternatives that are considered in subsequent analysis.

Causes of the Continuing Tire Waste Problem

California continues to face a waste tire management problem. Last year Californians generated about 31 million scrap tires that had to be reused, recycled, diverted or disposed of. Given the state's anticipated level of high population growth, and that scrap tire generation is directly related to population, this figure will only get larger. Under current CIWMB policies, about 75 percent of these waste tires are recycled or diverted into productive end uses. This includes the manufacture of recycled rubber products, alternative fuel sources for cement kilns and cogeneration plants, rubberized asphalt, and civil engineering projects. The remaining 25 percent of California's waste tire flow, or about 8 million tires, are disposed of in landfills or stockpiles. According to the previously described hierarchy of scrap tire use, burial represents a squandering of a potentially valuable resource.

To address the state's waste tire management problem of supply being greater than demand, the CIWMB has previously made efforts to develop and encourage new recycling/diversion markets. This emphasis on productive end uses over landfill disposal is reflected in State law, set forth in California's Public Resource Code (PRC) 42861. (a):

“The Problem posed by used tire storage and disposal requires a comprehensive, statewide response, including, but not limited to, reducing landfill disposal of used whole tires, recycling of tires into secondary uses, source material development and promotion of secondary markets for used tire byproducts, tire shredding, and energy recovery.”

And PRC 42861. (d):

“Used tires represent a valuable state resource which should be reclaimed whenever possible. An abundance of tire recycling alternatives exists which have been demonstrated to be environmentally safe. These alternatives need to be promoted in order to achieve the maximum uses of tires.”

Tire recycling and reuse is also called for in PRC 40051:

“In implementing this division, the Board and local agencies shall do both of the following: (a) Promote the following waste management practices in order of priority: (1) Source reduction. (2) Recycling and composting. (3) Environmentally safe transformation and environmentally safe land disposal, at the discretion of the city or county. (b) Maximize the use of all feasible source reduction, recycling, and composting options in order to reduce the amount of solid waste that must be disposed of by transformation and land disposal. For wastes that cannot feasibly be reduced at their source, recycled, or composted, the local agency may use environmentally safe transformation or environmentally safe land disposal, or both of those practices.”

Though one factor to consider arises in PRC 40180:

“‘Recycle’ or ‘recycling’ means the process of collecting, sorting, cleansing, treating, and reconstituting materials that would otherwise become solid waste, and returning them to the economic mainstream in the form of raw materials for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace. ‘Recycling’ does not include transformation, as defined in PRC 40201. [‘Transformation’ means incineration, pyrolysis, distillation, gasification, biological conversion other than composting.]”

The existence of PRC 40180 has produced disagreement as to whether the use of scrap tires as tire-derived fuel counts as “recycling” under California’s Public Resource Code. For the purpose of this report, the existence of PRC section 42861 (a) and (d) supports the use of scrap tires as fuel as a productive end use, though lower on the waste management hierarchy than recycling. Putting this debate aside, California law clearly supports the goal of recycling or diverting from landfills or piles all scrap tires generated in the state if it is “feasible.” Though it is not occurring now, we argue that there is no reason to assume that such a goal cannot be accomplished.

The reasons that about one-fourth of California’s scrap tires end up in landfills or an above-ground pile is a market imbalance between supply and demand. There is an ample supply of scrap tires generated in a year, but demand for the productive use of all of these scrap tires does not exist. Since reducing the supply of scrap tires generated in California each year is likely beyond the scope of policies available to the CIWMB, the solution to this imbalance is to try to increase the demand for scrap tires.

The excess supply of California’s waste tires that are disposed of in landfills or piles reflects a failure of the market to reach a socially desirable equilibrium. As discussed earlier, this failure stems in part from the fact that an unregulated market for scrap tires does not fully take into account the social and environmental costs associated with placing tires in landfills or piles. The presence of this market failure indicates a need for government intervention to correct it. Noting that the CIWMB has already made tremendous progress toward correcting this market failure, there is still the need to complete the final leg of its full elimination.

As described by Bardach (2000), governments have at their disposal a wide array of market intervention strategies to correct such market failures; these include taxation, regulation, grants and loans, service programs, budget modification, information dissemination, and similar strategies. Next we describe some key variables that need to be considered before suggesting which of these policy tools is the best to pursue.

Variables Inherent in Alternatives

The policy options proposed as alternatives to current tire management activities represent forms of government interventions that alter a component of California’s scrap tire market. The nature

of the intervention and the point at which the intervention occurs dictate the final policy impact. The following section outlines the major variables that exert an impact on the number of scrap tires recycled in California. These include the tipping fee, legislation governing landfill disposal, technological limitations in tire processing, public perceptions regarding TDF use, demand for products produced from crumb rubber, and transportation costs for tire transporters.

Tipping Fee

In the scrap tire market the tipping fee is paid by the tire transporter to the landfill/stockpile operator or tire processor to dispose of the waste tires they have collected. As discussed previously, the tipping fee has been called the most critical cost component in the end-use recycling process since it often surpasses the end-product price as a source of revenue for the tire recycler. Tipping fees vary across industries and within industries according to local conditions, such as proximity to other processors or end-uses. The tipping fee serves as a critical market signal that determines how the supply of waste tires flows to recycling processors, energy plants, or landfills. Lower tipping fees offer a clear incentive for tire haulers to deliver tire supplies to those processors who charge them. For example, relatively low tipping fees at landfills encourage the movement of waste tire volume to that disposal and away from more productive alternative uses.

Legislation Governing Landfill Disposal

The vast majority of waste management programs in the U.S. view landfill disposal of tires as an unproductive use that is socially, economically, and environmentally undesirable. Citing a nationwide survey of state waste management programs, Brown et al. (2001) notes that more than two-thirds of the states impose some form of restriction on landfill disposal of waste tires to reduce or regulate waste tire volume. Most states have prohibited disposal of whole tires in landfills and have required waste material to be partially processed into tire chips prior to disposal. Several states, including Minnesota, Arizona, and Wisconsin, prematurely banned all waste tire material from landfills before a market demand for them existed.

Due in large part to opposition from the solid waste industry, mandates established by the California Legislature have been less prohibitive than the wholesale banning of tires from landfills. Currently, the regulation of tire waste disposal in California has been limited to legislation enacted in 1993 prohibiting only the landfill disposal of whole tires. The impact of regulating landfill dumping is to alter the structure of the market by raising the price of placing tires in a landfill as a disposal option.

Technology Limitations in Tire Processing

A critical component of the waste tire recycling/diversion process is the technological factors that limit processing capacity. Tires are difficult to process because we do not want them to disintegrate on automobiles at high speeds. The result is high machinery costs to chop tires, which reduces the potential for private enterprises driven by a profit motive to engage in inexpensive processing of scrap tires.

Brown et al. (2001) refers to this vulnerability of the processing industry as a critical factor that must be considered in shaping the design of statewide scrap tire management activities. These researchers argue that, though the production of high-quality crumb rubber is technologically limited, it is not market limited. These technological limits raise the cost to produce high-quality crumb rubber and subsequently increase processor reliance on high tipping fees to stay in

business and result in higher prices charged for end product. As a result, less scrap tires find their way to crumb rubber processors in California. Phillips (2001) argues that an additional technological limitation facing the crumb rubber industry is that there are no widely used industry standards for processing and grading the final product. This creates uncertainty among firms that might otherwise use crumb rubber in their manufacturing processes, and hence reduces their demand for it.

Public Perception of TDF

Public perception regarding the use of TDF is another key variable to consider in constructing alternatives. As described in detail earlier, studies conducted by the U.S. Environmental Protection Agency (U.S. EPA) have shown that emissions associated with use of TDF are lower than emissions produced by burning traditional fuel sources such as coal alone (Phillips, 2001). But as also previously described, some groups and communities are strongly opposed to burning tires even in well-designed combustors.

Air Products, the owner of a cogeneration plant in Stockton, California, that uses TDF, overcame community opposition by putting together a comprehensive public-relations and information campaign prior to converting its system to partially rely on burning tires (T. Heller, personal communication, October 3, 2001). On behalf of other potential cogeneration plants and cement kilns throughout California, the State could undertake similar campaigns.

Lack of Demand for Products Produced from Crumb Rubber

The lack of market demand for products produced from crumb rubber is another variable that results in an excess supply of scrap tires in California. Though the successful use of scrap tires in highway construction, playground mats, retail mats, commercial flooring, and civil engineering applications is well documented, some argue that it still is not well enough publicized. This lack of consumer awareness could be an explanation for the observed lack of demand for products that use crumb rubber. To increase this demand, the CIWMB could pursue greater efforts to increase public awareness of the desirability of products made with crumb rubber as an additive and further documentation of the demonstrated technical performance and economic merit of products produced from crumb rubber.

Transportation Costs for Tire Transporters

The cost of transporting scrap tires from their point of generation to their ultimate disposal or use point is the final variable relevant to California's scrap tire problem. Mark Hope, a nationally respected expert on scrap tire industry, estimated that the total cost to transport 40,000 pounds of scrap tires (or a typical truckload) is roughly \$1.35 to \$1.70 per mile. Hope's estimate includes taxes, labor, overhead, and other associated expenses. Assuming a middle-range fee of \$1.55 per mile (that Mark Korte, General Manager of Tri-C Manufacturing confirmed as reasonable in an e-mail correspondence dated March 25, 2002), and that a typical automobile tire weighs 20 pounds, or that there are 2,000 tires in a typical truckload, this works out to \$0.00078 per mile, per tire. Thus to move a single tire 100 miles entails a cost of about \$0.08.

Though the cost of \$0.08 per tire to move them every 100 miles may seem small, it really is not considering that tipping fees usually range from \$0.30 to \$0.60 per tire. The cost of transportation deters tire transporters from taking a load of scrap tires to a tire processor if the processor is further away than the landfill, and the landfill is charging a tipping fee that is the same, or even smaller.

Introduction of Policy Alternatives

Table 2, on page 35, is a summary of policy alternatives that naturally arise from the scrap tire market variables just identified. Next is a further description of what is intended by each of these alternatives.

(I) Maintain Status Quo

An assessment of the benefits and costs anticipated with the implementation of alternative public policies requires that the researcher assume a baseline scenario that would occur if the policy options considered were not put in place. For this report, the baseline is a continuation of the forms of CIWMB tire recycling initiatives used in fiscal year 2000–01 and projected to continue until 2005–06. These status quo policies represent a combination of research subsidies, market development incentives, public information campaigns, and regulatory activities to manage the state’s waste tire problem. The amount of money spent on each program, and thus the total amount of money available to fund alternative policies, has been previously given in Table 1.

(II) Further Regulation of Landfill Disposal

The first proposed new policy alternative is an increase in the regulation of landfill disposal through CIWMB or State legislative action. This option involves an expansion of current state rules banning the disposal of whole tires in landfills. At the extreme this could mean a complete ban on the disposal of tire material—with the exception of tire chips used as alternative daily cover or to line new landfills—in the ground. Less extreme versions of this policy alternative would require greater processing of tires (chopping them into smaller pieces) before they are placed in landfills.

The effect of any such policy would be to raise the price for landfill owners who choose to have tires deposited in their sites. This would filter through the market process to an increase in the tipping fee charged to dump tires at landfills. The desired impact of this policy would be to divert scrap tire volume to more productive end-uses. Most notably, tires not dumped in landfills due to the resulting higher tipping fees charged there would go instead to processing facilities for use as tire-derived fuel or in crumb rubber applications. In an economic sense, this proposal corrects for an existing market failure by forcing the market to bear some of the social costs of landfill disposal not previously accounted for in the current market structure.

Table 2: Policy Alternatives Derived from Scrap Tire Market Variables

	Alternative	Brief Description
I	Maintain status quo	As described earlier in Table 1.
II	Further regulation of landfill disposal	Expand existing legislation prohibiting landfill disposal of whole tires to require greater processing and/or institute tax on unprocessed.
III	Per-tire subsidy to waste tire processors	Offer per-tire financial rebate for processors of waste tires generated in California and delivered to end-users.
IV	Per-tire subsidy to end users of waste tires	Subsidy to consumers of end-use recycled products based upon number of waste tires in final product.
V	Further subsidize capital purchases for waste tire processors	Expand grants and loans for capital purchases to waste tire processors to encourage market growth.
VI	Per-mile/per-tire subsidy for in-state transportation of scrap tires	Offer per-mile/per-tire subsidy to tire haulers that take load to processor.
VII	Informational campaigns	Expand information campaigns targeting local governments, processors, and the general public. Includes research and development activities.

Depending on the CIWMB’s legal ability to regulate the disposal of tires in landfills, action on this proposed policy might be limited to public information campaigning and legislative advocacy to generate public and political support for legislative action. The effectiveness of legislation restricting landfill disposal will depend on the ability of alternative-use markets to absorb tires that previously would have been deposited in landfills. If current markets are saturated due to technological limitations, environmental restrictions, price, or other related factors, restrictions on landfill dumping could result in increases in illegal dumping.

(III) Per-Tire Subsidy to Waste Tire Processors

End-use reimbursement programs subsidize and hence encourage production processes that use waste tires by offering per-tire (or per-ton) incentives to producers for generating processed tire material. Under this approach, reimbursements would go to processors who use scrap tires generated in California and deliver the product to a Board-certified end-user. The objective of a per-tire incentive is to lower the cost of production for tire processors. Such a reduction in processing costs should have the effect of reducing processor reliance on tipping fees as a source of revenue, and allow firms that use scrap tires to charge lower tipping fees. This reduction in fees would create a new incentive for haulers to divert tires away from landfills and increase the amount of scrap tires that are recycled.

As described in Section 1 of this report, several versions of end-use reimbursement programs have already been implemented in other states. A uniform reimbursement policy provides the same per-tire incentive to all tire-recycling industries eligible for the rebate and does not account for differences in production costs. An alternative version of the uniform end-use rebate would be a variable-rate reimbursement based on type of industry the scrap tires are used for. Subsidy rates could vary by industry, based upon the social desirability of the end product produced with scrap tires, or the cost differences in processing scrap tires into marketable products. A program based

on social desirability could be implemented according to a hierarchy of beneficial end-uses presented by Snyder (1999).

Using Snyder's hierarchy, selected uses such as crumb rubber production would be more heavily subsidized than less-desired uses such as TDF, which, as previously explained, produces some emissions (however misunderstood) and ash with a high zinc content. The introduction of an end-use subsidy program would require the development of an extensive tire manifest system for tracking the source of waste tires (i.e., from California) used in recycling/ diversion processes and the movement of tires through the system. The CIWMB is currently developing a manifest system that could serve as a foundation for this more extensive system. A reimbursement program would also require broadened administrative support from the CIWMB for monitoring and payment. To prevent the generation of processed tires that do not have an end use, per-tire subsidies would be paid to processors only after they deliver product to end-users. Completed delivery, and not just a signed contract for delivery, is the appropriate criterion to use to pay the subsidy.

(IV) Per-Tire Subsidy to End-Users of Waste Tires

Another policy alternative to consider is per-tire (or per-ton of processed rubber) incentives to producers of products that utilize scrap tires in their manufacturing process. Some of what the CIWMB has pursued in 2001–02 has been along these lines. For example, as shown earlier in Table 1, \$2.6 million was spent to help subsidize purchases for civil engineering, playground covers, track surfaces, green building, and applications that used scrap tires somewhere in their production. The proposal here is not to help with the purchase of these products directly, on a case-by-case basis, but instead to make a standing offer of a CIWMB subsidy that would be given to every purchaser of a specific product that contained scrap tires harvested and processed in California. The total subsidy would be based upon the estimated number of tires used to produce the good under the end-use subsidy program. Again, such an elaborate subsidy plan would need an equally elaborate tire manifest and tracking system to insure that all of the specified requirements of the program are satisfied.

(V) Further Subsidize Capital Purchase for Waste Tire Processors

Proposed policy alternative V would expand existing grant and loan programs to help tire processors purchase their processing equipment. The intent of this policy alternative is to supplant capital costs for existing firms and new entrants to the market. To ensure accountability, it is suggested that all funds be distributed initially as loans that would be converted to grants upon successful demonstration of increased processing capacity. To successfully increase the processing of scrap tires in California, the loan program would need to be substantial enough to lower firms' operating costs, increase firms' demand for scrap tires, and ultimately lower the tipping fee charged by processors that receive the loans. Again, this reduction in tipping fees would result in the movement of waste tire volume away from landfills toward more desirable uses.

Currently the CIWMB offers grants for new equipment purchases. But in reality they are small in comparison to the overall costs of equipping a tire processing facility. The costs associated with setting up a tire processing facility can be well over \$2 million, depending on the intended degree of processing. Increasing the dollar amount of each grant, as well as the number awarded, might help to grow the current market. Other states have accomplished this by providing processors with start-up loans that later convert to grants (not repayable) after a certain number of tires are

processed. Strategies such as this help to protect the taxpayers and the resources being granted to private industry and encourage long-term sustainability.

(VI) Per-Mile/Per-Tire Subsidy for In-State Transportation of Scrap Tires

A policy alternative to a per-tire subsidy for converting waste tires to other uses, or even one that could be used in conjunction with it, would be a per-mile/per-tire subsidy to tire transporters that haul scrap tires for non-landfill uses. Again this would be given only for scrap tires originating in California. It also could be a uniform subsidy, or one that varies by the type of recycling/diversion industry in which the scrap tire is deposited.

To avoid abuse of such a subsidy, an extensive tire manifest system would be needed and additional information would have to be available regarding where the tire transporter's shipment originated and the location of the nearest non-landfill processing opportunities. This information would be used to prevent tire transporters from driving unnecessarily long distances solely to collect bigger subsidies. The advantage of this subsidy proposal is that it would prevent hindering tire recycling/diversion due to distance alone. In other words, a rural tire transporter who always deposited scrap tires in the local landfill might now consider driving them to a distant tire processing facility because he or she would be compensated for the miles driven. This would serve the desired purpose of getting more of California's scrap tires out of landfills.

(VII) Informational Campaigns

Greater emphasis on informational campaigns related to environmental issues, technological opportunities, and demonstrations of those opportunities also represent a policy alternative for California's waste tire problem. The Board currently offers funds for public education and amnesty days that are aimed at educating the general public about tire disposal and maintenance. During fiscal year 1999–2000, 26 grants were awarded in the amount of about \$370,000. This is expected to increase to \$500,000 in subsequent years. Public education programs are important because they educate potential end-users of the benefits associated with using recycled rubber in their production processes and can stimulate market demand for processed tires. Targeting public education funds to assist industries that use tire-derived products could increase the rate at which scrap tires are diverted from landfills.

For example, a campaign designed to gather existing information on TDF and emissions generated, to produce new research on this topic and to disseminate, it may help a plant win public acceptance for the use of TDF that might not otherwise have been forthcoming. The Board provides funds for some of these activities under several categories, including technology commercialization, RAC grants, and grants for technical assistance on engineering applications. Expanding these programs by allocating more funds to the activities just described could offer a strategy for helping to increase the demand for scrap tires.

Clearly, the Board has successfully funded different projects that can provide hands-on experience in practical applications for scrap tire use. Having gained a great deal of insight through these research/demonstration projects, it would seem that no agency would be better equipped to provide technical information to potential RAC projects, civil engineering projects, processors of scrap tires or TDF users. By utilizing some of the research that has already been done, some of the pitfalls that accompany the use of this new technology could be avoided, making it less risky for private enterprise.

Conclusion

This section included a discussion of the key variables that influence the current occurrence of Californians producing more scrap tires in a given year than there are demands for their productive use. Notice that four of the five variables cited (tipping fees, ease of landfill disposal, technology limitations, and transportation costs) are economic-based and directly exert their influence in the market for scrap tires in the state. The final variable, public perception, exerts an indirect influence on the market in that if the public possessed a more accurate knowledge of TDF or rubberized asphalt, market demand for scrap tires in these socially productive uses may rise.

Given the focus these variables place on economics and market operations as the cause of California's current surplus of scrap tires, it is not surprising that the policy alternatives that flow from them are primarily designed to alter the signal that prices and costs currently convey. As described earlier, in one sense we can consider that the state's market for scrap tires has failed from a social and environmental sense and unhindered prices are sending the wrong signals. Government intervention can correct this failure and the six new policy alternatives listed above are suggested as possibilities that could do just that. In the next section of this report, Section 4, we describe the criteria that will be used to evaluate a final and smaller set of alternatives that are chosen in Section 5.

4. Criteria For Evaluating Alternatives

Section III introduced the set of alternatives that represent a range of policy options available to the CIWMB for dealing with California's waste tire problem. These alternatives included maintaining the status quo, further restricting the landfill disposal of tires, offering per-tire subsidies of different sorts, expanding subsidies for capital purchases by waste tire processors, and expanding an informational campaign on TDF and rubberized asphalt. The necessity of choosing among such a broad menu of policy options requires a structured process for determining which alternative(s) are most preferred for addressing the continued flow of California's scrap tires to landfills and stockpiles.

As described in Bardach (2000) and Munger (2001), a commonly employed approach involves the systematic weighing of benefits and drawbacks of each of the alternatives according to some set of selected criteria. These criteria serve as measurement tools that can collectively account for the issues and considerations anticipated that would affect the feasibility of a policy's implementation and the achievement of its intended outcomes. This section of the report provides an overview of the process of developing a set of evaluative tools and then discusses each criterion and the relative importance assigned to it. This process is critical to making our final policy recommendations.

We next identify the five criteria that have been chosen to assess the efficacy of the six new policy alternatives described in Section 3. A brief discussion of the rationale behind the selection of each criterion is provided. The criterion discussion is then extended by introducing the weight assigned for each measure in terms of its relative importance in our evaluation. Finally we offer an overview of the methodology employed in Section 5 that involves the application of these criteria to the policy options and the ultimate determination of the preferred option(s). The purpose of all these descriptions is to clearly show the reader how we came up with the final policy recommendations provided in Section 6.

Criteria Selection and Justification

Judgments regarding a preferred scrap tire policy require a systematic process by which to evaluate each policy and to determine, based on the set of assigned criteria, which choice(s) offer the greatest potential for achieving the desired outcome. In the case of managing California's scrap tire surplus, the desired outcome is an increase in the current 75 percent rate of diversion of scrap tires from landfill disposal. Secondary to this primary outcome is the achievement of increased diversion through policies with relative ease of implementation, minimal disruption to the current market system, and with broad political support and consensus from key policymakers, program administrators, stakeholders, and the public at-large.

The weighing of the advantages and disadvantages of any policy options is necessitated when a "Pareto efficient" solution is not achievable. "Pareto efficiency" is economic jargon for the occurrence that all economic actors being made better off, or at least no worse off, as a result of the policy's implementation. In the real world, however, this outcome is unlikely. Instead policy-makers look to a situation of "Kaldor-Hicks efficiency" which only requires that the "winners" who emerge from the policy intervention be well enough off that they could theoretically compensate the "losers" for their losses and still realize some overall level of gain from the policy. If a policy meets Kaldor-Hicks efficiency, then society as a whole will be better off after it is put in place. This notion of efficiency suggests that some determination must be made of who

will benefit from a policy and how those benefits are dispersed throughout the system. This is the determination we turn to next.

A policy that exhibits widely dispersed benefits and costs must be evaluated by a reasonable and openly described set of criteria. Bardach (2000) refers to two types of criteria—evaluative and practical—as necessary tools for analyzing policy options. Evaluative criteria, which include such measures as efficiency and equity, assess the overall efficacy of the policy, or its potential power to produce an intended result. Evaluative criteria focus primarily on the ultimate outcome of a policy rather on the means of achieving it. Alternatively, practical criteria encompass factors such as political constraints and administrative issues that focus on the feasibility of implementing the policy at reasonable cost and the level of effort. Ideally, any policy analysis should take into account both evaluative and practical criteria in selecting a preferred policy alternative.

In addition to the classification of criteria outlined by Bardach (2000), a set of general guidelines developed by MacRae (1993) and MacRae and Whittington (1997), and reiterated in Munger (2001), provide further direction for selecting the criteria by which to evaluate policy choices. These guidelines suggest that criteria should:

- Be articulated in a way that makes clear how the success or failure in satisfying the criteria will be measured.
- Allow for quantitative evaluation, rather than relying purely on subjective assessments.
- Encompass the anticipated concerns of all key decision-makers and constituent groups.
- Measure differing aspects of the policy option so that satisfaction of the criterion is mutually exclusive.

These guidelines, applied to the unique context of waste tire management in California and considering the lessons learned from the experiences of other states, provided the foundation for selecting the five major criteria we use. These criteria, shown below, are discussed in detail in the following section:

- Efficiency
- Equity
- Sustainability
- Political/legal feasibility
- Administration/improvability

Evaluative and Practical Criteria

Efficiency

The first criterion, efficiency, is included to account for the cost-effectiveness of a proposed policy. This is an economic criterion and in layperson terms can be thought of as what policy delivers the greatest “bang for the buck.” Bang can be thought of as tires that are no longer going to landfills because of a new policy, and buck can be thought of as how much the new policy costs per diverted tire in terms of both money and time. Alternatives that rate higher on measures of efficiency are believed to be more cost-effective than other competing alternatives.

Equity

The equity criterion focuses on the differential effects of the proposed policy on key economic actors in the market system. These economic actors can include tire haulers, scrap tire processors, end-use producers (i.e., recycled product manufacturers, cogeneration plants, cement kilns, etc.), and the California consumer. A policy receives a higher equity rating if key players and stakeholders in California scrap tire recycling/diversion are treated fairly, relative to their situation prior to the policy implementation and/or relative to other participants in the market. This assessment requires a value judgment about how individual operators “should” fare as the result of a policy’s implementation. For instance, landfill and scrap pile operators are expected to be worse off after any of the proposed new policies are put in place. Since the goal is to reduce the flow of tires going to these two socially undesirable uses, the policy would have to be considered a failure if this did not occur.

Sustainability

Sustainability refers to the potential for a given policy to sustain its beneficial impact beyond the scope of the immediate intervention. More specifically, the question of sustainability asks whether the future social and/or economic environment would continue to reap the benefits of a policy once that policy has ended. Sustainability is of special concern when the public policy under scrutiny is designed to correct for market failures that exist within the system.

Within the management arena of scrap tires, the past experiences of some other states have clearly illustrated the importance of considering sustainability when designing scrap tire management policies. For instance, the state of Texas has subsidized processors of scrap tires by paying them simply for every tire shredded, chipped, or made into crumb. The problem was that there was no demand or end use for the processed product. When the subsidy ended, the end result was just piles of processed tires instead of whole tires. An important criterion to evaluate in a proposal is the degree to which it fosters sustainable markets. A policy receives high marks on sustainability if there is a stronger likelihood that tires will continue to remain out of landfills and scrap piles after the policy intervention is reduced or eliminated.

Political/Legal Feasibility

A major practical concern involving the assessment of any new tire policy is the extent to which the policy is expected to receive political support from key decision-makers and stakeholders. In the State of California, as previously mentioned, waste management issues operate within a highly politicized environment that influences policy choices and dictates the ultimate effectiveness of these choices. Even policies with clearly demonstrated social benefits could fail to be adopted or achieve success in the face of strong political opposition. A policy alternative is given a positive assessment on the combined criteria of political/legal feasibility based on the expected chance it could gain political acceptability and be adopted.

Existing legal mandates governing scrap tire management functions also act as a constraint to proposed policies. For example, environmental statutes, regulation of commerce, and other legislative actions may severely limit the feasibility of any proposed policy that violates existing laws. In addition, legality is used here to refer to whether the requirements of a suggested policy alternative could be implemented directly by the CIWMB or instead would require legislative action. The authority legally granted the CIWMB necessarily dictates the types of strategies and activities that the Board can sponsor as a means of putting in place a proposed policy.

Policy alternatives that fall within the purview of the State Legislature would be more difficult to authorize than those that rely solely on the discretion of the Board, which might be restricted simply to participating in public relations, marketing, and advocacy efforts without any certainty the policy would ever be put in place. Thus a policy alternative is more likely to receive a positive political/legal assessment, under this approach, if existing State laws do not prevent the Board from direct implementation.

Administration/Improvability

The administrative criterion is intended to focus attention on the relative ease or difficulty with which a policy could be carried out once the Board adopted it. Even policies that score high ratings on the previous four criteria, for example, might be cost-prohibitive to implement or might not be realistic in terms of the administrative effort required to carry out the policy functions effectively. For this reason, policies that are designed to operate within the existing administrative structure or at low additional administrative costs are more practically feasible and receive a higher rating on the combined administration/improvability criterion.

Furthermore, improvability refers to the degree of flexibility in “fine tuning” a proposed policy once it is in place. A policy alternative with a high degree of improvability is easily manipulated once in place and thus allows for the further refinement of its components. By contrast, those alternatives that lack improvability would be more difficult to improve upon after implementation and might exert high social costs if the actual results were different than anticipated.

Relative Weighting of Criteria

The next step in making a policy recommendation is deciding how to weigh each of the criteria. Should each of the five criteria carry equal weight, or should some carry more or less weight than others? Answering this question is a tricky proposition because it is inherently a subjective task. Any science behind establishing weights for these criteria in a policy evaluation is not well established and generates controversy (Fuguitt and Wilcox, 1999).

At the same time, choosing to apply no differential weights across criteria implies that each criterion is of equal importance, and this is clearly not a reasonable assumption. A reasonable course to follow is, therefore, to be very explicit about reasons for assigned differences in weights and to describe the remaining process of evaluation in a manner that allows readers to easily substitute alternative weights if they disagree with chosen weights. This is the path we continue on.

In the interest of simplicity, the weights for each of the criteria are expressed in decimal form and add up to one. Thus, if each of the five criteria were assigned an equal weight they would each be set at 0.20. The ease of this approach will prove to be helpful later in the quantitative portion of this analysis. However, as described above, we have not chosen equal weights and instead have set the weights used here based upon our perception of the preferences of all Californians, and the preferences we have already heard stated by the CIWMB.

Specifically, the five master’s students who had completed their work on this study at the time of this writing came up with five different sets of weights that, although close, differed. The median, or middle weight, chosen for each criterion by all of these students is the one employed here. Table 3 offers a description of these choices. Specifics on the students’ reasoning beyond these choices of relative weights are given in the table below. The relative weights applied are also in

line with the academic consensus that efficiency and equity are usually the most important considerations when evaluating a proposed policy.

Table 3: Relative Weights Applied to Each Criterion Used to Evaluate Proposed Policies

Criterion	Weight
Efficiency	0.30
Equity	0.25
Sustainability	0.20
Political/Legal Feasibility	0.15
Administration/Improvability	0.10
Total	1.00

Efficiency

As shown in Table 3, the greatest weight (0.30) assigned to evaluating the desirability of a tire proposal is its efficiency. Any Californian who pays taxes appreciates the importance of efficiency in government. Californians demand that tax dollars be spent in a way that yields the greatest benefits to society per dollar spent. To consider a State-run program a success, citizens of the State require that its policy objectives be met in a satisfactory time frame and at the lowest possible expense to taxpayers. We also recognize that an efficient scrap tire policy is easy to administrate and also much more likely to be politically feasible. For these reasons, efficiency receives the highest criterion weight at 0.30. This weight is three times as great as the 0.10 weight given the lowest-weighted criterion.

Equity

Equity, or the expected “fairness” of a waste tire policy proposal, receives the second highest weight at 0.25. This is 0.05 above what would be assigned if equal weights were used. The rationale behind this higher weight is that consideration needs to be assigned to scrap tire policy choices that essentially achieve the same result of eliminating tires from stockpiles or landfills, but yields distinct differences in how “fair” the process that achieved the result. In addition, perceived inequities generated from a specific proposal greatly reduce the probability of lawsuits and political action directed at the Board. Therefore, as with the efficiency criterion, the criterion of equity overlaps somewhat with political feasibility. Like efficiency, equity carries a greater weight than if equal weight were assigned to all five of the criteria.

Sustainability

The sustainability of a policy geared toward reducing the number of California’s scrap tires that end up in landfills, after the policy has terminated or been cut back, is the third in importance criterion. In other words, would this alternative really create markets that are sustainable in the absence of the policy? Assigned a relative weight of 0.20, it is ranked the same as if all five criteria received equal weight. The CIWMB has repeatedly stressed the importance of sustainability and stakeholders throughout the scrap tire industry have echoed this sentiment. California taxpayers would not want a repeat of the fiasco in Texas that left piles of shredded tires rather than whole tires in stockpiles, neither of them having a developed market for use.

Political/Legal Feasibility

Political feasibility is a concern in evaluating alternatives because no matter how beneficial a potential policy may be, if it is politically or legally impossible to put in place, devising it and talking about it is an exercise in futility. If an alternative requires approval by the State Legislature, then the likelihood that a proposal will come to fruition as it was originally intended could be decreased significantly. Handling the scrap tire problem in the most politically and legally expeditious manner carries a weight of 0.15. The weight given this criterion is just below what it would be given if equal weights given to all five criteria because much of the political component of this feasibility has already been factored into the higher weights assigned the efficiency and equity criteria.

Administration/Improvability

The criterion of administration and improvability received a relative weight of 0.10, or half the consideration it would have been given if all five factors were weighted equally. Though important, we feel that this is one of the criteria whose importance should be reduced in order to give greater credence to efficiency and equity. Further justification for this choice comes from the fact that administration considerations, at least in part, are already being picked up by the additional weight given efficiency. “Bang for the buck” can only be high if administrative burdens are not onerous and there is room to improve initial decision regarding policy implementation over time.

Methodology

The remainder of the approach to evaluating the proposed policy alternatives involves the development of a clear and easily simulated process for evaluating each option according to a uniform set of criteria. Simulation ease is desired so readers unhappy with our choices can instead plug in their own and reach their own conclusions. Two methods are described here and then utilized in Section 5. The first method involves the creation of a qualitative alternative-criterion matrix. The second method yields a quantitative form of a similar matrix. The purpose of these matrices is to compare and evaluate the alternatives.

Qualitative Alternative-Criterion Matrix

A full description of the qualitative alternative-criterion matrix method is discussed in Bardach (2000) and Musso, Biller, and Myrtle (2000). The matrix is set up by listing the policy alternatives as row headings and the criteria to be used to evaluate them as column headings. A short description of the projected outcome related to the respective criterion and policy alternative is then filled into the appropriate cell. The purpose of all this is to make comparisons possible.

The qualitative alternative-criterion matrix is a useful tool for choosing among policy alternatives because it tabulates the analyst’s evaluation of the likely consequences associated with each alternative. Extremes stand out and this helps the analyst or client see the range of costs and benefits by pointing out options with serious disadvantages or risks. If readers disagree with the analysis, this method allows them to see which specific area of analysis is different from what they believe—and they can then argue their case accordingly.

Quantitative Alternative-Criterion Matrix

Munger (2001) presents the quantitative version of the alternative-criterion matrix. This matrix is set up with the same column and row headings as the qualitative version described above. The difference is that each cell in the quantitative matrix contains a number value that offers an ordinal evaluation of the performance of that alternative for the particular criterion. The ordinal scale to be used is up to the researcher. For our purposes we choose a scale of one, two, three, four, or five; where (1) equals “very weak,” (2) is considered “somewhat weak,” (3) represents “moderate”, (4) is equivalent to “somewhat strong”, and (5) equals “very strong.” Table 4 offers an idea of what is necessary for a given policy alternative to achieve either a rating of five or one for each of the five criteria used.

Munger also makes some important observations about the use of an alternative-criterion matrix that deserve repeating here:

- The final decision on the best alternative can depend on the choice of weights on the criteria.
- The alternative-criterion matrix approach is conceived as a means of organizing a policy decision and further thought is needed to choose the “best” policy alternative.

The CAM approach is valuable because it offers a somewhat scientific approach to policy analysis. Munger continues his justification for using this approach: “The CAM [criterion-alternative matrix] works well because of the structure it imposes on the decision process, and the discipline it imposes on the analyst to reveal and justify assumptions about tradeoffs in values.” The quantitative alternative-criterion matrix is complete when a score is calculated for each cell within it that equals the one-to-five rating assigned it multiplied by the respective weight assigned the criterion under consideration.

For example, an alternative that only satisfies in a “somewhat weak” fashion the efficiency criteria would be assigned a value of “2” on the rating scale. This rating of “2” is then multiplied by the weight of 0.30 assigned for the efficiency to arrive at a total score for the cell of 0.60. After these total scores are calculated for each of the criteria on a given policy option, the five total scores are added together to create a cumulative rating for that alternative. This cumulative rating can then be compared to similar cumulative ratings calculated for all policy options.

In the first step of the analysis, each policy option will be discussed independently and assessed according to the cumulative score. Later, consideration will be given to the possibility of “packaging” alternatives or combining various strategies into a more comprehensive policy approach similar to the current approach of the CIWMB. The first step of this analysis is in the next section.

Table 4: Key for Interpreting Criteria-Rating Scale

Criteria	Interpretation of Ratings	
	5—Very Strong	1—Very Weak
Efficiency	Anticipated to achieve full policy objective (i.e., further diversion of 8 million scrap tires) within existing cost structure; impact occurs within short-term time frame.	Not likely to improve existing diversion rates, or produces marginal improvement relative to time frame for realizing benefits.
Equity	With the exception of landfill operators, the benefits of the policy are distributed equally across industries; key economic players are not adversely affected relative to their situation prior to implementation.	Industries are differentially affected by the policy with notable extremes in impacts across key players; several key players are worse off relative to their situation prior to implementation.
Sustainability	Market distortions are minimal; beneficial impacts of the policy are anticipated to extend beyond the elimination of the program.	Benefits are not likely to be sustained once the program sunsets; intervention will require indefinite support.
Political/Legal Feasibility	Board endorsement is extremely likely; and/or Board is authorized to implement all proposed policy components.	Not likely to be endorsed by the Board and/or Legislature; and/or Board not granted authority to oversee or implement any portion of the policy; limited to advocacy role.
Administration/Improvability	Implementation could be achieved within existing administrative structure and costs to implement are minimal; and/or policy elements are flexible and amenable to periodic change.	Implementation will require major administrative restructuring and administrative function is likely to be costly and difficult to manage effectively; and/or policy elements are fixed once the program has been implemented.

5. Analysis of Policy Alternatives

The formulation of policy options and the development of criteria to systematically assess them laid the groundwork for the core analysis of this report that is contained in this section. This analysis will determine which option, from the menu of alternatives, represents the “best” policy choice for California in managing its waste tire stream. More specifically, the analysis will focus on selecting the policy option that demonstrates the greatest efficacy and feasibility in achieving the goals of reducing landfill disposal and encouraging diversion to beneficial end-use markets. The analysis will also specifically address the anticipated impacts of each alternative on California crumb rubber markets and will discuss the projected outlook for crumb manufacturers if each policy were to be implemented.

Next we provide a discussion of the policy objective underlying the waste tire management strategies employed by the CIWMB. This discussion revisits the tire problem facing California and examines in detail the sources of market failure that established the need for market intervention. A more detailed description of each of the policy proposals formulated to address the tire issue is also provided. Each policy description will also include a discussion of the projected outcomes for tire reuse and disposal markets. The third part of this section of our report presents a qualitative assessment of each alternative evaluated according to the five established criteria, including both a narrative discussion and brief summary of findings. Finally, the results of this analysis are quantified using the weighting system and rating scale introduced in the last chapter.

Discussion of Policy Objective

The policy objective for each of the proposals under consideration is to increase the current percentage of California waste tires that are diverted to beneficial end-uses each year. As stated in earlier chapters, approximately 25 percent of California’s waste tire stream is annually deposited in landfills throughout the state. In 2000 this amounted to approximately 8.7 million tires being buried. CIWMB staff has also estimated that an additional 3 million tires, imported from other states, are deposited in California landfill sites. Altogether, this makes 11.7 million scrap tires placed in the state’s landfills in 2000. If nothing new is done, this number is only expected to increase each year as the state’s population also increases.

Throughout the state, there are an estimated 666 landfills or land reclamation projects currently accepting waste tires; of these, 306 are located in southern California and 360 are located in northern California. While precise estimates of the magnitude of the volume of tires disposed at individual sites are not typically available, a small number of major tire disposal facilities accounts for the vast majority of places where waste tires end up.

Of the active facilities statewide, the Azusa Land Reclamation Project, a large monofill located in the Southern California region, is by far the largest. In fact, industry experts we talked to believe it absorbs the majority of the 8.7 million tires disposed of in 2000. According to the last count taken in 1996, there were more than 34 million tires deposited at the Azusa site. Moreover, according to one industry expert (Hope, 2001), at current rates the disposal capacity of Azusa is projected to span an additional 20 to 30 years.

Within the existing market structure, tire recyclers, including tire processors, cement kilns, and other recycling/diversion industry firms must actively compete with landfill operators, in the form

of tipping fees, for raw material to use in their production processes. The current relatively low cost of landfill disposal allows operators to charge tipping fees at a level below those charged by processors, creating an incentive for haulers to landfill tire waste. Across regions, the tipping fee charged by waste tire facilities in 2001 for disposal varied from approximately \$54 per ton of shredded tires (or about \$0.54 per tire) in Northern California, to \$35 to \$70 per ton in the Central Valley, to \$18 to \$55 per ton in Southern California.

Estimates for the Azusa monofill suggest that tipping fees range from \$20 to \$45 per ton, although industry sources have reported fees as low as \$17 per ton for preferred contracts with haulers. Michael Blumenthal, technical director of the Rubber Manufacturers Association, estimated in an April 12, 2001, e-mail correspondence that landfills in California on average accept scrap tires at a tipping fee of \$0.43 per passenger car tire. The average tipping fee for scrap tire processor in California is \$0.45 per tire. Table 5 below compares estimates on per-tire tipping fees between landfills and various recycling/diversion industries.

Table 5: Average Range in California of Per-Tire Tipping Fees Across Major Industries

Landfill (All Regions)	Cement Kilns	Crumb Manufacturers
\$0.18–\$0.70	\$0.10–\$0.40	\$0.20–\$0.45

In the current market system, the flow of waste tire volume is dictated by both the tipping fee and the costs to tire haulers of transporting to an end-use location. Recall that in Section 3 it was estimated that it costs about \$0.08 per 100 miles to transport a scrap tire in California. Consider the hypothetical case of a landfill located only 10 miles from a tire transporter’s central place of business; while the closest crumb rubber manufacturer is 110 miles away.

If this tire transporter’s per-tire cost of transporting scrap tires 100 miles is \$0.08, the differential between the landfill tipping fee and the crumb manufacturer’s tipping fee would have to be greater than \$0.08 per tire to make the trip economically feasible. Consequently, in cases where landfill-tipping fees equal or slightly exceed tipping fees charged by alternative end-users, landfills located in close proximity to tire sources (e.g., landfills located in or around high-density population centers) may still be less costly end-points for disposal than alternative uses.

Under current market conditions, landfilling tires represents a less costly disposal alternative for approximately 8.7 million tires in the current waste stream. One major hauler in the Southern California market (Roth, 2001) has observed that tipping fees for tire processors are becoming more competitive with landfills due to the development and stabilization of the processing industry. Even if this is the case, the sheer volume of tire waste entering Azusa suggests that the facility continues to influence the economics of at least the Southern California region and that competition from this landfill persists as a major reason that scrap tires are not going to more productive uses.

An ongoing goal of the CIWMB is to use specific market interventions as tools to alter the existing market structure to encourage a higher percentage of waste tires to flow away from landfills to more beneficial end-uses. To accomplish this goal, each year the Board has used revenues generated from the California tire fee to fund a combination of permitting, enforcement and market-development activities to manage the state’s waste disposal and reuse efforts. As discussed earlier, the analysis conducted in this section assumes that the budget available for implementation of the proposed policy alternatives is consistent with levels projected by the CIWMB in its *Five-Year Plan* (2001) and detailed earlier in Table 1. Assuming that funding for

permitting and enforcement efforts remains fixed, the portion of the budget earmarked for market-development activities totals approximately \$7.5 million for fiscal year 2001–02, excluding administrative costs, sponsored conferences, and print materials. This figure is expected to increase annually to approximately \$8.6 million by 2004–05.

Policy Specifics and Projected Outcomes

Recall that Table 2 in Section 3 contained a broad description of the six new policy alternatives that we are considering. Next we offer specifics on what each of these policies entail. For purposes of simplifying the analysis of the desirability of each of these proposals, the policy options are presented independently. In reality, however, the interventions could potentially be undertaken as part of a more comprehensive waste management strategy involving a combination of multiple components. The purpose of the analysis that follows, therefore, is not to prescribe a single policy “solution,” but instead to provide sufficient information on the various policy choices and their anticipated outcomes so that informed decisions can be made about the most effective total approach to achieving the intended outcome. We will begin with Alternative II because Alternative I would be to maintain the status quo, discussed in Section 1.

Alternative II: Further Regulation of Landfill Disposal

The first proposed alternative modifies the regulatory environment governing waste tire disposal to create a disincentive for burying tires in the ground. The theoretical justification underlying this strategy is that landfill operators who set tipping fees for haulers are doing so without full consideration of the social costs of tire disposal. Imposing some sort of “tax” on landfill disposal would force landfill operators to think about these social costs and result in them charging higher tipping fees. A higher landfill-tipping fee removes the current misdirected incentive that tire haulers have to dump their loads there.

The “tax” proposed under this policy alternative is not in the traditional sense of forcing landfill operators to collect a fee due the government for every additional tire disposed. Instead we suggest stricter statewide requirements regarding the processing of tires before they can go into the ground. Under current regulatory guidelines, whole tires are banned from landfills and must be structurally modified in some way prior to dumping. Many landfills currently require tires to be reduced to 12-inch chips, the same size as required for alternative daily cover (ADC); some landfills, such as the Azusa monofill, require only that tires be halved or bailed prior to dumping.

Since most tire transporters show up at a landfill with whole tires, the greater the processing requirement, the more costly it is for owners of landfills to accept waste tires. According to an industry source, (Mark Korte, General Manager of Tri-C Manufacturing, and confirmed by tire recycling expert Terry Gray) the cost to tire processors to shred a whole tire into 4-inch chips (or one pass through a Barclay tire shredder) is approximately \$8 to \$10 per ton, or equivalently to \$0.08 to \$0.10 per tire. To get down to a 2.5-inch nominal chips would cost anywhere between \$0.17 and \$0.20 per ton. These processing costs are shown in Table 6 below.

Table 6: Per-Tire Costs Associated with Incremental Reductions in Tire Chip Size

Chip Size	Number of Feeds	Total Per-Tire Processing Cost
4 inch	1	\$0.08–\$0.10
2.5 inch	2	\$0.17–\$0.20

Specifically, we propose that tire chips of no more than 2.5 inches be allowed in the ground anywhere in California. As shown in Table 6, this requirement would raise current processing costs for landfill operator between \$0.17 to \$0.20 a tire. The effectiveness of this regulatory policy rests on the assumption that non-landfill tire processors would have additional demand for scrap tires if they could charge a higher tipping fee. If landfill operators are forced to charge higher tipping fees, then tire processors can do the same and still receive scrap tires. After this proposal is in place, socially beneficial processors could charge a higher tipping fee because of the increase in tipping fees at landfills.

A downside of this policy is that it raises operating costs for tire haulers. This very likely would be passed back to retailers in the form of transporters charging them higher disposal fees to pick up used tires. Retailers would then pass these increased costs back to consumers of new tires. An unintended consequence could be a rise in illegal stockpiling or dumping by haulers wishing to avoid the now-higher tipping fees. Retailers may be resistant to paying more for disposal because of anticipated customer resistance to the imposition of additional charges to get rid of their old tires. Customer resistance to higher disposal fees may be more pronounced given that they already must pay \$1 per tire into the California Tire Recycling Management Fund.

Alternative III: Per-Tire Subsidy to Waste Tire Processors

This alternative encourages further tire recycling/diversion through the introduction of a financial reimbursement per ton of recycled material (or alternatively per tire that creates it). The assumption underlying this subsidy is that lowering operating costs for tire processors, by reimbursing for processed material, would enable processing firms to lower tipping fees and attract tire haulers that once dumped at California’s landfills.

Specifically, alternative III provides for direct rebates to processors of waste tire materials that originate within the state and are processed from tires in their original form. An invoice must exist for the sale and delivery of the processed materials to a certified end-user. Eligible end uses outlined in the operating provisions of the program would include, but not be limited to:

- Civil engineering projects that use tire material as a soil or sand substitute or as aggregate in construction projects such as road bases and embankments, and fill material (prior approval of road base and embankment projects should be required to avoid projects that are better classified as just storage).
- Burning of waste tire materials for energy recovery.
- Products manufactured from scrap tire materials such as rubberized asphalt, mats, play surfaces, drainage systems, building materials, and recycled products.

Under this policy, tires shred for alternative daily cover (ADC), which represent a lower-value end use, are excluded. Eligibility for the end-use reimbursement would require that firms have California-based operations and meet specified criteria that establish the origin of waste material

from within the state. These criteria require that material either is discarded as the result of sale, trade, or exchange within the state, or be extracted from an existing California tire pile or landfill. Successful implementation of this program would include creation of a complex manifest system for tracking the origin and flow of waste tires. Such a system is already under development by the CIWMB and would require only moderate modifications.

The major factor in implementing an end-use subsidy program is determining the level of reimbursement. As discussed in Section 1, and summarized again in Table 7, several states have instituted programs that could serve as models for the development of a California program. While some of these programs are currently active, many of them (including Wisconsin, Texas, and Oregon) were implemented on a short-term basis to support tire pile cleanup efforts and have now ended. Reimbursement rates across states and provinces range anywhere from roughly \$20 to \$117 per ton. The level of reimbursement would be designed to allow for an assessment of market impacts and rate adjustments accordingly.

Table 7: Comparison of Per-Ton Waste Tire End-Use Incentives by Province/State

Province/State	Revenue Source	Tires in Annual Waste Stream	Incentive Rate	Status
British Columbia, Canada	\$1.88 U.S. on retail tire sale	3.8 million per-tire equivalents (PTEs)	End use incentive varies depending on the type and level of processing. Maximum end use incentive available is \$114 per ton for crumb rubber if all components of the tire are recycled and sold, i.e. rubber, steel, and fiber. Transportation incentive also available; rate varies depending on the distance hauled; average in 2001 was \$39 per ton.	Active
Louisiana	\$2.00 on retail tire sale	4.3 million PTEs	\$90/ton for processing with required end-use market	Active
Oregon	\$1.00 on retail tire sale	6.4 million PTEs	\$20/ton	Sunset in 1993
Texas	\$2.00 on retail tire sale	24 million PTEs	\$80/ton	Sunset in 1997
Utah	\$1.00 on retail tire sale	NA	\$75/ton for crumb rubber; \$65/ton for recycled material other than crumb; \$50/ton for chipped tires	Active
Virginia	\$0.50 on retail tire sales	7 million PTEs	\$22.50/ton for tires from waste stream; \$50/ton for tires pulled from certified tire piles	Active

Recommendations from industry representatives and budgetary constraints provide parameters for establishing a range of potential reimbursement rates. Randy Roth of Lakin Tire Company, for instance, has stated that any proposed subsidy should be designed to limit market distortions, with the subsidy value not to exceed the price differential between landfill disposal and disposal at the

next-lowest price alternative. He estimates that this differential for the Southern California region would be roughly \$5 per ton or \$0.05 per tire. A higher-end estimate can be calculated as the highest level of reimbursement within the projected budget (FY 2002–03) to cover an estimated 31 million tires generated annually, or \$8 million divided by 31 million scrap tires. This equals about \$0.27 per tire or \$27 per ton. Given this background, we suggest an initial offer of \$0.17 per tire (arrived at by splitting the Roth estimate and the maximum amount in half). If all of the 31 million waste tires generated in California in 2001 had received this subsidy, such a program would have cost about \$5.3 million. We would also suggest an additional allocation of \$1 million to administer this program.

To avoid replication of subsidy program failures experienced in the states of Texas and Oklahoma, under the policy proposed here tire processors would be required to demonstrate delivery to a recognized legitimate end-user such as a highway project or civil engineering project, product manufacturer, cogeneration plant, or other energy user. In addition, a per-tire subsidy to a civil engineering projects would require pre-approval by appropriate State agencies such as CIWMB (landfill uses) or Caltrans (transportation). These requirements would help prevent firms from processing tire material without an identified consumer market and from collecting reimbursements on processed material that may ultimately be deposited in landfills.

Alternative IV: Per-Tire Subsidy to End-Users of Waste Tires

This policy alternative is designed to stimulate the demand side of the market by subsidizing the consumption of products made from recycled or diverted tire material. More specifically, the program would provide a grant to purchasers of eligible products that contain a minimum percentage of recycled or diverted tires as content in their production process, and for which the purchaser spends a required minimum amount. As described for the previous policy option, these eligible products would include, but not be limited to:

- Civil engineering projects which use tire material as a soil or sand substitute or as aggregate in construction projects such as road bases and embankments, and fill material.
- Burning of waste tire materials for energy recovery.
- Products manufactured from scrap tire materials such as rubberized asphalt, mats, play surfaces, drainage systems, building materials, and recycled products.

Our suggested minimum requirements for grant qualification would be recycled content of 50 percent (with perhaps the exception of a lower required content for rubberized asphalt) and purchases of \$20,000. We also suggest an initial subsidy of \$0.50 per tire for tires that have gone into a product and a much lower subsidy of \$0.10 per tire if tire-derived fuel is the end product.

Again, we would require that these rates be flexible and constantly monitored to determine their success at certain levels. If half of California's 31 million tires were turned into TDF and the other half processed for other eligible end uses, and all of these tires qualified for end-use grants, the suggested program would have cost the state \$9.25 million. We anticipate that given the proposed 50 percent content (for most applications) and \$20,000 expenditure requirements, this level of subsidy will not occur. We therefore budget \$8 million for this program, with at least \$1 million of this used for new administrative costs that would arise.

The assumption underlying the strategy is that subsidizing the purchase price will stimulate demand by both private and public entities for products made from recycled California scrap

tires. The anticipated boost in consumption of tire-derived products would increase demand for waste tire inputs, lower volume-sensitive production costs for manufacturers, and ultimately, lower tipping fees charged tire haulers by tire processors. Additionally, the increased use of consumer products made with recycled rubber, such as rubberized playground surfaces, retail mats, and commercial flooring, would act to demonstrate the benefits and functionality of tire-derived products and further develop the market.

Waste tires are currently diverted from landfills and scrap piles for playground resurfacing projects. One example that offers an estimate of the magnitude of the expense of this program is a sample project completed recently by the Pleasant Ridge Union School. The school district spent \$23,414 to cover roughly 3,500 square feet of playground surface. This resurfaced area required 2,027 waste tires, or about 22,300 pounds of tire material. At a per-tire content subsidy of \$0.50 per tire, the school district would have received \$1,014 to help offset the cost of this project. At a subsidy of \$2.00 per tire content, the Board would have subsidized over one-sixth of the entire cost of this project. Though not formally suggested here, the Board may want to consider higher subsidy rates for scrap tire end uses such as playground or retail mats that rank highest on the tire recycling/diversion hierarchy.

Alternative V: Further Subsidize Capital Purchases for Waste Tire Processors

This policy proposal builds on existing strategies employed by the CIWMB to develop and expand recycling and diversion markets. Specifically, the proposal would provide funding for loans convertible to grants, most notably capital subsidies, to new and existing firms for tire product-commercialization efforts. The assumption underlying capital subsidy programs is that offsetting the costs of large capital purchases encourages firms to expand their production processes because of the lower relative costs of doing so. Such a subsidized expansion would require the use of more scrap tires and thus require firms to lower tipping fees charged to tire haulers to attract more product. As in the other proposals, lowering the tipping fees charged by tire processors would encourage further diversion of California's scrap tires from landfills.

Under this proposal, grants would be distributed on a first-come, first-served basis to eligible businesses or research institutions. The maximum grant amount would be set at \$250,000, consistent with current CIWMB guidelines. To be eligible for funding, firms would have to have California-based operations with purchased equipment that remained in the state for a minimum of five years, and would have to use waste tires generated exclusively from within the state. Funded entities would have to provide a minimum 50 percent match to support project costs. Firms also would have to successfully demonstrate a project's capacity to consume a minimum of 250,000 additional tires on an annual basis as a result of the newly purchased capital.

As given in Table 1, the CIWMB plans to spend about \$4 million annually on these types of capital subsidy programs (Product Commercialization Grants and RMDZ Loans). Our proposal suggests doubling this amount to \$8 million. Even if all annual grants are funded at a maximum of \$250,000 per project, such an annual expenditure would result in 32 more tire processing machines throughout the state. To eliminate the potential for firms to misuse funds on non-viable projects, funding would be issued initially as a loan and then converted into a grant structure upon demonstration of processing capacity. This performance-based model, successfully implemented in other states, is designed to minimize the risks associated with large grant distributions.

Alternative VI: Per-Mile, Per-Tire Subsidy for Instate Transportation of Scrap Tires

Policy alternative VI is an attempt to overcome the problem of landfill opportunities for scrap tires being quite prevalent and geographically distributed throughout California, while tire processing, whether for crumb rubber or TDF, and cement kiln burning is not. Thus, as described earlier in Section 3, scrap tires do not find their way to these more socially beneficial uses because of the additional transportation costs that a transporter needs to absorb to get them there. A natural economic solution would be, therefore, to subsidize the transport of scrap tire to these more desirable uses.

As also described in Section 3, it costs about \$0.08 per tire to transport a load of scrap tires 100 miles. Based upon this, we suggest that the CIWMB create a program that reimburses California tire haulers \$0.08 a tire to transport scrap tires 100 miles. This works out to \$0.008 per tire for 10 miles, and \$0.0008 per tire for one mile. We suggest that the state spend \$4 million on miles reimbursement in this program, which would allow it to subsidize the hauling of scrap tires to more socially desirable uses in the amount of 5 billion tire miles driven (\$4,000,000/\$0.0008). We estimate that an additional \$1 million would need to be spent on the administrative issues that are discussed next.

To achieve the greatest “bang-for-the-buck,” this program would subsidize the transport of scrap tires that originated in California and were delivered to a processor in the state. The check on this could be done with some further expansion of the tire manifest system that the Board is currently developing. In addition, this mile subsidy should be given for driving only to the nearest processor of a given sort. Thus, the CIWMB would also need to develop and maintain lists of all tire processors throughout the state. If this information is stored in a Geographic Information System (GIS), it would be quite easy to use the address of a tire hauler’s location of business and the manifest records of how many tires were delivered to eligible processors to figure out the transportation subsidy to be sent to the hauler for any given month. Reimbursement would occur only in the amount computed for deliveries to the closest processors.

Alternative VII: Informational Campaigns

The last policy alternative to be considered is that of expanded information gathering and dissemination campaigns. Our specific proposal is for the CIWMB to provide \$4 million each year for the staff and resources necessary to gather the most-up-to-date background information on tire recycling/diversion and to conduct information seminars for people in industry and the public in general.

Currently the CIWMB provides ongoing contractual support to northern and southern California Rubberized Asphalt Concrete Technology Centers (RACTC). The RACTCs conduct “how to” seminars on using rubberized asphalt. This proposal encourages the CIWMB to emerge as a leader in the industry by setting a regular schedule of meetings and classes. Because it is labor-intensive to have CIWMB engineers and staff travel throughout the state to teach, it may be possible to develop online class sessions, where people from all over the state could participate without requiring anyone to travel.

Also, some of the information could be shared via prepared brochures and information packets that could be mailed, again saving travel expenses. Information covered in these sessions could vary in each session, but the overall theme would be to share ideas and information regarding technological advances, environmental issues, and new recycling techniques in the waste tire

field. In addition to technology, it would be useful to share information regarding air emissions related to tire-derived fuel because, as discussed earlier, the debate on this issue is not fully settled. These information campaigns should even be of the type that are currently used to promote the recycling of beverage containers and appear as television advertisements.

As given earlier in Section 3 of this report, California's Public Resource Code 40051 calls for "source reduction" as the top waste management priority of the CIWMB. Regarding scrap tires, this can be accomplished through public information or education campaigns that promote better tire maintenance, and therefore longer useful lives, and/or the purchase of higher mileage tires.

The hope is that the long-term sharing of accurate information of the effects of TDF, on tire recycling ideas, and tire processing technology would result in cleaner and more efficient ways to process tires. The notion is that when more efficient ways of processing tires are realized, more tires will be processed into socially beneficial uses instead of being landfilled. We estimate that the magnitude of the positive results in the short term will be small, but in 5 to 10 years there would be a reduction of approximately 20 to 50 percent in the 8.7 million tires now being landfilled. Just half of California's cement kilns or cogeneration facilities would need to begin burning tires to achieve such a reduction.

Lindsay Smith, of Rubbersidewalks, Inc. (a California company that uses crumb rubber to produce paver tiles that take the place of concrete) offered a nice summation of the benefits that a CIWMB-sponsored information campaign could provide to the promotion of a product like that produced by Rubbersidewalks (e-mail correspondence, April 11, 2002):

"Acquiring equipment serves crumb rubber and feedstock producers, etc., i.e. non-consumer-product producers, but for those of us who sell product to the consumer, we also need financial support to market our product, and market it in a skilled and professional way. Contributing to the perception of recycled goods as inferior or undesirable is the lack of marketing altogether, or marketing that is neither mainstream nor competitive. ...It is imperative to the success of my company, for instance, that I provide well-produced educational video material to my potential customers—who need this as a tool to inform their superiors, such as city councils. The CIWMB has allowed marketing funding on a limited basis, which is a good thing. In order to build consumer demand for molded rubber products, the CIWMB needs to support marketing funds for the product makers."

Rick Snyder of U.S. Rubber Recycling, Inc. (a California manufacturer of sport flooring made from recycled tires) echoes this sentiment and adds (e-mail correspondence, April 9, 2002):

"I totally agree that an information campaign could be a good use of funds. However, information campaigns, if handled by the CIWMB and without thorough input from stakeholders such as myself are a complete and utter waste of taxpayer dollars. There is real expertise that the [Board] staff could call upon but they rarely, if ever, choose to do this. These are government workers who know nothing about marketing or the marketplace. They have a much better understanding of TDF and rubberized asphalt."

Some of Mr. Snyder's thoughts are on target and we recommend those information campaigns only be undertaken with the full advice and consent of industry stakeholders like him.

As an example of how an information campaign could work, consider that the U.S. EPA considers that the use of tires in cement kilns has been shown to reduce stack emissions as well as NOx emissions when compared with standard coal-fired kilns. If the currently permitted facilities

that are not burning began doing so, they could reduce the amount of tires going to landfills by 2.25 million to 4.5 million annually.

There are no clear losers in this scenario. It seems that everyone in the waste tire industry would gain from the involvement of the CIWMB in the accurate education of industry personnel and the public. However, if the information campaign resulted in an increased demand for tires in California, some out-of-state tires might flow into the state. The CIWMB conceivably could turn this into a benefit by inviting staff from other states' programs to participate in the California education campaign. If the Board could explain the merits of developing a comprehensive program to other states, they might be inclined to set up their own programs to handle waste tires, lessening the export to California.

Analysis of Outcomes In Terms Of Criteria

Next we evaluate each of the six policy proposals in terms of the five criteria introduced in Section 4. Recall that our criteria include efficiency, equity, sustainability, political/legal feasibility, and administration/improvability. Each of the proposals is evaluated in the form of narratives included in the appropriate cells in the qualitative alternative-criterion matrix contained in Table 8. These narratives are then used to assign the number values recorded in Table 9.

Each of the proposed policies was rated against the five evaluative criteria using a four-point scale, with values ranging from "very strong" (5) to "very weak" (1). Remember that there is no exact science to assigning the values in Table 9. They represent only the judgment of the author of this report. Readers are encouraged to observe the assigned numbers and, if they think appropriate, assign different numbers and hence come up with different totals.

Of the six new policy alternatives under consideration, the per-tire subsidy to waste tire processors (Alternative III) rated highest with a score of 3.35 out of a total possible of 5.00. This proposal never received a very strong score in terms of any one specific criterion, but it was rated somewhat strong in terms of both efficiency and equity. Since efficiency and equity accounted for over half (55 percent) of the criteria's weight, it is no surprise that this proposal came out on top. In terms of political/legal feasibility and administration/improvability this winning proposal only ranked in the middle with a moderate rating. Per-tire subsidies as a solution to getting the remaining 25 percent of California's scrap tires out of landfills each year only warranted a somewhat weak assessment in terms of sustainability.

Perhaps even more important than noting the single "winner" in Table 9 is observing that three out of the five alternatives that were ranked below the top total were within an overall score of 0.15. Further subsidies to capital purchasers (Alternative V) and information campaigns (Alternative VII) both received scores of 3.25.

Subsidies to capital purchasers achieved this with moderate ratings on efficiency, equity, and sustainability, and a somewhat strong rating on political/legal and administration/improvability. Information campaigns just missed the top rating, largely through its somewhat weak assessment in terms of "bang for the buck" or efficiency. Close behind was the policy of per-tire subsidies to end-users of waste tires. It did not achieve the top ranking because it was rated slightly below subsidies to waste tire processors in terms of equity (due to more than one subsidy rate being used) and greater expected administration requirements.

What does emerge from the totals recorded for the different policy alternatives in Table 9 is that further regulation of landfills (Alternative II) and transportation subsidies (Alternative VI) are the

most inferior proposals relative to the other five. Landfill regulation receives the highest ratings possible in terms of efficiency and administration/improvability, but it suffers from weak ratings assigned for all the remaining criteria. The plan for a transportation subsidy is fine in terms of efficiency and equity, but really suffers in its overall assessment when sustainability, political/legal feasibility, and administration/improvability is considered.

Summary

This next-to-last section of the report began with a review of the policy objective desired by California's Integrated Waste Management Board. This led to a description of the six new policy alternatives that we suggested the CIWMB consider in its quest to achieve this objective. These policy alternatives were then evaluated in both a qualitative and quantitative sense using the five criteria derived earlier. The process of doing this was purposefully transparent so that the reader could easily substitute his or her own evaluations.

The bottom line is that although one proposal received a high score, four of the six considered were so close that their desirability, in our minds, is virtually indistinguishable. What is beneficial about the process employed in this chapter is that readers can clearly see the benefits and costs of each. We utilize these finds in the last section to offer our conclusions on subsidies and other options to further tire recycling/diversion in California.

Table 8: Qualitative Alternative-Criterion Matrix for Waste Tire Management Alternatives

	Criterion 1: Efficiency	Criterion 2: Equity	Criterion 3: Sustainability	Criterion 4: Political/Legal Feasibility	Criteria 5: Administration/ Improvability
<p>Alternative II: Further Regulation of Landfill Disposal</p> <p>Require that all tire material placed in California landfills are processed to a maximum 2.5-inch chip.</p>	<p>Highly effective at getting waste tires out of landfills. Increased processing costs force landfill operators to consider the social cost of landfill disposal and bear more of it if they wish to continue to bury scrap tires. Near-zero cost to implement beyond funding initial advocacy efforts to pass legislation, but some additional costs of increased enforcement. May result in illegal dumping if alternative-use markets do not arise.</p>	<p>Fair in sense that all landfill operators face higher processing regulation; but, relative to other economic factors in tire market, all landfill operators are adversely affected through loss of tire revenue. In addition, potential increases in operational cost to tire haulers if alternative-use markets are saturated or resulting higher tipping fees are not passed onto new tire consumers. Consumer may have to pay higher disposal fee along with new \$1 per-tire fee.</p>	<p>Waste tires likely to flow back to landfills if regulation lifted and alternative end-use markets are not significantly developed. Other than providing a greater flow of scrap tires to non-landfill uses, this policy does nothing to develop the long-term sustainability of keeping tires out of landfills if the processing regulation is lifted.</p>	<p>Targeting of landfill operators for new regulation is likely to raise strong opposition from solid waste management lobby. Also potential opposition from tire haulers and retailers if they anticipate they will have to bear rising costs.</p> <p>CIWMB has the legal authority to authorize.</p>	<p>Minimal administrative requirements beyond routine enforcement. Improvability could be obtained through raising required chip size if suggested amount does not keep tires out of landfills, or lowering chip size if tires come out of landfills but is too costly to tire consumers or haulers. Improvability hindered if markets cannot absorb diverted tire volume and illegal dumping occurs.</p>

<p>Alternative III: Per-Tire Subsidy to Waste Tire Processors</p> <p>Institute a \$0.17 per-tire subsidy paid to California processors of scrap tires that originate in the state. Paid only if processor has a contract for purchase of material by qualified end-user.</p>	<p>Criterion 1: Efficiency</p> <p>This per-tire subsidy increases processor demand for scrap tires now going to landfills by lowering processing costs. These lower costs are passed on to tire haulers in the form of lower tipping fees that make disposal at processor more competitive with landfill. Rate of subsidy and market conditions determine how effective this proposal is at getting tires out of landfills.</p>	<p>Criterion 2: Equity</p> <p>Landfill operators excluded from reimbursement, but this proposal does not directly target them with a new cost. Tire processors and TDF producers benefit equally under equal rate paid them. Tire haulers benefit when per-tire subsidy results in lower tipping fees for all tire disposal options.</p>	<p>Criterion 3: Sustainability</p> <p>Requires ongoing high expenditure that could be slowed or discontinued only when end-use markets are substantially developed. Based on experience of other states, discontinuation of subsidies could not occur in short term (5 to 10 years).</p>	<p>Criteria 4: Political/Legal Feasibility</p> <p>Historically not supported by the CIWMB, but new Board representation and concerns of competition from Canadian crumb rubber producers may improve political favor. Political objections to cost mitigated by fact that CIWMB now has new resources to do it. CIWMB has the legal authority to authorize.</p>	<p>Criteria 5: Administration/Improvability</p> <p>Requires complex tire manifest system to administer that could be vulnerable to fraud if not adequately regulated and enforced.</p> <p>Improvability possible by altering reimbursement rate based on observed flow of tires to processors and landfills with current rate in place.</p>
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	Criterion 1: Efficiency	Criterion 2: Equity	Criterion 3: Sustainability	Criteria 4: Political/Legal Feasibility	Criteria 5: Administration/ Improvability
<p>Alternative IV: Per-Tire Subsidy to End Users of Waste Tires</p> <p>Pay purchasers of California products made from scrap tires a content subsidy of \$0.10 per tire for TDF and \$0.50 per tire for all other products. Minimum total purchase of \$20,000 and 50 percent tire content required for subsidy.</p>	<p>Subsidy stimulates demand for product made from California scrap tires. In turn, manufacturers of these products demand more scrap tires and lower tipping fees, and tires are diverted from landfill disposal. Limited impact if subsidies fail to create a substantial enough increase in demand for final products.</p>	<p>Direct benefits flow to only TDF and crumb rubber processors. Though, based on established hierarchy of tire use, differences in subsidy may be perceived as unfair. Tire haulers benefit when per-tire subsidy results in lower tipping fees in all tire disposal options.</p>	<p>Requires ongoing expenditures to maintain support for product demand. This could only be slowed or discontinued if end-use markets are substantially developed for scrap tires that previously went to landfills, and instead go to alternative end uses without requiring a subsidy. End uses are slightly more likely to be developed under this per-tire subsidy than previous per-tire processors.</p>	<p>A block variant of this proposal in the forms of playground cover, track/recreational surfaces, and green building grants are currently part of CIWMB strategy. CIWMB has the legal authority to authorize.</p>	<p>Greater administrative burden in verifying and policing subsidy applicants to make sure they are submitting an appropriate request. Also need to determine scrap tire content in eligible products. Potential for improvability through altering per-tire content grant. This could be in the form of amounts and relative differences for TDF and other products.</p>

<p>Alternative V: Further Subsidize Capital Purchases for Waste Tire Processors</p> <p>Double the use of existing program to provide a matching grant of up to \$250,000 to assist California firms in obtaining capital to increase their use of scrap tires generated from within state by at least 250,000 a year.</p>	<p>Criterion 1: Efficiency</p> <p>A grant to purchase tire-processing machines lowers production costs and savings are likely to be passed on to tire haulers in the form of lower tipping fees. This will encourage the diversion of scrap tire volume from landfills. Processing requirements must be met before grant is given, improving efficiency. Though requires minimum amount of tires be processed to receive loan, still less of a direct impact than per-tire subsidy program.</p>	<p>Criterion 2: Equity</p> <p>Grants target all tire processors and TDF producers, but do favor new market entrants or expanding firms because a firm with existing machines has no immediate need to buy new ones. Lower cost to purchase machines passed onto tire haulers in the form of lower tipping fees. Product manufacturers that use processed scrap tires benefit from lower cost of material supply. As with all policy proposals, landfill operators are worse off due to competition for tires.</p>	<p>Criterion 3: Sustainability</p> <p>Once tire processor receives grant and purchases machine then the increased demand for scrap tires is sustainable for as long as the machine lasts (say 10 to 20 years). But like other programs, this one is only sustainable in longer run if end-use markets develop that make the purchase of a replacement machine worth it without necessitating another subsidy.</p>	<p>Criteria 4: Political/Legal Feasibility</p> <p>Component of current waste management strategy and therefore idea already supported by CIWMB.</p> <p>CIWMB has the legal authority to authorize an expansion of existing program.</p>	<p>Criteria 5: Administration/Improvability</p> <p>Some increase in administrative burden resulting from higher volume of grants/loan reviews and additional requirements beyond what is currently done. But does not require new infrastructure to implement.</p> <p>No potential for improvability for tire use by a firm receiving a grant once it has been given. Program allows for some refinement between funding releases.</p>
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	Criterion 1: Efficiency	Criterion 2: Equity	Criterion 3: Sustainability	Criteria 4: Political/Legal Feasibility	Criteria 5: Administration/ Improvability
<p>Alternative VI: Per-Mile, Per-Tire Subsidy for Instate Transportation of Scrap Tires</p> <p>Reimburse California-based tire haulers \$0.08 for transporting a California-generated scrap tire 100 miles.</p>	<p>Many scrap tires currently go to landfills, even when the tipping fee is greater than at an alternative processor, because of the cost of transportation to the non-landfill alternative. A subsidy would overcome this misdirection and divert tires from landfills. However, such a plan would do little in the case of a landfill and crumb rubber processor located near each other if the landfill charges a lower tipping fee.</p>	<p>This transportation subsidy is available to all tire transporters, but more of it would go to rural operators or those farther away from non-landfill processors. This subsidy would also unequally benefit processors that are farther from places where scrap tires are generated in that they would see the largest increase in scrap tire deliveries.</p>	<p>Like other proposals, once this transportation subsidy was removed, the delivery of some scrap tires to processors would cease and the tires would revert back to landfill disposal. The exception being if the program has increased end-use demand for scrap tires.</p>	<p>The Board has neither used a transportation subsidy in the past nor, to our knowledge, even discussed it. Tire transporters are the direct beneficiaries of this program and as a group they are likely to have the least political clout. C/IWMB has the legal authority to authorize this program.</p>	<p>Of all the proposed policy alternatives this is the most difficult to administer. It requires knowledge on scrap tire origination, tire transporter origination, and distance to nearest non-landfill processors of all possible types. Though it could be done using GIS technology, it would still be costly to implement and police. Potential for improvability through altering amount of per-tire transportation grants.</p>

<p>Alternative VII: Information Campaigns</p> <p>Spend up to \$4 million per year on information campaigns on the benefits of TDF, rubberized asphalt, and other end products that use scrap tires as a primary input.</p>	<p>Criterion 1: Efficiency</p> <p>The efficiency of an information campaign is very uncertain. It depends entirely on how the public and government agencies respond to the information given them. If current lack of demand for products produced from scrap tires is not caused by wrong information or lack of it, and it is more driven by cost considerations, then this program will be highly inefficient at achieving the diversion of tires from California's landfills.</p>	<p>Criterion 2: Equity</p> <p>No real issue of fairness arises here with the possible exception of the decision regarding where to target the information campaign. In interest of fairness, we would suggest one-third divisions of information budget on issues relating to TDF, crumb rubber, and rubberized asphalt.</p>	<p>Criterion 3: Sustainability</p> <p>By definition, if this program succeeds at permanently changing peoples' and governments' perceptions on the further non-landfill applications of California scrap tires, then it will be the most sustainable of all the policy alternatives.</p>	<p>Criteria 4: Political/Legal Feasibility</p> <p>Political opposition to documented information being more widely distributed should be limited. Exceptions could come from those in the traditional asphalt industry worried about losing market share and environmentalists fearful of increased use of TDF (no matter what the scientific evidence says). CIWMB has the legal authority to authorize this expansion of the current program.</p>	<p>Criteria 5: Administration/ Improvability</p> <p>By the very nature of this proposal, nearly the entire cost of this program is administrative. Potential for improvability is high given that a certain form of information campaign can be tried and if it fails to divert the necessary amount of scrap tires from California's landfills it can be changed or abandoned and a new one put in place.</p>
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Table 9: Quantitative Alternative-Criterion Matrix for Waste Tire Management in California

Ratings: (1) Very weak (2) Somewhat weak (3) Moderate (4) Somewhat strong (5) Very strong.

	Criterion 1: Efficiency	Criterion 2: Equity	Criterion 3: Sustainability	Criterion 4: Political/Legal Feasibility	Criterion 5: Administration/ Improvability	Total Score
Alternative II: Further Regulation of Landfill Disposal	Rating: 5 Weight: 0.30 Total: 1.50	Rating: 2 Weight: 0.25 Total: 0.50	Rating: 1 Weight: 0.20 Total: 0.20	Rating: 1 Weight: 0.15 Total: 0.15	Rating: 5 Weight: 0.10 Total: 0.50	2.85
Alternative III: Per-Tire Subsidy to Waste Tire Processors	Rating: 4 Weight: 0.30 Total: 1.20	Rating: 4 Weight: 0.25 Total: 1.00	Rating: 2 Weight: 0.20 Total: 0.40	Rating: 3 Weight: 0.15 Total: 0.45	Rating: 3 Weight: 0.10 Total: 0.30	3.35
Alternative IV: Per-Tire Subsidy to End-Users of Waste Tires	Rating: 4 Weight: 0.30 Total: 1.20	Rating: 3 Weight: 0.25 Total: 0.75	Rating: 3 Weight: 0.20 Total: 0.60	Rating: 3 Weight: 0.15 Total: 0.45	Rating: 2 Weight: 0.10 Total: 0.20	3.20
Alternative V: Further Subsidize Capital Purchases for Waste Tire Processors	Rating: 3 Weight: 0.30 Total: 0.90	Rating: 3 Weight: 0.25 Total: 0.75	Rating: 3 Weight: 0.20 Total: 0.60	Rating: 4 Weight: 0.15 Total: 0.60	Rating: 4 Weight: 0.10 Total: 0.40	3.25
Alternative VI: Per-Mile, Per-Tire Subsidy for In-state Transportation of Scrap Tires	Rating: 3 Weight: 0.30 Total: 0.90	Rating: 3 Weight: 0.25 Total: 0.75	Rating: 2 Weight: 0.20 Total: 0.40	Rating: 2 Weight: 0.15 Total: 0.30	Rating: 1 Weight: 0.10 Total: 0.10	2.45

6. Recommendations

During the last 12 years of its existence, the California Integrated Waste Management Board has continually tried to meet or exceed targeted landfill diversion rates. Regarding the diversion of scrap tires away from landfills and above-ground tire piles, the CIWMB has used a variety of market intervention strategies with relative success. As detailed in Section II of this report, in as late as 1990 about two-thirds of the scrap tires generated in California were deposited into tire piles or landfills. In the first years of the twenty-first century, this percentage has fallen to about one-fourth.

With the fee levied on new tire purchases rising from \$0.25 per tire to \$1.00 in 2000, and it now being assessed on tires entering the state on new automobiles, the Board can expect sizable increases in the amount of money that could be devoted to further market development for scrap tires. Knowing this, and the fact that a quarter of California's scrap tires continue to be used in a socially non-optimal way, the CIWMB has sought to evaluate the effectiveness of its current interventions and to consider various policy options for expanding its waste tire management program. The present report was commissioned as a tool to help accomplish this goal.

This study has employed a framework to assess the efficacy of several alternative strategies for managing California's waste tire problem. The policy analysis has focused on identifying potential alternatives and evaluating each of them according to a set of established criteria. The criteria determine both the potential effectiveness of each alternative for achieving the intended outcome of fewer tires in landfills, and its comparative cost and feasibility.

In this concluding section of our report, we summarize the findings from the analysis completed in the five previous sections. Based on these findings, we then provide our set of recommendations for implementing a multi-component waste management strategy. We begin this section with a reexamination of our alternative-criterion analyses and discuss these findings in terms of the trade-offs involved with the adoption of one policy proposal over others. Building on the results of this discussion, we next present a series of recommendations for implementing a waste management strategy within the budgetary guidelines established for fiscal years 2001–02 through 2005–06. The report concludes with a brief discussion of a design for putting into practice our recommendations and addressing both short- and long-run implementation issues.

Confronting the Tradeoffs of Various Policy Alternatives

In the previous section of this study, a set of policy proposals was evaluated on the basis of five independent criteria. A qualitative assessment of each these proposals expected performance in terms of each criteria was then translated into a quantitative rating that was summed across the weighted criteria to yield a total overall score. The advantage of this structured analysis is that it allows for the comparison and contrast of the various proposals on specific aspects and answered questions such as, "Which of the policies is the most equitable?" In addition, this form of analysis allowed for ratings on the various criteria to be standardized and combined into an overall score to evaluate the desirability of the policy as a whole.

We now build upon that earlier analysis by comparing and contrasting the set of policies, not on individual criteria, but as an entire packaged intervention. This comparison takes into account some of the advantages and shortfalls of each policy. Confronting the tradeoffs inherent to each of these policy strategies better facilitates the necessary decision regarding which of the approaches, or which combination of them, best addresses California's continuing waste tire problem. We turn first to the tradeoffs inherent in choosing a policy of landfill regulation.

Regulation of Landfill Disposal

(Total Score 2.85 / 5.00)

The increased regulation of landfills provides a potentially efficient solution to the problem of scrap tires being deposited there at a very low cost to the state tire fund. The only anticipated monetary cost would be for the administrative burden of gaining support for and enforcing the proposed reduction in chip size. Due to this low dollar cost of implementation, this policy could be implemented in combination with one or more of other market development incentives and still remain within the projected budgets assigned to scrap tire market development.

Given the “very strong” rating we awarded landfill regulation in terms of efficiency, or “bang-for-the-buck,” it appears to be a potentially effective solution to the waste tire disposal problem. But as itemized in Tables 8 and 9, considerable tradeoffs arise if this regulatory policy strategy is adopted. The requirement that tires deposited in landfills be no more than 2.5 inches in size directly penalizes landfill operators by increasing their operating costs. Some of these increased costs will be passed on in the form of higher tipping fees to tire haulers who rely on landfills to dispose of their excess tire waste. This targeting of these two key players in the current market system, in a punitive sense, is likely to produce major opposition in the political arena and calls into question the feasibility of regulation relative to other alternatives under consideration.

In addition, another important tradeoff is the high potential this policy has to generate unintended consequences. These consequences involve the potential for major market disruption and a consequent re-emergence of illegal dumping if alternative-use markets are not able to absorb the annual addition of nearly 9 million scrap tires. The realistic implementation of the policy would thus require that effective market development incentives are used in combination with landfill regulation to insure that current recycling/diversion and new technology expansion is sufficient and ongoing. Although landfill disposal is considered undesirable when alternative uses are available, it does provide a necessary means of disposal when markets have not yet fully developed. Significantly increasing the price of this disposal option before markets are able to absorb excess flows could result in increasing costs for landfill operators and tire haulers without the benefit of increasing diversion rates.

Per-Tire Subsidy to Waste Tire Processors

(Total Score: 3.35 / 5.00)

A per-tire subsidy strategy of \$0.17 was determined to represent an effective strategy to support recycling and/or diversion industries and received a “somewhat strong” rating on efficiency. By directly subsidizing the production costs of tire processors that hold a contract for the purchase of processed material, processors will lower tipping fees and successfully motivate the diversion of tires currently going to landfills.

The two major disadvantages of a reimbursement program like this are cost-based. Moving to this policy requires that per-tire subsidies be paid on all qualified California tires recycled or diverted in the market. Furthermore, there would be large administration costs involved with starting the program and administering/policing it once in place. The large-scale nature of the reimbursement program would, therefore, require major budgetary support and reallocation of funds from other existing programs. This cost issue suggests that the Board, if unwilling to fund a full-scale reimbursement program, consider it for targeted demonstration projects. The Southern California market for scrap tires—which contains the Azusa tire monofill, many crumb rubber processors, cement kilns, and potential TDF users—would seem to us a perfect place to do this.

In terms of benefits, however, the pervasiveness of a statewide per-tire subsidy program increases the likelihood that it will substantially impact diversion rates relative to what the other suggested alternatives could be anticipated to accomplish. Though politically there may be challenges to starting such a program, in the end we feel that they could be overcome if opponents could be convinced of the market signals—through tipping fees—that a per-tire subsidy could unleash. Sustainability would also be a concern that opponents of such a program would raise. But, considering the large flow of scrap tires such a program should generate to those that possess contracts for their end use, induced demands for these products very likely could be sustained in the future even without per-tire processing subsidies.

Per-Tire Subsidy to End Users of Waste Tires

(Total Score: 3.20 / 5.00)

This subsidy program is in many ways like the subsidy to processors just described. Thus it exhibits some of the same pluses and minuses. On the plus side, its pervasiveness is more likely to guarantee a large-scale impact. On the minus side, this again means a program that is costly in expected payout and to administrate.

A crucial difference to note is that per-tire subsidies to the purchasers of products that contain scrap tire content represents the only proposal that targets the demand side of the market. Because this is expected to directly lower the manufacturing cost of these products and the price charged for them, it would increase the quantity that consumers purchase. Getting these products into the hands of consumers has the effect of raising their scale of production and increasing consumer taste for continued use of them. If this occurs to a large enough degree, the continued purchase of these products would be sustainable even after the subsidy goes away.

Further Subsidize Capital Purchases for Waste Tire Processors

(Total Score: 3.25 / 5.00)

Government grants for the purchase of waste tire processing equipment offer a tool that the CIWMB could use to lower the cost of processing tires into recyclable components. In turn, lower production costs would allow waste tire processors to expand current operations and ultimately use additional waste tires that had gone to piles or landfills. The targeted and limited nature of such programs makes them inherently less risky than the two per-subsidy proposals just discussed and therefore usually more politically attractive. While some risk is associated with misuse of grant funding or general under-performance (i.e., failure to meet the established target of processing 250,000 tires annually), this risk is mediated here by structuring the grants as capital loans that convert to grants based on demonstrated performance.

In terms of efficiency, product commercialization grants offer greater potential for increasing diversion rates than information campaigns, but have less potential than market-wide subsidies to produce substantial increases in total diversion rates. The diversion of 8.7 million tires, for example, would require the initiation of 33 commercialization grants annually. These would have to be perfectly targeted to processors that would each use 250,000 scrap tires per year that would not have been used without the grants.

Per-Mile, Per-Tire Subsidy for Instate Transportation of Scrap Tires

(Total Score: 2.45 / 5.00)

This policy proposal received the lowest overall score. Though it was ranked “moderate” in its expectation of being able to divert scrap tires away from landfills at a reasonable cost, it fared

poorly in terms of sustainability, political acceptability, and administration. In short, our analysis indicates that the costs of this program are likely to be greater than the benefits.

Information Campaigns

(Total Score: 3.20 / 5.00)

An information campaign would be designed to provide accurate and up to date information on TDF and rubberized asphalt, and could also promote the greater purchase of products that contain scrap tires by touting their relative benefits. In addition, this campaign could further the Board's current pursuit of centers to disseminate information on technological advances that make the processing of tires easier and hence less expensive for private firms. As noted by the "somewhat strong" ratings assigned in regard to equity, political/legal feasibility, and administration/improvability, such a program has much to offer. The reason it did not come out on top was the "somewhat weak" rating assigned in terms of efficiency. The tire diversion "bang" for the "bucks" spent on such a program is anticipated to be both relatively low and uncertain.

Recommendations

The previous discussion of tradeoffs was meant to demonstrate the benefits and drawbacks of implementing each policy as an independent strategy for addressing California's waste tire issue. In reality, however, maximum program benefits are more likely to be delivered through a comprehensive waste management strategy that involves a mixture of components rather than a single policy prescription. Such an approach would allow the CIWMB to draw benefits from the most desirable features of each strategy, while minimizing the risk associated with relying on only one policy for successful diversion of tires. The Board already has demonstrated support for a multi-policy approach by choosing this method for its current *Five-Year Plan*.

The following recommendations serve as the findings of this study. The recommendations rely on staying within the dollar confines of the proposed budget for fiscal year 2002–03 outlined in the CIWMB *Five-Year Plan* (2001) and summarized previously in Table 1. Each of the recommendations presented is discussed in terms of its impact on the structure and allocation of funds for the current projected budget. Total spending for market development activities by the CIWMB for fiscal year 2001–02 is projected to be about \$8 million. Table 10 below presents the level of funding allotted to each of the major budgetary categories that would be impacted by our recommendations. Any remaining categories, such as funding for training conferences, brochures, and other information campaigns, would not be impacted.

Table 10: Key Components of the CIWMB Market Development Budget for 2002–03 Impacted by Study’s Recommendations	Program Area	2002-03 Planned Expenditure
Civil Engineering Uses		\$1,000,000
Playground Cover		\$800,000
Track/Recreational Resurfacing		\$1,000,000
Product Commercialization		\$2,000,000
Green Building		\$400,000
RACTC		\$500,000
Signs for Caltrans RAC Projects		\$30,000
Recycling Market Development Zones		\$2,000,000
Capital Improvement State Parks		\$200,000
CalMax and WRAP (Miscellaneous)		\$20,000
Total		\$7,950,000

Recommendation #1: As demonstrated through our previous discussion and analyses, per-tire reimbursement programs provide an effective mechanism for increasing the number of waste tires used in recycling processes. Understanding the fact that the Board has already made great strides in increasing the number of tires recycled or diverted in California, and that the difficulty in recycling/diverting each additional tire increases as more tires have been recycled, *we recommended that the CIWMB begin some form of a per-tire reimbursement program.* Previously we have suggested either: (1) a \$0.17-per-tire subsidy paid at the processor level, or (2) a subsidy of \$0.10 per tire for TDF and \$0.50 per tire for content in end-use products. Our previous evaluations in Tables 8 and 9 indicated a preference for the \$0.17-per-tire subsidy paid to processors, but either of these per-tire subsidy programs would be acceptable in our minds.

Working within the budget established by the CIWMB for fiscal 2002–03 in Table 10, we suggest that the Board initially allocate \$5 million a year to implement this recommendation. Whatever is not used for set-up, policing, and other administration costs would then be placed in a fund devoted to paying out the per-tire subsidy. If \$4 million remain for this task, and the subsidy plan is the suggested \$0.17 per tire paid to eligible processors, a total of about 24 million tires could receive the subsidy. If more than this number of recycled or diverted tires qualifies for the subsidy (as would be hoped since over 30 million scrap tires are generated a year in California), then we suggest that the Board evaluate the success of the program at that time. It could further fund the remaining applications if the subsidy is deemed to be doing what was intended (i.e., a smaller percentage of tires are going to California’s landfills than in 2001–02).

If this recommendation is implemented, the Board must do a thorough and careful analysis of the revenue it has available to undertake it and a regular and complete accounting of all money spent on per-tire subsidies. This will likely entail the hiring of a major private consulting/management firm.

Recommendation #2: Requiring that scrap tires be processed to a 2.5-inch chip before being deposited into a California landfill would no doubt offer an effective disincentive to landfill disposal. Such a policy could contribute to solving the remainder of California’s waste tire problem once alternative-use markets were stable and sufficiently developed to absorb the new scrap tire flows it would create. However, due to the risks of implementing such a regulatory

change before these scrap tire markets have matured, *we recommend that further tire chip regulation of landfills not be implemented as part of the CIWMB's future tire waste management strategy.* Instead we suggest that this approach be tabled for later re-consideration once other market development incentives are operational and end-use markets for California's scrap tires have matured. Once this is the case, landfill disposal of scrap tires should be an issue only at isolated sites far from other end uses. A combination of further regulation, and subsidies to transport scrap tires from these isolated sites, could offer the solution to this occurrence even after our following recommendations are in place.

Recommendation #3: Given the favorable assessment that subsidizing the capital purchases made by waste tire processors received in our criterion-alternative matrix, *we further recommended that the CIWMB continue its funding of capital subsidies at \$2 million annually.* With a maximum funding level of \$250,000 per grant that requires a matching expenditure by the firm receiving it, a minimum of eight grants could be offered in a year. These eight grants would mean \$4 million worth of new tire processing equipment comes into existence each year the program is in place. If each of these pieces of machinery must process 250,000 tires a year to retain its grant status, this alone would result in 2 million tires being recycled.

To achieve greater efficiency in the use of capital subsidies we also suggest that the Board hire a full-time expert capable of evaluating the operations and viability of companies applying for grants. The person would also be responsible for follow-up and enforcement of the stipulations necessary to convert the loan to grant.

If concern over the under-funding of the per-tire subsidy program recommended above is great, the Board may want to make tires processed on machines that received CIWMB grants ineligible for the per-tire subsidy. However, in the interest of using whatever is available to achieve the goal of getting all of California's tires out of landfill, we would instead prefer the payment of subsidies for eligible California tires processed on any machine in the state. We make this suggestion knowing that the Waste Tire Fund, from which the money would need to come, is projected to receive at least \$30 million in deposits in fiscal year 2002–03.

Recommendation #4: The fourth and *final recommendation from our study is that Board spend the remaining \$1 million of its anticipated \$8 million market development budget for 2002–03 on information campaigns.* In the interest of equity, and to increase the political feasibility for adopting this recommendation, we suggest that money spent on information campaigns be equally divided between distributing accurate information on the further use of TDF, the further use of crumb rubber in general, and the further use of rubberized asphalt. Though we have previously suggested the types of information to emphasize in such campaigns, we would leave the specifics to CIWMB staff. As shown in Table 10, this suggested \$1 million expenditure would nearly double what the current plan spends on “getting the word out.”

To achieve greater efficiency in its information campaign we also suggest that the Board consider hiring a permanent liaison to the California Department of Transportation to promote and assist Caltrans in evaluating the further use of rubberized asphalt. In addition we suggest the greater use of marketing experts from the business sector to help craft an information campaign that can be truly effective.

Though not a formal recommendation, we would like at this point to step out of the parameters given us for this study—that being that the budget for market development activities remain at the levels provided in the Board's *Five Year Plan* (2001)—and suggest an overall increase in these planned budgets. After the increases in revenue guaranteed from the new \$1 per-tire fee, the Board has significantly more resources available. To achieve the desired goal of getting all of California's scrap tires out of landfills and piles, more of these resources may be needed. If more

than the \$8 million to \$8.6 million budgeted for market development through fiscal year 2005–06 becomes available, our suggestion would be to allocate the new money in the same ratios above: five-eighths to per-tire recycling, two-eighths to capital subsidies, and one-eighth to information campaigns.

Implementation

The major change in strategy embedded in the recommendations offered above is the introduction of a per-tire subsidy program for a total budget allocation of \$5 million in the first year (2002–03) of implementation. This new budget category would be funded through elimination of all existing tire program components with the exception of RAC Technology Centers and Caltrans signs, which would become part of the \$2 million suggested information campaign.

The introduction of a per-tire subsidy would no doubt represent a major administrative challenge for CIWMB staff. The program would require extensive monitoring and enforcement built upon the new tire hauler manifest system currently under development. Program delays may be required until this manifest system is fully functional and able to support the various elements of the program, including, but not limited to, accurate tracking of the sources of waste tires in the state and their flow through California markets.

The experimental nature of the program within California suggests the need for a detailed implementation plan to guide program development and refinement. We suggest that CIWMB staff consult with waste management staff from other states that possess experience in implementing and overseeing subsidy programs. We recommend that the Board seriously consider employing the expertise and experience that a major private consulting/management firm could bring to this important task.

In the longer term, specific elements of the program need to be flexible. Most importantly, this includes the rate of reimbursement. Implementation plans also would need to include established timelines for review and evaluation to determine whether programs are effective in achieving new waste tire diversion goals.

7. Addendum

Summary from Public Workshop

August 15, 2002

The California Integrated Waste Management Board's Special Waste and Market Development Committee held a public workshop to provide interested parties the opportunity to comment on the draft report: *An Analysis of Subsidies and Other Options to Expand Tire Recycling/Diversion in California*. The workshop was held on August 15, 2002, from 9:30 a.m. to 2:00 p.m. at the Joe Serna Jr., Cal/EPA Building, 1001 "I" Street, Sacramento, California 95814.

The workshop began with Martha Gildart, Manager of the Waste Tire Management Program describing the history and background of the program. Dr. Robert W. Wassmer, Professor of the Public, Policy and Administration Program from California State University, Sacramento, then summarized the draft report. After Dr. Wassmer's presentation, Board Member Jones opened the floor for public comments.

Comments from the Public

The Committee received the following comments from the public during the workshop. The comments have been summarized and grouped by subject.

Subsidies—A few of the speakers were, in principle, opposed to subsidies but believed that to create a level playing field with the Canadian crumb rubber producers, the State should provide subsidies to California crumb rubber producers. One speaker added that if crumb rubber producers are provided subsidies, tire buffings should also be included. The concern expressed was that the California Department of Transportation is using Canadian rubber for its road projects. The crumb producers felt the Board should either provide subsidies or ban imported rubber. Others were not in favor of subsidies, but if the mandate is to apply the funds that the Board has in that matter, it needs to be done in a fair and consistent manner that doesn't disrupt existing markets. Another speaker indicated the Board should provide subsidies to businesses that take waste tires and make real products for sale on the commercial market, as the only ones that should be considered at all for subsidy.

Tire Derived Fuel (TDF)—Several speakers at the workshop commented on the use of tire-derived fuel as an alternative. One group had studied the test data from the Hanson cement kiln in Cupertino and is opposed to TDF. The group stated that burning is not recycling and more efforts should be towards source reduction, such as manufacturing tires rated with higher mileage, and providing subsidies to end-use products that truly recycle. Another speaker felt that, due to global warming, tires should not be burned. And finally, one group believed the report is flawed because it treats TDF as equivalent to other diversion options, such as recycling tires into rubberized asphalt. The group felt the report did not address the health effects of burning tires.

Landfills—One speaker indicated the report had a negative tone with negative statements on almost every page about landfills in general that accept tires. The speaker pointed out that environmentally safe landfilling is listed in the existing hierarchy of the law. Another speaker would like to see landfilling evaluated in the report, and felt all alternatives should have been considered.

Matrix in the Report—One speaker suggested changing the weights in Table 9 in column 3, criteria 3, sustainability, to 80 percent rather than 20, and recalculate the math so a completely different result would occur. Another speaker believed that efficiency and equity are weighted too

high and that sustainability is weighted too low. They suggested the weighting of the evaluation criteria be modified to: 25 percent for efficiency, 20 percent for equity, 30 percent for sustainability, 15 percent for political/legal feasibility and 10 percent for administration and improvability. This change in weighing results in Alternative 5, further subsidizing capital purchases for waste tire processors as the highest rated policy alternative that would assist new businesses and technologies entering the marketplace.

Rubberized Asphalt—A speaker recommended that the Board require the State and local governments use rubberized asphalt in their road-building projects.

General—One of the speakers commented that the report has provided an interesting opportunity to explore one potential with respect to subsidies. The speaker encouraged the Board to use contracts through the California State University System to provide the Board the opportunity to explore further policy alternatives. Another speaker suggested the Board ask whether the policies actually prevent the disposal of tire rubber permanently.

Comments from the Committee

After public comments were received, the committee members provided the following directions to staff.

Board Member Papanian informed staff that he wanted to see another draft that addressed the concerns of TDF and recycling. In his view, use of tires as a fuel was not recycling; further, the analysis lacked an environmental criterion to distinguish between alternatives. He suggested that the final report be accepted but not become a Board publication. He also directed the Board's legal office to review pages 50 and 51 and provide comments.

Board Member Eaton stated that if recycled products are to be produced, the Board must support them in some manner. He directed staff to add an addendum to the report summarizing what happened at the workshop. He also directed staff to add a disclaimer to the report.

Committee Chair Jones intends the report to be a tool for the Board just like the comments that were received at the workshop. He feels the question before the Board is how best to direct the funds now available so as to create sustainable markets after funding ends. He directed staff to attach the comments from the workshop and the comments of the different committee members. Then the committee could accept the report as completion of the contract obligation. After the committee has reviewed another draft of the report, it should be submitted to the full Board for acceptance.

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