PRODUCT STEWARDSHIP INSTITUTE

*Sustainable Solutions to Protect Our Environment*

# Tire Stewardship Briefing Document

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Boston, MA 02116

***Prepared by the Product Stewardship Institute, Inc.***

**The Product Stewardship Institute**

The Product Stewardship Institute (PSI) is a national, membership-based nonprofit committed to reducing the health, safety, and environmental impacts of consumer products across their lifecycle with a strong focus on sustainable end-of-life management. Headquartered in Boston, Mass., we take a unique product stewardship approach to solving waste management problems by encouraging product design changes and mediating stakeholder dialogues. With 47 state environmental agency members, along with hundreds of local government members from coast-to-coast, and 95 corporate, business, academic, non-U.S. government, and organizational partners, we work to design, implement, evaluate, strengthen, and promote both legislative and voluntary product stewardship initiatives across North America.

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# I. INTRODUCTION

## *Purpose of this Briefing Document*

The purpose of this *Tire Stewardship Briefing Document* was to prepare participants for a PSI-facilitated meeting that was held in Hartford, Connecticut on January 21-22, 2015. The meeting was national in scope but focused on the northeast region. It will also serve as a basis for additional discussions on scrap tire management in the United States. The briefing document includes background information on tire composition, markets, and lifecycle management. It also includes a product scope, key issues, project goals, and possible meeting outcomes. Finally, it presents potential solutions pertaining to each of the project goals.

A significant amount of material used in this updated report was taken from PSI's July 2005 *State of California Tire Product Stewardship Final Action Plan,*[1] which was sponsored by the California Integrated Waste Management Board (now CalRecycle). The information in that report was derived through discussions with 22 key stakeholders, as well as a review of available literature. It also included stakeholder input from discussions that took place during the July 2004 PSI Tire Stewardship Dialogue Meeting held in Sacramento, CA. PSI updated information in 2014 and 2015 based on numerous phone conversations, a literature review, and informal surveys regarding the identification of scrap tire management problems and solutions. In addition, this document has incorporated information obtained during the PSI Tire Stewardship Dialogue Meeting held in Hartford, CT in January 2015. **This *Briefing Document* reflects varying perspectives on the management of tires and not a unanimous approach.**

## *Product Scope*

In the U.S., state scrap tire fee legislationhas historically regulated passenger and light truck, and truck/bus radial tires, but has not included off-road tires. Other state requirements that address all tires include collection, storage, transportation, and illegal dumping. In Ontario, Canada, all tire types are regulated with respect to fees and other requirements including on-road tires (e.g., passenger, light truck and medium truck, bus, RV) and off-road tires (e.g., agriculture, logger/skidder, motorized vehicle).

## *Key Issues*

The following issues regarding scrap tire management are representative of a range of perspectives. They do not represent a consensus among all stakeholders. Instead, they are indicative of the concerns expressed to PSI staff regarding the management of scrap tires.

### Illegal Dumping

While many large scrap tire piles have been eliminated, government officials report that there continues to be an accumulation of numerous small piles, river and ocean dumping, and roadside dumping, with associated concerns related to public health and safety (e.g., mosquito-borne illness, fire risks), environmental protection, urban blight, and government costs for clean-up and enforcement. Factors contributing to illegal dumping include low barriers to entry for haulers, limited storage availability at retail locations, lack of consumer convenience, regulatory barriers that increase costs and decrease the

convenience of collection, and tipping fees for scrap tire disposal. Additional factors include lack of laws and regulations for scrap tire collection and transport, including manifest tracking systems, lack of enforcement of existing laws, and illegal conduct including theft.

Reducing illegal dumping requires the creation of adequate incentives to promote reuse/retread, recycling, and proper management of scrap tires. These incentives need to exist throughout the scrap tire management system including for collection, transportation, and end-of-life management.

**Market Challenges for Higher Uses of Scrap Tires**

Support for market development is a key component in creating opportunities for higher end uses of scrap tires that follows the hierarchy of options (see below). Market challenges include the convenience and low cost of tire-derived fuel (TDF) and landfilling, the need for greater government agency acceptance of new end uses, and public concern over scrap tire use in particular products. State policies, including government procurement and restricting the use of scrap tire fees to tire-related purposes, can help support higher end scrap tire markets. Another option is to provide incentives to collect, haul, and process tires as has been done in some jurisdictions. These incentives can be a sliding scale based on the end use (e.g., the higher value the product, the more incentive a processor receives). This can help drive production of higher value products.

**Lack of Sustainable Financing**

At least 26 states fund stockpile cleanup programs.[2] Even among states with tire fee laws, however, funds are not always used to clean up tire piles or to increase scrap tire markets. In some states, funds from state tire fees have been funneled into the general fund, making them unavailable for the management of scrap tires.

## *Project Goals*

Based on the current issues and context of scrap tire management in the U.S., stakeholders have generally proposed the following three project goals:

**Goal 1**: Reduce the illegal dumping of scrap tires.

**Goal 2**: Attain the highest value possible for scrap tires while protecting human health and the environment (e.g., follow the hierarchy of options: reduce, reuse/retread, recycle, reclaim for TDF, proper disposal).

**Goal 3**: Provide adequate and sustainable funding to reduce illegal dumping and for higher and better use of scrap tires.

## *Possible Meeting Outcomes*

The following proposed meeting outcomes for the January 21-22, 2015 PSI Tire Stewardship Dialogue Meeting in Hartford, CT were intended to establish joint expectations:

1. Develop a greater understanding of the issues related to managing scrap tires;
2. Develop a greater understanding of stakeholder perspectives and priorities;
3. Identify key remaining issues and potential strategies for resolution;
4. Agree on a process for resolving remaining issues;
5. Develop a greater understanding of the elements of a model tire product stewardship bill; and
6. Agree on a process for providing input to the development of any product stewardship legislation.

## II. PRODUCT STEWARDSHIP AND EXTENDED PRODUCER RESPONSIBILITY

(This section is taken from *Product Stewardship and Extended Producer Responsibility: Definitions and Principles*, developed by PSI and two other organizations in March 2012. See Appendix A for the full document.)

The growing product stewardship movement in the United States seeks to ensure that those who design, manufacture, sell, and use consumer products take responsibility for reducing negative impacts to the economy, environment, public health, and worker safety. These impacts can occur throughout the lifecycle of a product and its packaging, and are associated with energy and materials consumption; waste generation; toxic substances; greenhouse gases; and other air and water emissions. In a product stewardship approach, manufacturers that design products and specify packaging have the greatest ability, and therefore greatest responsibility, to reduce these impacts by attempting to incorporate the full lifecycle costs into the cost of doing business. PSI uses the following definitions for product stewardship and extended producer responsibility.

**Product Stewardship** is the act of minimizing health, safety, environmental and social impacts, and maximizing economic benefits of a product and its packaging throughout all lifecycle stages. The producer of the product has the greatest ability to minimize adverse impacts, but other stakeholders, such as suppliers, retailers, and consumers, also play a role. Stewardship can be either voluntary or required by law.

**Extended Producer Responsibility (EPR)** is a mandatory type of product stewardship that includes, at a minimum, the requirement that the producer's responsibility for their product extends to post-consumer management of that product and its packaging. There are two related features of EPR policy: (1) shifting financial and management responsibility, with government oversight, upstream to the producer and away from the public sector; and (2) providing incentives to producers to incorporate environmental considerations into the design of their products and packaging.

## III. TYPES OF FINANCING SYSTEMS

Most waste management costs in the United States (e.g., program administration and enforcement, collection, reuse, recycling, and disposal, and clean-up) are largely borne by state and local agencies through government programs, and are paid for through rates and taxes. However, while responsibility for scrap tire management costs vary by state, these costs are primarily shared by consumers and government agencies.

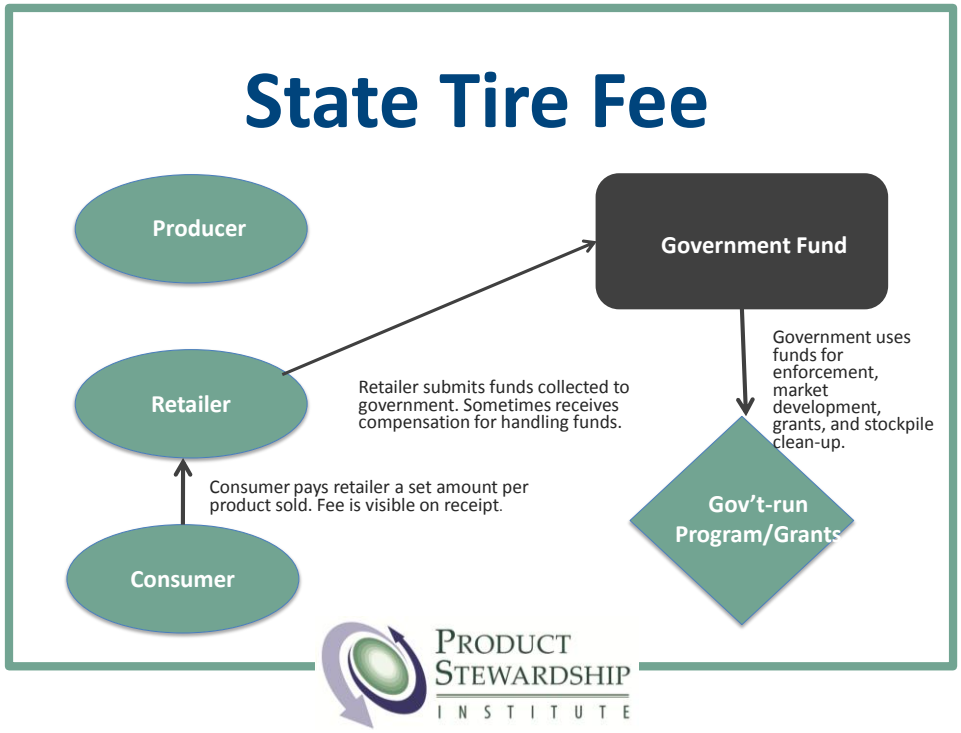
### *Tire Fees*

All 50 states have some form of regulation on scrap tires covering transportation and storage; landfill bans on whole or shredded tires; and incentives for government procurement of tire-derived products. In addition, 37 states require that a state tire fee be paid; this fee is usually understood as a visible fee paid by a consumer at retail. State fees are typically used to pay for the costs of staffing and enforcement of scrap tire management regulations, market development (research, grants, loans, and incentives), municipal and county grants, and stockpile abatement. These fees are quite variable among the different states, ranging from $0.25 to $2.50 per passenger/light truck tire.

North Carolina and Arizona are the only states that do not have a flat fee, but instead charge a percentage of the tire purchase price. Arizona limits its percentage to under $2 per tire, while North Carolina charges one or two percent, depending on the tire size. In some cases, state tire funds have been used to finance general fund activities unrelated to scrap tire management. In addition, when the state fee is paid at retail, most states allow retailers to keep a portion of this fee to help cover costs of scrap tire recycling and disposal.

Under state tire fee systems, retailers deposit funds collected from consumers into a state government account. These fees require little involvement from. Although state tire fees are considered product stewardship systems in the U.S., these laws are not considered EPR because they are *consumer* financed and *government* managed. (See Figure 1 for a schematic of a typical state tire fee system.) In addition, these fees only cover a portion of the total scrap tire management costs. Aside from the state tire fee, many retailers impose their own scrap tire charge on consumers (most state programs allow this). This can help retailers pay for their full costs of end-of-life management of scrap tires, as the portion of the state tire fee received by the retailer, if any, may not cover all costs.

**Figure 1: Schematic of a Typical State Tire Fee Financing System**



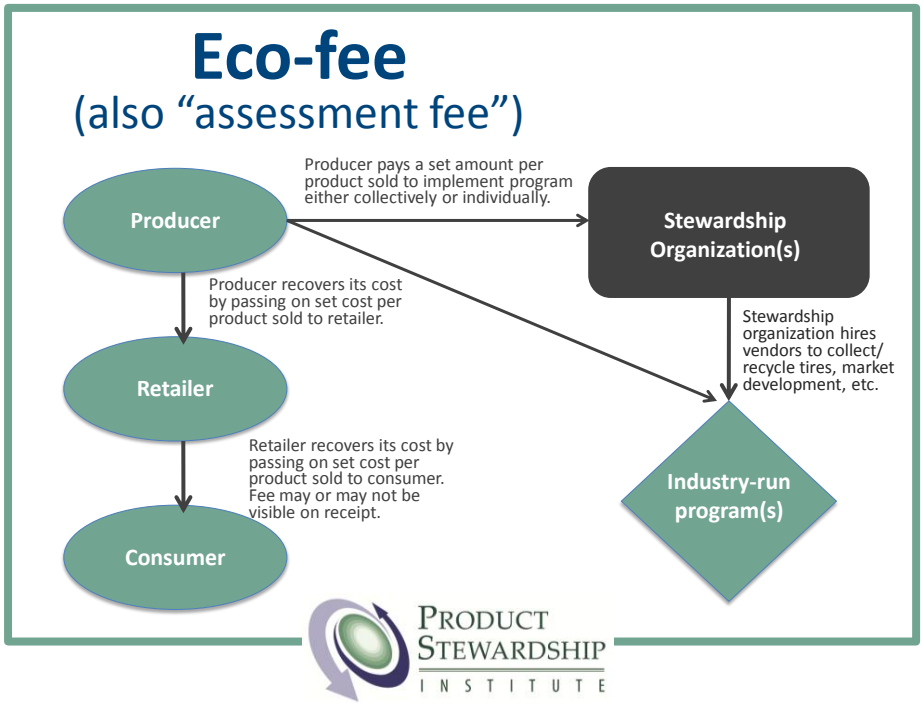

### *Extended Producer Responsibility (EPR)*

There are two basic types of EPR financing systems that seek to cover waste management costs by incorporating these costs into the purchase price of a new product: (1) eco-fees and (2) cost internalization. In general, under both systems, manufacturers take responsibility for the collection, transportation, and recycling of the products, often by creating an industry-run stewardship organization to coordinate services, collect payments from producers, and manage the overall system. Since funding is managed by manufacturers and the fund is not subject to being funneled into the government's general fund, EPR systems provide a greater degree of control for manufacturers.

### *Eco-fees*

One type of producer responsibility financing system, eco-fees, allows manufacturers to pass on a fee through the retailer to the consumer (as a visible or invisible charge) for post-consumer product management costs. Eco-fees are funded by consumers but managed heavily by producers. The fee is rarely set in the legislation, but instead is proposed by the manufacturers' stewardship organization and approved by the state oversight agency. As shown in Figure 2 below, the producer uses the funds from the eco-fee to either pay an amount per product sold into an industry-run stewardship organization, or finance and manage its own program (which is much less common). These funds are used by the stewardship organization to hire vendors to collect and process the collected scrap tires from retailers, municipalities, and other sources. In the U.S., eco-fee EPR systems have been implemented for paint, mattresses, and carpet.

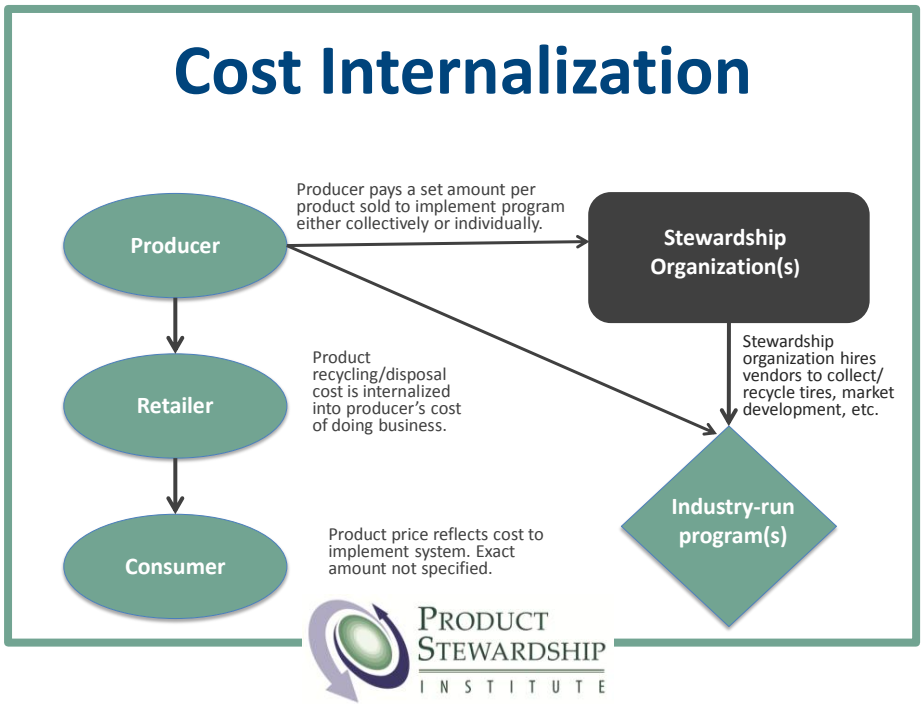
**Figure 2: Schematic of a Typical Eco-fee Financing System**




### *Cost Internalization*

This type of producer responsibility financing system requires manufacturers to internalize post-consumer management costs into the cost of doing business so that they are invisible to the consumer and retailer, even though the costs may be passed on to the consumer. These systems are industry-funded *and* industry-managed. Much like eco fees, a producer either pays into an industry-run stewardship organization or finances and manages its own program. These systems differ from eco fees in that the law does not require that the producer pass the cost onto the retailer, and then onto the consumer. (See Figure 3 below.) In the U.S., cost internalization EPR systems have been implemented for batteries, electronics, thermostats, auto switches, and other products.

**Figure 3: Schematic of a Typical Cost Internalization Financing System**




## IV. ELEMENTS OF AN EXTENDED PRODUCER RESPONSIBILITY (EPR) BILL FOR TIRES

### *Scope of Products*

The scope of products identifies the types of materials affected under the bill. Examples for tires might include: on-road tires (such as passenger, truck, bus, and RV tires) and off the road tires (e.g., agricultural equipment and off-road motorized vehicle tires). Related questions include whether the scope of products should include specified tire weights and sizes.

### *Producer/Responsible Party*

Producer responsibility laws for tires can identify and define responsible parties in a number of different ways, and can specify which parties are exempt from the law. Participation may be required for the manufacturer, marketer, brand owner, first importer, or retailer.

### *Funding Mechanism*

The funding mechanism specifies how the program will raise funds for collection and recycling activities and administrative costs. The tire stewardship bill can include the cost internalization or eco-fee model. In addition, this element may include a definition of program-related costs for which producers are responsible and can include collection, transportation, recycling/disposal, promotion, reporting, and other administration.

### *Incentive Payments*

Incentives can be a key component to maximizing tire collections, which fuel investment, material recovery, job growth, and high environmental outcomes. Some EPR laws promote recycling of specific

target products by providing cash incentives to collectors and processers, often by weight or volume of target material managed. Incentives can also be offered to consumers to return their products (e.g., deposits, rebates, coupons, etc.). Some EPR laws also include disincentives for manufacturers of products containing targeted materials. This element includes these types of policies. Some states elect to let manufacturers decide whether incentives are necessary to reach the goals set forth in their plans.

### *Performance Standards*

Performance standards encompass the collection rate and recycling efficiency to be reached by the program, or the methodology by which responsible parties must set their own goals in the stewardship plan submitted to the state agency. Performance standards are often numerical targets for annual collection or recycling volumes, weights, or rates.

### *Convenience Standards*

Convenience standards represent the minimum level of service to be provided to ensure that consumers across the entire state have access to qualified collection and recycling services for the target products. Standards can be set in statute, or left to manufacturers to define in their stewardship plans submitted to the state environmental agency. Convenience indicators are often expressed as a number of collection sites or density of collection sites per capita or geographic area, but also might include qualitative measures. A related element is whether retailers should be required to collect tires or whether their role should be voluntary.

### *Stewardship Organization*

This bill element defines whether responsible parties must join a representative organization in complying with the law, or whether they may create and implement their own individual plans. Legislation allowing flexibility often includes text that holds manufacturers responsible "individually or collectively." The bill must also set dates by which manufacturers must join stewardship organizations, and indicate whether multiple stewardship organizations are allowed. Having one stewardship organization obviates the need for an agency to review multiple stewardship plans, but also eliminates competition.

### *Outreach and Education Requirements*

This element defines the minimum requirements in the statute to ensure that consumers, responsible parties, retailers, and others are educated about the program, as well as any stipulations on how responsible parties must include outreach and education in their plans and annual reports. It also specifies that producers/responsible parties fund the education and outreach efforts.

### *Stewardship Plan Contents*

This bill element is a key component to responsible parties meeting their legal requirements. It is also a key element in the authority of state agencies to make sure that programs operate effectively. Stewardship plans are considered the program roadmap, and include how the responsible party will ensure consumer convenience, meet the performance goals, provide education and outreach, fund the program, and other key aspects. The section also describes the process and schedule by which plans are approved by the state environmental agency and updated by the responsible party, and may include

stakeholder and public comment periods as part of the plan review. Producers want to know that the data requested are truly needed by state officials to manage and enforce the program, since a request for more data adds program cost, as well as agency review time and resources. Harmonizing state agency requirements across multiple state programs will reduce program costs and complexity and increase data sharing and program efficiency.

### *Audit Requirements*

This element describes the program phases when an independent financial audit, or other type of independent audit, will be required. Some producers have advocated for reduced auditing frequency (e.g., every one year vs. three years) if a program meets its performance targets.

### *Antitrust*

Language is included in this section to ensure that responsible parties (or stewardship organizations and their members) are immune from liability for any claim of antitrust law or unfair business practice related to the execution of their responsibilities under the law.

### *Reporting Requirements*

This section lays out the minimum information that responsible parties must include in each report, typically submitted annually, to the state environmental agency, often including program performance data, a narrative description of program activities and outcomes, an evaluation of the funding mechanism, an independent audit, education and outreach efforts, and other items. Reports are made public and/or transmitted to the state legislature by the state agency.

### *Penalties for Violation*

This bill element provides a schedule of specific penalty amounts and infractions. Such penalties can be imposed on non-compliant producers and may also be specified for retailers who sell products from non-compliant producers.

### *Administrative Fees*

This section includes the amount of money to be paid to the state agency annually to administer the program; it may include a maximum amount. This element is tied to program reporting in that the more that producers are required to report, the greater the resources an agency will need to review that information, and the higher the administrative fee will be. The balance sought is to ensure that the fee is adequate for the work that all parties agree is needed to monitor program performance and ensure a level playing field.

### *Implementation Schedule*

An implementation schedule includes key milestones, such as when the act takes effect, when manufacturers must join a stewardship organization, when plans are due to the state and the amount of time before a plan must be approved or rejected, and when tires from non-participating brands may no longer be sold. These schedules are influenced by how many state programs are scheduled to go into effect within a given span of time, and whether the programs are in the same geographic region.

### *Disposal Ban*

Some EPR bills include a disposal ban to increase the flow of the target material to recyclers. Such provisions include the date by when the ban goes into effect.

### *State Procurement Requirements*

Some bills require state agencies to buy recycled-content products to create a market for the increased supply of recycled materials resulting from EPR laws. The bill may define existing purchasing standards to follow and set other procurement goals.

## V. TIRE INDUSTRY AND SCRAP TIRE MARKETS

This section provides background information on the nature of tires, sales, market trends, manufacturers, and processors.

### *Tire Composition*

A typical passenger tire contains 30 types of synthetic rubber, eight types of natural rubber, eight types of carbon black, steel cord, polyester, nylon, steel bead wire, silica and 40 different kinds of chemicals, waxes, oils and pigments. Modern tires contain little or no recycled rubber as it limits performance and increases fuel consumption.[3]

### *Tire Sales and Manufacturers*

The eight largest tire manufacturers collectively accounted for an estimated 80.2% of the $44.5 billion tire sales in North America in 2013 (see Table 1).

**Table 1: Market Share by Major Tire Manufacturers[4]**

| Company | Percentage of Market Share of Annual Sales |
|---|---|
| Michelin/Uniroyal Goodrich | 21.3% |
| Bridgestone/Firestone | 20.8% |
| Goodyear/Dunlop | 18.0% |
| Continental Tire | 6.2% |
| Cooper | 5.6% |
| Hankook | 2.9% |
| Toyo | 2.7% |
| Yokohama | 2.7% |
| Other | 19.8% |
| **TOTAL** | **100%** |

### *Market Trends – Scrap Tires*

From 2011 to 2013, there has been a growth in the U.S. scrap tire market, with an increase from 3.2 million tons per year to 3.7 million tons. In this time period, TDF increased by 48.6%, ground rubber decreased by 10.8%, and civil engineering applications decreased by 41.7%.[5]

### *Tire Diversion in the U.S.*

The U.S. is faced with the challenge of managing 233 million on-road scrap tires generated each year, of which about 96% percent are diverted from stockpiles or disposal (see Table 2 below). In addition, while the U.S. has made great progress in cleaning up tire dumps, an estimated 75 million tires remain in stockpiles or illegal dumps.[6]

**Table 2: Tire Diversion in the U.S. (2013)[7]**

| Application | Number of Tires (in millions) | Percentage |
|---|---|---|
| Tire-derived Fuel | 129.4 | 55.5% |
| Crumb Rubber | 59.5 | 25.5% |
| Exported | 15.0 | 6.4% |
| Civil Engineering Applications | 10.5 | 4.5% |
| Other (Reclamation Projects, Electric Arc Furnace, and Miscellaneous Uses) | 9.4 | 4.0% |
| **TOTAL TIRES DIVERTED** | **223.8** | **95.9%** |
| **TIRES LAND DISPOSED** | **20** | **8.6%** |
| **TOTAL TIRES GENERATED IN THE U.S.** | **233.3*** | **104.5%**** |

*Data includes on-road tires only (not off-road or agricultural tires).
** This number exceeds 100 percent due to tires managed from stockpiles.

**Landfilling**

Currently, 8.6% percent of scrap tires generated in the U.S. are landfilled, even though 38 states ban landfill disposal of whole tires and 12 prohibit cut and shredded tires from landfills.[8]

**Reuse and Retread**

Reuse refers to when a tire has been used once but still has useful life and could be used again. Tires are most often reused and resold by retailers or dealers changing tires on a vehicle. Reuse also occurs by haulers who segregate and sell used tires to some tire dealers. One stakeholder has estimated that approximately 10 percent of all tires disposed of at retail could be reused, while another noted that 2 to 5 percent of all incoming tires are currently segregated for reuse. While there are more opportunities for reuse than are being taken today, used tires must often compete with inexpensive new tires, so consumer prices for used tires must remain low.

In addition, tires can be retread, in which the tire casings are recapped. In 2011, approximately 680 firms produced retreaded truck tires, 18 produced off-road retreaded tires, five produced aircraft retreads, and four small businesses produced passenger vehicle retreads. Nationally, retread businesses sold an estimated $1.4 billion in retreaded tires in North America in 2011.[9] The majority of these sales were medium truck tires. The Tire Retread & Repair Information Bureau estimates that 15.6 million commercial truck retread tires were sold in the U.S. in 2014.[10] Retreading is most cost-effective and viable for large commercial truck tires.

Scrap tires with casing integrity can be retread after passing company inspection for flaws and other concerns. Unfortunately, retreads have a negative reputation among those who mistakenly assume that tire pieces on the side of the road are derived from retreads and believe them to be inferior to new tires. The fact is that retreading a tire extends the tire casing life and gives that tire another life equal to its original. Tire pieces along the road are most often a result of a failure to maintain sufficient air pressure, which causes tire casings to become extremely hot and eventually come apart. A retread is no

more likely to come apart than a new tire. There is a tremendous opportunity to increase retread use in local government fleets.

In addition, a July 2003 draft report from the California Integrated Waste Management Board (CIWMB) notes that increasing retreads could have a positive impact on the ability of tire manufacturers to acquire high-quality, pure rubber feedstock. Since high-quality buffings, used in new tires, are a byproduct of the retread process, increasing retread use in passenger and light truck tires would increase the supply of buffings and make recycled content in new tires more feasible. Countering this, however, the Tire Retread Information Bureau contends that there is only a small market for retreads in passenger and light truck tires since there are no cost savings by using retreads over new tires. When consumers are given the choice, they will always choose a new tire.

**Crumb Rubber**

The use of crumb rubber as a product or as a feedstock raw material in new product manufacturing is considered one of the highest value end uses for scrap tires. Over the years, crumb rubber production has become more efficient and cost-effective, as technologies have evolved to manufacture a greater amount of tire material into crumb rubber products. These markets, however, have been slow to develop, and crumb rubber product is costly to manufacture. While the potential exists for greater crumb rubber use, the Rubber Manufacturers Association (RMA) has reported that crumb rubber markets nationally have decreased from 66.7 million tires in 2011 to 59.5 million in 2013.[11]

In the U.S., about two dozen tire processors manufacture a crumb rubber product. Some of these processors are targeting specific markets, such as molded products, while others are manufacturing their own end products. Within the U.S., markets have not matured to the point of being able to absorb all the tires produced in the country. To date, it is estimated that approximately 25 percent of the country's scrap tires go to crumb rubber applications.[12] Tire processors are diversifying their markets to avoid economic collapse if any one market drops significantly. The hope is that diverse and sustainable markets will strengthen the tire recycling infrastructure over time and enable more scrap tires to be turned into crumb rubber products.

Another barrier to increased crumb rubber use pertains to the chemical make-up of tires. Currently, each tire manufacturer has its own manufacturing recipe. In addition, each tire component (e.g., sidewalls vs. the inner liner) is comprised of different compounds. As a result, scrap tires sent to recycling facilities do not have the exact same chemical properties, making it impossible to remanufacture a truly homogenous product. When molding rubber, chemical makeup is important, as it will dictate material performance during manufacture, its melt threshold, binders or chemical additives needed, and end product performance. While it is not realistic that manufacturers will share a uniform recipe, there would be greater market opportunities for crumb rubber if the tires had a more consistent chemical makeup. Developing such consistency, however, would have to be deemed viable within the confines of anti-trust legislation.

A third barrier is the cost to produce recycled crumb rubber as compared to virgin rubber. The grinders, hammermills, and other equipment needed for scrap tire recycling are expensive to purchase and

maintain. In addition, there is an overcapacity of crumb rubber production in the U.S., and Canada exports considerable crumb rubber to the U.S. While tires diverted to crumb rubber processors avoid landfills, there are few markets for the crumb rubber, resulting in the stockpiling of processed material. As a result, it has been difficult for tire processors and recyclers to manufacture a quality crumb rubber product that can compete with virgin material at an equal or lower cost. Tire manufacturers and molded product manufacturers would potentially use greater quantities of recycled rubber in their products if the cost were more competitive with virgin supply.

Stakeholders cited other challenges to growth in the use of crumb rubber and crumb rubber product markets. Including the following: 1) access to scrap tires; 2) difficulty competing with TDF; 3) negative media and public perception given health concerns about crumb rubber on playgrounds and fields; and 4) obtaining new product approval for government procurement.

**Crumb Rubber Markets**

***Recycled Content in Tires***

As revealed in CIWMB's 2003 draft report, *Increasing the Recycled Content in New Tires*, some new passenger tires contain from 3 to 5 percent of the rubber component as recycled content, at a ground rubber size of 80 to 400 mesh. The report also showed that manufacturers could add as much as 10 to 15 percent recycled content, although there is a debate as to the impact that adding any amount of recycled content has on tire longevity and performance.

As mentioned above, one of the greatest challenges to increasing the market for crumb rubber is that each tire is comprised of multiple materials. Mixed rubber from a variety of tire brands is challenging to turn into a recycled content tire. For this reason, manufacturers are often more willing to use scrap rubber that is internal to its own plant instead of post-consumer tire scrap. In addition, adding post-consumer recycled crumb rubber can reduce the physical properties of tires, therefore reducing the life of a tire and resulting in more tires being landfilled, not fewer.

It was also mentioned that, in today's marketplace, recycled rubber is more expensive and less predictable than virgin rubber. This creates a major barrier to the use of recycled content in new tire manufacture. To illustrate this point, tires that have been cryogenically processed (instead of ambient grinding) are more suited for use in new tires because they are typically of higher quality (without metal or fluff) and can be more easily made into smaller mesh sizes. However, this process for tire recycling is more expensive than ambient processing and, therefore, more costly for tire manufacturers to purchase as an industrial feedstock.

***Loose Fill Crumb Rubber Products***

Owing to the increased cost of scrap tire material over gravel, wood mulch, or other materials, recyclers that manufacture rubber recreational products today rely on government subsidies. To encourage the use of scrap tires in recreational applications, some states offer grants.

The potential exists to increase the use of crumb rubber in loose fill material for playgrounds, and even horse arenas. Crumb rubber, compared to pea gravel or mulch, provides a greater cushion than traditional materials when children fall. Crumb rubber, at one-half inch to one inch in size, can also provide improved drainage and absorb impact. In addition, crumb rubber can be poured in place for playing surfaces.

Even so, health and safety concerns regarding artificial turf fields and playgrounds made with crumb rubber from scrap tires could be a significant barrier to market growth in this area. There is some concern that the material can be dirty, can leave black marks or smudges on clothes or shoes, can have a strong rubber smell, that there could be steel fragments left in the tires that could cause harm, and that crumb rubber could burn should someone put out a cigarette or otherwise ignite the surface. Furthermore, human health concerns have been raised over the past several years. In California, Senate Bill 47, *The Children's Safe Playground and Turf Field Act of 2015*, calls for a ban, until January 1, 2018, on the installation, or contracting for new installation, of artificial turf made from recycled tires within the boundaries of a public or private school or public recreational park; it also would require the further study of potential adverse health effects from the use of scrap tires as artificial turf. The Los Angeles Unified School District (LAUSD) Office of Environmental Health & Safety also issued a "Safety Alert" in December 2014 related to concerns about lead content of crumb rubber. In this alert, the LAUSD indicated that it had removed artificial turf from early education centers and, in 2009, had removed recycled crumb rubber from design specifications and replaced it with in-fill material from non-recycled sources.

***Molded Products from Crumb Rubber***

Crumb rubber, ground to between 4 and 100 mesh in size, can be used as a raw material in the manufacture of a variety of rubber products, from mats, hoses, and truck bed liners to flower pots and more. Market acceptance of these products has been slow, although some products are starting to find greater recognition. As mentioned previously in relation to other uses of crumb rubber, a significant barrier is the inconsistency of the chemical makeup of tires. This difference in chemical composition can affect the manufacturing process of the product, as well as its performance. Another major challenge is developing a ready market for the tire-derived products that are manufactured. Government agencies, tire retailers, and others (including some tire manufacturers) do not have purchasing policies that favor tire-derived products. This is especially true of companies that sell large quantities of tire-derived products to consumers, and which also sell a significant quantity of new tires, such as large discount retailers. Probably the largest single barrier to market acceptance, however, is a lack of knowledge about which products are available and where to buy them.

***Rubberized Asphalt Concrete***

Crumb rubber can be mixed with liquid asphalt and used in road paving to make Rubberized Asphalt Concrete (or RAC). At least 38 states have incorporated RAC into some of their roads in the past, but only four routinely use it in their asphalt paving (Arizona, California, Florida, and Texas). Arizona, California, and Texas all use a process that meets the ASTM definition of asphalt rubber (at least 15 percent crumb rubber), whereas Florida uses a process that contains between 5 percent and 12 percent crumb rubber. California and Texas also use a modified binder that contains less than 10 percent crumb rubber. Arizona has assumed a leadership role in the widespread use of RAC. By 2004, 70 to 80 percent of the state's road projects had some component of rubberized asphalt. The quantity (by weight) of rubberized asphalt laid makes up 25 to 30 percent of all asphalt pavement placed. Arizona has used rubberized asphalt since 1970 (in chip seals) and began common use of the material in hot mix in 1988.

The state has been able to reduce its costs and build quieter-riding roads as a result of adding crumb rubber to its asphalt design mix.

One common criticism of the use of RAC is that it increases initial project costs. However, even though RAC is more expensive per unit of material compared to traditional asphalt, Arizona found that its overall road budget did not increase owing to its technique for laying thinner layers of rubberized asphalt. Instead of placing a 4 to 6 inch layer of traditional asphalt over a cracked road surface, the Arizona Department of Transportation can lay as little as 1 inch of rubberized material. Roads laid this way have reportedly lasted 40 percent longer before cracking occurs. Arizona uses rubberized asphalt as standard operating procedure in the majority of its pavement projects. As a result, both material and lifecycle costs can actually be reduced with the use of RAC.

Multiple stakeholders suggested that this would be a good potential market for New England. Advantages include the large volume of scrap tires that could be used and the recyclability of the product. State and local procurement directives can help advance this market as has been done in CA and AZ.

**Civil Engineering Applications**

Shredded scrap tires have been substituted for commonly used materials, such as aggregate, stone, and sand in a variety of civil engineering applications across the country. In 2013, civil engineering applications made use of approximately 10 million scrap tires.[13] Some stakeholders have expressed concern about the ability to recycle scrap tires after they are used in civil engineering applications. Another barrier to the use of shredded tires for these applications is competing materials and related cost and availability of the material. Other stakeholders, however, believe these applications hold great promise for scrap tire market opportunities, particularly because of the large numbers of tires that are needed for each job. CalTrans conducted one test project with shredded tires as lightweight fill, using 660,000 tires on an embankment project on the Dixon Landing in Santa Clara County in 2001. CalTrans also placed 75,000 tires as lightweight fill behind a retaining wall in Riverside County.

Nationally, since 1988, more than 70 projects with a thickness of 1 meter or less have been constructed using shredded tires and an additional 10 fills with a thickness of less than 4 meters were constructed. In 1995, three tire shred fills with a thickness greater than 8 meters experienced a catastrophic internal heating reaction, resulting in fires. This unfavorable experience temporarily curtailed the use of tire shred fills on highway projects. Since the development of the ASTM specifications, however, many successful lightweight fill projects have been built nationwide.

Possible causes of the 1995 incident are oxidation of the exposed steel belts and rubber. Microbes may also have played a role in the internal combustion reaction. Although details of the reaction are being studied, the following factors are thought to create conditions favorable for oxidation of exposed steel and/or rubber: access to air or water; retention of heat caused by the high insulating value of tire shreds in combination with a large fill thickness; large amounts of exposed steel belts; smaller tire shred sizes and excessive amounts of granulated rubber particles; and the presence of inorganic and organic nutrients that would enhance microbial action.

The RMA has developed design guidelines to minimize the potential for heating of tire shred fills by minimizing the conditions favorable for this reaction. As more is learned about the causes of the reaction, it may be possible to ease some of the guidelines, which are divided into two classes: Class I Fills with tire shred layers less than 1 meter thick, and Class II Fills with tire shred layers in the range of 1 meter to 3 meters thick. Although no projects using less than 4 meters of tire shred fill have experienced a catastrophic heating reaction, to be conservative, tire shred layers greater than 3 meters thick are not recommended. These guidelines considered the insulating effect caused by increasing fill thickness and the favorable performance of projects with tire shred fills less than 4 meters thick. Thus, design guidelines are less stringent for projects with thinner tire shred layers.

The following subsections outline the most common civil engineering applications using shredded tires between 2 and 12 inches in size that serve as a lightweight fill or aggregate. According to RMA, tires in civil engineering applications show 10 times better drainage properties than soil and 8 times better insulation properties than gravel.

***Landfill Applications***

Shredded tires can be used for several landfill applications – as daily cover, in the landfill drainage layer, as part of a landfill cap, and to assist landfill gas venting. Shredded tires have been used in the required daily cover layer at landfills, replacing dirt, sand, or other cover material. Chipped tires have also been used during new landfill construction in the bottom layer to provide drainage in the leachate collection system. While use of scrap tires for landfilling applications provides benefits that disposal does not, some stakeholders do not support these applications because they view landfill applications as simply another form of land disposal. Others believe that there are higher-value end uses that have not been fully explored. In addition, there are risks of fire if shredded tires are not installed properly, although the risks of spontaneous combustion are very low when tires are laid as a landfill drainage layer less than 3 feet thick. However, a tire fire at Monroe County Landfill in Indiana on January 10, 2004, renewed concerns about using tires in the liner layer of landfill construction.

***Lightweight Fill***

Chipped tires can be used as a lightweight fill substitute, especially on top of weak soils, as subgrade fill and in the construction of bridge embankments, retaining wall reinforcements, and other projects. In these applications, tires are substituted for other raw materials, such as gravel or sand. ASTM standards have been developed for testing the physical properties of chipped tires and provide data for assessing

the leachate generation potential of processed or whole scrap tires. The ASTM website outlines typical construction practices to demonstrate use.

One challenge that must be overcome, however, is that is has been difficult to get large quantities of shredded tires to a jobsite when needed. Since civil engineering projects are under construction for only a limited period of time, there are logistical challenges to transporting the tires, finding temporary storage, and managing scrap tires at the job site. This challenge is not insurmountable, however, as the Dixon Landing pilot project used 660,000 tires at one location, and scheduled the delivery of the shreds to coincide with the contractor's daily installation/compaction rate.

***Septic Field Drainage***

Chipped tires can also be used as a backfill around effluent leach field piping in septic systems. While in some areas of the country, such as South Carolina, chipped tires in septic fields have gained acceptance, this is not true for all communities across the country.

***Road Base***

Shredded tires can be used in the base layer of a road construction project in place of aggregate or stone. However, while tires have been used successfully in such applications for years, many still recall the state of Washington road fires, which were caused by using chipped tires at too great a thickness level. New standards have significantly reduced the risk of spontaneous combustion of tires used as an aggregate substitute in road base. Unfortunately, a negative perception still remains among some transportation officials. In addition, since road construction occurs over a limited period of time, the logistical challenges mentioned above for lightweight fill apply here as well.

**Tire Derived Fuel and Tire Chip Fuel**

Scrap tires can be used whole or chipped, depending on the facility, and fed into industrial boilers, electric arc furnaces, cement kilns, pulp and paper mills, and co-generation plants to serve as an energy substitute for coke or coal. In 2013, an estimated 129 million tires were combusted in the U.S. for energy recovery.[14] Tires provide a good energy source as they generate 14,000 BTUs of energy per pound, compared to coal, which generates 12,500 BTUs of energy per pound. Tires contain about 25 percent latex which is harvested from trees. This biogenic material does not contribute to greenhouse gas emissions because it is composed of material pulled from the atmosphere. As a result, TDF is a more sustainable fuel than coal or petroleum.[15] In addition, in some instances, such as in cement kilns and in electric arc steel furnaces, the iron/steel contained within a scrap tire is converted into raw material for the manufacture of end products. Additionally, tire-derived fuel

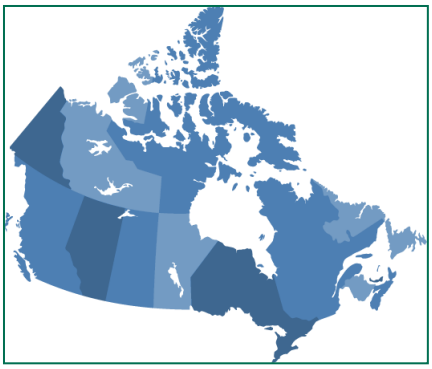
markets are typically more economically viable, and allow for a greater degree of minor contaminants than tire processing markets. In some cases, the facility removes the bead wire prior to incineration to recover the metals value.

Those in favor of using scrap tires for energy production point to a fuel that is cleaner, more efficient, and more environmentally-friendly than the mining, transportation, and use of coal. It has also been suggested that, if tires are not burned, other items will be burned anyway. Furthermore, processing scrap tires into crumb or small pieces requires energy resulting in considerable emissions. The use of whole tires as TDF requires very little additional energy to reclaim the entire energy value of the tire. Tires can also be burned for energy in co-generation plants, or facilities specifically built for energy recovery. In the case of chipped tire fuel for co-generation plants, while the product has value, there is also a cost to process the scrap tires prior to sending them to co-generation plants. There could be additional co-generation markets developed if proven economical.

Although the U.S. Environmental Protection Agency has approved scrap tires as a fuel substitute, an increasing number of stakeholders, including recyclers, are concerned that promoting tire-derived fuel decreases the potential to use scrap tires in higher-value applications. In addition, they argue, burning a tire loses the long-term value of the initial resource. Other barriers to the widespread use of TDF relate to regulatory and facility retrofit costs, as well as tire transportation costs. A significant cost is the "test burn" that is required to ensure that the facility can meet air quality standards. In addition, equipment installation and conversion costs that enable a facility to process scrap tires for fuel can be high. (Industrial boilers may or may not require significant adaptation to burn tires as an energy source, while electric arc furnaces do not require significant conversion costs.) For example, the cost for a cement kiln to drill a hole in the shaft/tube and install a conveyance or feed system to bring the tires from the ground level into the kiln is approximately $1.5 million per kiln. Further, costs are often significant to transport scrap tires to facilities that can burn them. In California, no state funding can be used to support TDF use because it has been determined to be a lower market priority by state officials.

## VI. TIRE MANAGEMENT IN CANADA

Each of the Canadian provinces has developed similar tire product stewardship programs, although there are regional variations (see Tables 3, 4, and 5 below). Each program includes a mandatory fee on new tires purchased, between $3 per tire (passenger tires in Quebec and Newfoundland) and $1,311 per tire (Giant Off-the-Road tires in Ontario, which are part of Ontario's program only).



Five programs are led by government: Quebec, Prince Edward Island, Nova Scotia, New Brunswick, and Newfoundland & Labrador. In these programs, the money is collected by government to pay for the cost of managing the scrap tires.

Four programs are operated by Producer Responsibility Organization (PROs):[16] British Columbia, Saskatchewan, Manitoba, and Ontario. All PROs in Canada are not-for-profit. Three are overseen by tire manufacturers, while one (Saskatchewan's voluntary Saskatchewan Scrap Tire Corporation) is overseen by a multi-stakeholder board. All of these programs charge a fee to cover the costs of scrap tire collection and recycling. Ontario's fees are charged to tire producers by Ontario Tire Stewardship. Tire producers decide whether to pass along these fees to consumers. The other programs charge a tire recycling or advanced disposal fee directly to consumers.

Alberta's tire recycling program is run by the Alberta Recycling Management Authority (ARMA), and is funded by the collection of an advanced disposal fee. ARMA is neither a government organization nor a PRO. Instead, it is considered a delegated authority run by a Board of Directors representing many stakeholder groups. Although it was created by government, it is not government-funded.

**Table 3: Breakdown of Provincial Tire Recycling Programs**

| Province | Program Manager | Board Composition | Fee Type |
|---|---|---|---|
| British Columbia | PRO – Tire Stewardship BC | Stewards | Eco-fee |
| Manitoba | PRO – Tire Stewardship Manitoba | Stewards | Eco-fee |
| Ontario | PRO – Ontario Tire Stewardship | Stewards | Eco-fee |
| Saskatchewan | PRO – Saskatchewan Scrap Tire Corporation (voluntary) | Multi-stakeholder | Eco-fee |
| Quebec | Government - Recyc-Quebec | Multi-stakeholder | Advanced Recycling Fee |
| Prince Edward Island | Government - Island Waste Management Corporation | Multi-stakeholder | Advanced Recycling Fee |
| Nova Scotia | Government - Resource Recovery Fund Board | Multi-stakeholder | Advanced Recycling Fee |
| New Brunswick | Government - Recycle New Brunswick | Multi-stakeholder, with industry advisory committee | Advanced Recycling Fee |
| Newfoundland/ Labrador | Government – Multi-Material Stewardship Board | Multi-stakeholder | Advanced Recycling Fee |
| Alberta | Delegated Authority (created by government, but no government funding) – Alberta Recycling Management Authority | Multi-stakeholder | Eco-fee |

**Table 4: Tires Included in Provincial Tire Recycling Programs in Canada**

| Province | Passenger Light Truck (PLT) | Medium Truck (MT) | Agricultural (Ag), Forklift | Small/Medium/Large Off-the Road | Giant Off-the-Road |
|---|---|---|---|---|---|
| Manitoba, Ontario, Prince Edward Island | X | X | X | X | X |
| British Columbia | X | X | X | | |
| Alberta, Saskatchewan | X | X | X | X | |
| Quebec, New Brunswick, Newfoundland/Labrador | X | X | | | |
| Nova Scotia | X | X | X | | |

### *Spotlight on Ontario*

The Used Tires Program in Ontario has been operating since September 1, 2009 and has collected over 70 million tires to date. Prior to the implementation of this program, the government charged a $5 "tire tax" between 1989 and 1993. The money collected was remitted to the government and placed in the general revenue. Between 1993 and 2009, retailers generally collected a disposal fee from consumers to cover the cost of removing scrap tires. A study conducted by the Rubber Association of Canada in 2006 found that the average disposal fee was $3 per tire.[17]

In 2008, the Government of Ontario directed Waste Diversion Ontario (WDO), a non-government corporation created by the Waste Diversion Act of 2002, to create a waste diversion program for scrap tires. WDO was directed to create the program with an "Industry Funding Organization" (IFO), in this case, Ontario Tire Stewardship (OTS), the board of which is comprised of tire "stewards" (i.e., brand owners,

manufacturers of tires, Original Equipment Manufacturers (OEM) of the vehicles on which tires are first sold , or first importers). In keeping with the principles of the Waste Diversion Act, the program was to be funded by tire stewards, and was to address the diversion of *all* motor vehicle tires, including "Off-the-Road" (OTR) tires. After a period of multi-stakeholder consultations, a proposed Used Tires Program Plan was submitted to the government for approval, and the Plan was approved in April 2009.

**Table 5: Scrap Tire Processors Located in Canada**

| Company | Location | Type of Processing |
|---|---|---|
| Lehigh Northwest Cement | British Columbia | TDF |
| Western Rubber Products Ltd | British Columbia | Crumb rubber, Mulch |
| Liberty Tire Recycling Canada (AB) Ltd | Alberta and Ontario | Shred, Crumb, Molded (AB), Mulch, TDF |
| Alberta Environmental Rubber Products | Alberta | Crumb |
| Cutting Edge Tire Recycling LP | Alberta | TDA |
| Shercom Industries | Saskatchewan | |
| OTR Recycling Inc | Manitoba | TDA, Fabricated (Snow plough blades, Water troughs) |
| Reliable Tire Recycling | Manitoba | TDA, Molded, Crumb, Blast mats, TDF |
| A1 Blasting Mats | Ontario | Blasting mats |
| Best Blasting Mats | Ontario | Blasting mats |
| CRM CO ULC | Ontario | Crumb, Mulch |
| Emterra Group | Ontario | Crumb |
| Ideal Rubber | Ontario | Crumb |
| Moose Creek Tire Recycling Inc/Animat | Ontario and Quebec | Rubber mats |
| National Rubber Technologies Corp | Ontario | |
| Presidium Equipment | Ontario | |
| Recycled Rubber Corporation | Ontario | |
| Ridge Recycling | Ontario | Crumb, Mulch, Shred |
| Rubber Ventures Corp | Ontario | Crumb, Mulch, Mats |
| Treadcraft/Eldan | Ontario | Crumb |
| Windsor Rubber Products | Ontario | Mulch, Parking curbs, Speed bumps |
| Dynamat | Quebec | Blasting mats |
| Lavokika | Quebec | Crumb |
| Les Industries Kancorp/ Div. Rubberplast | Quebec | Rubber flaps – Truck |
| Tire Recycling Atlantic Corporation | New Brunswick | Crumb, Mats, Mulch |
| Halifax C&D | Nova Scotia | TDA |
| Lafarge | Newfoundland and Labrador | TDF |

The Used Tires Program Plan includes five-year performance targets for accessibility, collection, and recycling. Note that the "burning" of any designated waste, including tires, is not considered diversion or counted towards diversion under the Act. In addition, Ontario does not have a tire disposal ban. The Used Tires Program Plan also includes promotion and education activities that OTS undertook in the first year of the program, and has remained an ongoing program component. OTS is required to provide WDO with quarterly and annual reports (with audited financial statements). WDO compares OTS's quarterly and annual performance against the targets found in the program plan. WDO is required to provide OTS's Annual Report to the Minister of Environment and Climate Change. Program roles and responsibilities are found below in Table 6.

Under the Waste Diversion Act, tire stewards operating in the Province of Ontario are responsible for remitting Tire Stewardship Fees (TSFs) to Ontario Tire Stewardship for each tire they supply into the Ontario marketplace. The first set of TSFs is included in the program plan. The current fee (until April 30,

2015) on a passenger light truck (PLT) tire is $5.43. This fee is calculated based on a combination of the cost to recycle PLT tires and the number of PLT tires supplied into the Ontario marketplace. Under Ontario's Used Tires Program, Ontario consumers may drop off scrap tires for free during normal business hours at one of the over 3,000 registered collection points across the province.

**Table 6: Ontario's Used Tires Program Roles & Responsibilities**

| Stakeholder | Roles and Responsibilities |
|---|---|
| Manufacturers | • Pay OTS to manage the tire collection and recycling program on their behalf<br>• Sit on the OTS Board |
| Ontario Tire Stewardship | • Manage day-to-day operations of the Program<br>• Support the development of markets for tire-derived products<br>• Educate tire stewards and the public<br>• Report to WDO on tire collection performance on a quarterly and annual basis |
| Waste Diversion Ontario | • Monitor program effectiveness and efficiency<br>• Report to Government of Ontario on Program performance<br>• Approve changes to Program operations (that are not considered "material")<br>• Help to resolve disputes and proactively manage program challenges |
| Government of Ontario (Ministry of the Environment and Climate Change) | • Decides the waste materials for which WDO is to develop a waste diversion program<br>• May establish policies applicable to WDO and direct WDO to conduct public consultations & report on any matter(s)<br>• Approves substantial ("material") changes to the Program<br>• Enforces the Waste Diversion Act and related regulations and rules |
| Service providers (collectors – including municipalities, haulers, processors, Recycled Product Manufacturers) | • Register with Program (and sign agreement)<br>• Report to Program on activities<br>• Manage material in accordance with the agreement and guidebooks provided |

The TSF charged on each tire supplied is directly related to the cost to manage the tires. OTS pays a collection allowance to tire collectors. OTS also pays processors both a transportation incentive and a processor incentive to haul and process tires. OTS provides a sliding scale of incentives to processors based on the Tire-Derived Product (TDP) they produce (i.e., the higher end the product, the more incentive the processor receives – e.g., crumb receives up to $264/tonne, while shred-only scrap receives up to $54/tonne). This is meant to drive production of higher value products. Ontario Recycled Product Manufacturers also receive a manufacturing incentive when they use TDP produced in the program in their products.

## VII. TIRE MANAGEMENT IN EUROPE

In Europe, 3.8 million tons of scrap tires were generated in 2012 with about 58 percent reused, retreaded, or recycled.[18] In addition, approximately 37 percent of these scrap tires were used for energy recovery and five percent landfilled or unknown (no documented evidence of tire destination).[19] According to the European Tyre and Rubber Manufacturers' Association (ETRMA), throughout the European Union (EU), each country has its own scrap tire management model dedicated to managing scrap tires. Today 19 countries operate an EPR based system and 14 end-of-life (ELT) management companies set up by tire manufacturers assist companies in meeting their responsibilities under the law.

Europe has enacted an "End-of-Life Vehicle Directive" which requires that tires be removed from the vehicles, stored appropriately, and also imposes recycling and recovery obligations. In addition, in the European Union (EU), whole tires were banned from landfills in 2003 and shredded tires were banned as

of 2006 pursuant to the EU Landfill Directive. Only bicycle tires and very large tires (outside diameter of more than 1400 mm, approximately 55 inches) are excluded from the landfill diversion obligation. These two regulations create the need for tire management systems. There are additional EU directives that promote EPR and application of a waste hierarchy (Waste Framework Directive) and that establish limits on the use of whole and shredded tires in cement kilns (EU Directive on Incineration of Waste).

According to ETRMA, 65 percent of the scrap tires in Europe were managed under a producer responsibility system in 2012.[20] Consumers are generally charged a collection and recovery fee when they purchase a new tire, usually through a separate, visible line item on the invoice. This fee has been observed to be decreasing over time. ETRMA has indicated that the producer responsibility model "is being progressively extended to most European countries."[21]

According to information from the World Business Council for Sustainable Development and ETRMA, European countries follow three basic systems:[22,23]

- **Free Market System**: The distributors deal directly with the recycler of their choice on a free market basis. This system requires the last holder of a tire to have responsibility for handling it. Free market systems are active in Austria, Germany, Ireland, Switzerland, and United Kingdom.
- **Government Responsibility Financed through a Tax System**: Under this system, producers pay a tax to the government, and the state is responsible for the overall organization and pays recyclers. A tax system is active in Croatia, Denmark, and the Slovak Republic.
- **Producer Responsibility System**: End of life tire (ELT) regulations mandate producer responsibility generally through a collective system (although self-compliance is also a possibility in ELT regulation but relatively uncommon in Europe). The law provides the legal framework and assigns responsibility to tire manufacturers and importers (producers) to organize the management of scrap tires. Producers generally contribute to a collective fund that finances collection, transportation, education/communication, recycling, and recovery. These systems are in place in Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Greece, Hungary, Italy, Lithuania, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden and Turkey.

Europe has increased the amount of tires recycled from approximately 11 percent in 1996 to 39 percent in 2012.[24] The main market for scrap tires in Europe is crumb rubber, which is converted into products such as rubber infill, tiles, horse arenas, and used in road applications. The use of rubberized asphalt has been hindered by political and economic factors (including the recent economic crisis), as road construction is a government responsibility. In France and Belgium, carbon from the tires is extracted for use in making steel. As in the United States, Europe has a healthy retread market for truck tires, but not for passenger car tires. Energy recovery was used to manage 37 percent of scrap tire generation in 2012.

Table 7 below outlines the various markets for European scrap tires and provides information on tire disposition in Europe for 2012 and 2002.

**Table 7: Used Tires Analysis in Europe[25]**

| | Tire Generation (000 Tonnes) | Reuse (%) | Export (%) | Retreading (%) | Material Recycling (%) | Energy Recovery (%) | Landfill & Unidentified (%) | Used Tire Recovery Rate (%) |
|---|---|---|---|---|---|---|---|---|
| 2012 | 3,418 | 4 | 6 | 9 | 39 | 37 | 5 | 95 |
| 2002 | 2,695 | 5 | 7 | 11 | 24 | 27 | 27 | 73 |

## VIII. POTENTIAL STRATEGIES RELATED TO PROJECT GOALS

**This section presents potential strategies related to the three project goals listed in Section I. The potential strategies described below were raised in response to PSI's 2014 surveys on scrap tire management problems and solutions, during PSI's 2014 and 2004 stakeholder interviews, during PSI's 2004 California tire stakeholder meeting, and/or during PSI's 2015 Connecticut tire stakeholder meeting. These potential strategies are presented for the purpose of engaging stakeholders in a productive discussion about how to enhance the management of scrap tires. These are not recommendations of PSI, and there is not consensus on these strategies.**

### *Goal 1: Reduce the Illegal Dumping of Scrap Tires*

Strategies to reduce the illegal dumping of scrap tires are considered here in four main areas: (1) improve collection and recycling infrastructure and performance; (2) increase consumer awareness and education related to tire generation and recycling; (3) provide consumer recycling incentives; and (4) address regulatory barriers and enforcement needs. In general, high rates of recycling require that a convenient collection infrastructure be in place (whether collection sites, curbside pick-up, or other), that targeted participants know how to recycle, and that they are motivated to recycle. The *easier* it is to recycle, the *more* recycling will take place.

#### *Improve Collection and Recycling Infrastructure and Performance*

The following strategies can potentially improve the collection infrastructure.

**Strategy #1: Increase consumer convenience.** Consumer convenience includes the number of collection sites per population size or geographic area, as well as the effectiveness of existing sites. The following options could help to achieve this strategy:

- **Encourage or require retailers to collect tires.**
- **Increase the number of municipal sites collecting tires.** This strategy could also help increase collections in rural areas where there are relatively few retailers.

**Strategy #2. Conduct research to determine which collection-based requirements are most effective.** For example, the impact of state or local retail collection requirements on program performance could be studied.

#### *Increase Consumer Awareness and Education*

**Strategy #1: Increase consumer education on the benefits of extended tire lifespan.** The purchase of longer life tires and increasing tire lifespan through tire maintenance, repair, and retread can reduce the scrap tire generation rate. Information about tire lifecycle costs and benefits could help encourage more consumers to invest in better quality, longer-lasting tires rather than purchase low-cost, shorter life tires. In addition, most consumers are unaware that tire maintenance (e.g., optimal tire pressure and proper wheel alignment) is related to increasing the life of their tires and could save them money. Education on tire maintenance could occur at retailers, municipal locations, auto repair shops, and through the media. A specific target for education on tire maintenance could be commercial fleets. Tire repair services can increase tire life. Proper maintenance of commercial or heavy-duty truck tires can

increase the ability and likelihood of retread. Retreaders need a good casing for effective retreading, which can only be achieved through proper maintenance in a tire's first life.

**Strategy #2: Provide consumer education on health, safety, and environmental risks of illegal dumping.** Public education on the public health dangers of illegally dumped scrap tires (e.g., mosquito-borne illness, rodents, and fire risk), as well as on reporting illegal tire dumping activities may help reduce illegal tire dumping. An effective outreach and education program will identify the target audience, develop a clear and simple message, use various methods to disseminate information, and solicit feedback on education efforts.

### *Provide Consumer Recycling Incentives*

Consumer incentives can fall into several categories: coupons or discounts, deposit/return programs, or bounties. The following strategies could be considered, or additional research conducted, to estimate program costs, impact on tire recycling, and viability (including manufacturers' willingness to implement):

**Strategy #1: Coupons.** Retailers and manufacturers typically offer coupons or other discounts to entice consumers to purchase a targeted product. This strategy could be applied to the purchase of new tires in exchange for a customer bringing in used tires to recycle.

**Strategy #2: Deposit/Return.** A deposit/return system could also be used to increase recycling of tires and reduce illegal dumping. Beverage container legislation and auto battery deposits (also called "core charges") have been successful at increasing recycling rates, although the deposit incentive and the program administration are added costs, and there is sensitivity to this being seen as a tax. Eleven states have beverage container laws, which are known to triple the rate of recycling for targeted products as compared to similar containers not covered in the legislation.

**Strategy #3: Bounty.** Bounty programs provide a cash incentive to a consumer upon the return of the target product. Two states (ME and VT) require thermostat manufacturers to pay a $5 bounty to heating and cooling contractors and homeowners for each mercury thermostat returned. These two states have the highest per capita thermostat collection rates in the country. Such a bounty program could be established for tires, although some stakeholders oppose bounties because they increase program cost, and some oppose bounties and deposits as an incentive to steal functional tires off of functional vehicles.

### *Address Regulatory Barriers and Enforcement Needs*

**Strategy #1: Improve scrap tire tracking while avoiding excessive increases in tire collection costs.** Tire manifest systems can help reduce illegal dumping and provide important data regarding the magnitude and flow of scrap tires. However, use of manifests can result in fewer haulers, difficulties finding a hauler to pick up scrap tires, problems of inadequate space at retail to store scrap tires, and increased costs of collection and government oversight. Streamlining manifest systems to reduce regulatory costs without compromising environmental protection can help address this issue. It is important to ensure that barriers to entry for haulers are not set too low. Reviewing and revising scrap tire management rules and regulations to be more conducive to smaller collectors, haulers, and processors could increase competition and decrease costs of tire management.

**Strategy #2: Ensure strong enforcement of existing and future tire laws.** Poor enforcement of anti-littering and anti-dumping laws can encourage illegal scrap tire dumping, especially in the face of tipping

fees for tire disposal. Whenever feasible, municipalities should be given authority to enforce the provisions of state law, which will provide added enforcement capability. They should also be given authority to develop, implement, and enforce regulatory requirements for retailers (e.g., storage under a roof and with security). Government audits of tire dealers are also a means to reducing illegal dumping. Penalties imposed by ordinances could include fines, incarceration, vehicle impoundment, cost recovery for site clean-up or security, liens on property, revocation of licenses or permits, and community service.

### *Goal 2: Attain the Highest Value Possible for Scrap Tires.*

Potential strategies to strive for the highest value possible for scrap tires (following the waste management hierarchy of reduce, reuse, retread, recycle, waste-to-energy/TDF, and proper disposal) while protecting human health and the environment fall into two categories: (1) increasing development of scrap tire markets; and (2) establishing program performance goals.

#### *Increase Development of Scrap Tire Markets*

**Strategy #1: Reduce lower end uses of scrap tires through incentives and disincentives.** Existing market challenges reduce the number of scrap tires going to higher end uses through retreading and recycling. Phased-in landfill bans, increasing landfill tipping fees, recycling incentives for retailers or haulers, and requirements for storage and marketing of tires before landfilling can help overcome this barrier to support of recycling markets. Use of scrap tires for TDF helps divert these materials from landfills as well. However, TDF falls second to last in the waste management hierarchy of reduce, reuse, recycle, waste-to-energy, and appropriate disposal. Higher and better uses of scrap tires should be sought.

**Strategy #2: Increase reuse and retreading.** Reuse refers to when a tire has been used once, but still has useful life and could be used again. Tires are most often reused and resold by retailers or dealers changing tires on a vehicle. Reuse also occurs by haulers who segregate and sell used tires to some tire dealers. Estimates of all tires disposed of at retail that could be reused vary, ranging from 2 percent to 10 percent of all incoming tires. While reuse of scrap tires can be more challenging than reuse of other products, there are some legitimate reuse opportunities that could impact the number of tires being landfilled. A separate market that offers even more opportunities to reduce waste exists for retread tires. Retreading refers to reusing a tire casing with a new tread applied to the tire surface and is most cost-effective and viable for large commercial truck tires. Retreads offer performance equal to a new tire at a lower cost. However, the relatively low cost of new tires versus that of used tires and retreads, in addition to the negative consumer perception of retread quality and safety, also provides a disincentive for reuse and retreading. Temporarily subsidizing the price of retreads to compete with new tires may help address this problem. Work needs to be done as well to reduce retailer liability concerns associated with reused and retread tires. Promoting use of retreads among government and commercial fleets can also help stimulate market development. Retreads are most common and practical in commercial fleets for large truck tires. There is a significant opportunity to increase retread use by county and city fleets, federal government fleets, as well as commercial fleets. Education could be accomplished through workshops, outreach, and targeted campaigns, including a model local government procurement strategy for retread tires. As mentioned previously, education on the maintenance of truck tires can help increase retreadability.

**Strategy #3: Increase crumb rubber markets.** When tires are processed cryogenically (frozen and broken) or ambiently (ground) to a small particle size, the finished product, crumb rubber, can be used in a variety of applications, from loose fill to molded products to rubberized asphalt. Crumb rubber markets currently struggle owing to the high cost of producing crumb and technological barriers. In order to develop long-term, diversified, and sustainable markets for crumb rubber, there need to be technological advancements, financial assistance, and education to overcome the barriers that exist today. Stakeholders also suggested that access to scrap tires is an issue, as well as difficulties competing with TDF, health concerns, and onerous product approval processes for government procurement. Potential strategies include promoting existing specifications for crumb rubber, increasing government and business purchase of tire-derived products, overcoming perception related to inferior quality of recycled content tires, R&D strategies to overcome technical barriers to using crumb rubber as a raw material, temporarily subsidizing the price of crumb rubber to compete with virgin rubber, and providing equipment grants and marketing assistance for crumb rubber manufacture. Furthermore, it was suggested that studies be conducted by unbiased researchers to better understand risks to public health from crumb rubber use in playgrounds and turf fields.

**Strategy #4: Increase the percentage of recycled content in new tires.** Today, the tire industry uses between .05 and 5 percent recycled content in new tire manufacturing (although some tires do not contain any recycled content). According to a 2003 report commissioned by the CIWMB on recycled content, it is technically feasible for manufacturers of tires to use as much as 10 to 15 percent recycled content, although there is a debate as to the impact that adding any amount of recycled content has on tire longevity and performance. Tire manufacturers, however, do not agree that it is technically feasible to use 10-15 percent recycled rubber in new tires. The goal would be to increase recycled content in tires without compromising performance and safety, and without causing tires to degrade and enter the waste stream earlier. Through technological advancements and financial assistance, and by overcoming public perception of product inferiority, there could be opportunities for greater recycled content in new tire manufacturing. Potential strategies include conducting research on technologies to increase recycled content in tires, provide financial incentives to increase demand for recycled rubber, develop recycled-content tire procurement specifications along with a strategy for procurement of recycled-content tires and molded products, and provide incentives to manufacturers to use recycled content.

**Strategy #5: Develop sustainable and diversified rubberized asphalt concrete (RAC) markets.** The states of Arizona, California, and Florida successfully use rubberized asphalt pavement for many road-paving projects. However, RAC use has often faced barriers regarding a perception of higher cost and lower performance. California's Department of Transportation (CalTrans) developed an internal goal, which it has exceeded, of using RAC on 15 percent of all its flexible pavement projects. There is great potential to increase RAC use within state and county highway departments, and among asphalt contractors through education, financial assistance, use of existing specifications, and technological advancements. Potential strategies include: (1) promoting the use of existing standardized asphalt mix designs and paving standards for RAC; (2) training and educating state and local highway engineers, and others on rubberized asphalt use, costs, and benefits; (3) gaining acceptance of RAC use by promoting successes to convince those who are skeptical about practicality of using RAC; (4) requiring those

receiving state funding to purchase tire-derived tire rubber; (5) developing infrastructure and logistics for material delivery at jobsites; and (6) evaluating RAC market potential and funding.

**Strategy #6: Increase the civil engineering applications for shredded tires.** Shredded tires can be substituted for traditional civil engineering materials, such as aggregate or stone, and as a lightweight fill material. There are existing ASTM standards for the use of shredded tires in many civil engineering applications, including road base, embankments, landfill drainage, and landfill cover. Owing to past problems associated with using scrap tires in these applications, there is some reluctance to use shredded tires today. In addition, some have expressed a concern about the reuse or recyclability of shredded tires after their use in civil engineering applications, and whether they eventually become landfilled. Through local and state government education and use of standard specifications, these barriers may be able to be overcome. Additional strategies will be needed to address the "after use" issue. Potential strategies include providing education and information on benefits of using scrap tire shreds in landfill applications, educating transportation officials about ASTM specifications for tire shreds, allowing for, and promoting, waste tire use in local septic fields/drainage through local ordinances and state rule, and educating about specifications to increase the use of tires in road base.

**Strategy #7: Develop sustainable and diversified recreation markets.** Loose fill crumb rubber can be used in a variety of applications for recreation and outdoor use, such as playgrounds, running tracks, sports fields, horse arenas, golf courses, and walking trails. However, public health concerns over the use of crumb rubber in these markets has hindered their potential. Some states have implemented grant programs to help encourage the use of the crumb rubber in recreation application. Yet, there are still limited markets and questions as to what it will take for this market to be sustainable so that subsidies can be eliminated. Through public education, grants, marketing, and other avenues, stakeholders could build more sustainable markets for recreational use of scrap tires. Potential strategies can include: (1) developing a focused market development plan for recreational uses and assistance to manufacturers of crumb rubber to market their products to parks departments, schools, and daycare centers; (2) promote benefits of crumbed and chipped rubber over traditional materials used in sports fields, playgrounds, horse arenas, golf courses, walking trails and as mulch; and (3) having a public forum discussion about possible health risks associated with crumb rubber use in recreation markets.

**Strategy #8: Develop other sustainable and diversified markets for tire-derived products.** While crumb rubber, RAC, and shredded tires have been used in various applications, there are other emerging recycling technologies and tire-derived products that may have new markets beyond those discussed above.

**Strategy #9: Provide government support of market development.** Government support for scrap tire markets can help accelerate market development. These initiatives could include the following: marketing assistance to tire-derived product manufacturers; increased government purchase of tire-derived products (including crumb rubber in state highway pavement); developing product specifications with manufacturers to get products to market; adopting product specifications (including those developed by standard-setting organizations) to advance procurement of tire-derived products; streamlining product approval processes for government procurement; and use of government funds for R&D of end use markets.

**Strategy #10: Conduct a Life Cycle Market Assessment.** Developing a life cycle assessment of all the tire markets to help prioritize efforts and funding. Such a study could enlighten participants about the true

costs and benefits of each market opportunity, and would be a useful tool with which to engage stakeholders in objective discussions. There is a need to develop sustainable markets that are not continually subsidized financially.

### *Establish Performance Metrics for Program Success*

Developing and establishing program success performance metrics for recycling and reuse are an important component of any strategy to encourage progress towards a goal of higher and better uses of scrap tires. Despite inherent challenges, it is important for policy makers and program operators to know how tire collection and recycling programs are performing, including the overall environmental benefits gained, program cost, and how program changes (such as increasing the number of collection sites, or a new promotional campaign) impact program performance.

**Strategy #1: Set measurable goals for market development and tire diversion from landfill disposal and waste-to-energy/TDF.** Setting goals for the amount of tires that should be diverted from disposal and TDF or into different market development efforts could help focus priorities (e.g., divert 70% of newly generated scrap tires to reuse or recycling by a given year). Setting short- and long-term goals for reuse, retread, recycling, and reduced disposal of scrap tires can draw attention to the need to develop new markets and to prioritize market development activities, as well as allowing for a dynamic vision for tire management that does not lock into a single approach. Market opportunities can be prioritized and grant funding allocated based on evaluative criteria. This work should be accomplished with agreed upon timelines and a method for monitoring the progress towards meeting the goals.

**Strategy #2: Conduct life cycle assessment and comparison among different market opportunities.** Stakeholders expressed interest in the development of a life cycle assessment across all markets as a way to compare life cycle costs and benefits of the different market development options. By evaluating markets based on objective criteria, funding strategies could be better prioritized.

**Strategy #3: Evaluate regulatory barriers.** As an example, defining "scrap tires" by statute may set up the perception of a waste material and not a valuable or potentially valuable market commodity. In addition to this statutory barrier to market development, there could be other regulatory barriers that inhibit market opportunities. States could evaluate these regulatory barriers by market and address those that negatively impact tire recycling.

### *Goal 3: Provide Adequate and Sustainable Funding to Reduce Illegal Dumping and for Higher and Better Use of Scrap Tires.*

Today, 37 states have a per tire fee that is collected at the point of retail from consumers on each new tire purchased. That fee funds the state's tire programs, although in some cases funds are diverted into the state's general fund. Having a sustainable funding source will be critical to the success of any statewide tire collection and processing program, and keeping costs low will require the active involvement of all stakeholders. However, the goal of funding should be to provide the market stimulus necessary for scrap tires to have value at the end of their life and that

tire markets be able to sustain themselves. Some states have sunset their tire fees before that sustainable dynamic has occurred and often had new illegal tire piles form with no funding source for proper management.

**Strategy #1: Develop a third party stewardship organization (SO) that can provide cost-effective system management.** A stewardship organization (SO), composed primarily of tire industry officials, with a multi-stakeholder advisory panel could manage the tire infrastructure system, market development projects, and other critical initiatives. The SO could also function as the fund manager, keeping government out of fund collection and distribution. Government could maintain its planning and enforcement role and set overall system goals. Having a third party organization manage the fund could ensure that tire fees are not raided to meet state general fund needs. For states with existing government-managed fee-based systems, research would be needed to determine how an SO could be integrated into the existing system. It is possible that an SO could serve a function other than collecting and distributing fees, such as on education, contracting for collection and recycling services, and other tasks. In other product stewardship initiatives, a third party organization oversees all funding and programs and helps set, meet, and evaluate goals. Whether led by the state or an independent organization, evaluating the fee on a regular basis and setting and working towards reaching goals will ensure that adequate funding is available and spent to meet predetermined goals for scrap tire diversion from landfills.

**Strategy #2: Distribute funding according to negotiated priorities.** Funds could be distributed based on a negotiated agreement among stakeholders representative of the key interest groups in a state. Funding would follow priority strategies agreed to as part of this dialogue process. This could be done in conjunction with a life cycle market assessment. Such a mechanism could lead to greater commitment from stakeholders to a full package of options rather than staying focused on their own particular interests. The goal of the funding strategies would be to work towards a sustainable tire infrastructure, and fund program priorities set by the state and other participants in the context of this tire stewardship dialogue process. Stakeholders would need to develop a process for updating priorities and evaluating projects and funding allocations. The SO could play a critical role in this process.

### *Further Research to be Considered*

Further understanding of the issues related to managing scrap tires may be advanced by considering the following:

- Obtain better data on scrap tire management and flow, including illegal dumping.
- Developing a life cycle assessment of all the tire markets to help prioritize market development efforts and funding.
- Conducting additional research on how and whether the chemical composition of the tire impacts tire markets, and whether strategies exist to remove this potential barrier.
- How stewardship organizations could be integrated into existing government-run fee programs in the U.S.
- Distinguishing what the tire fees fund in the U.S. versus what they cover in Canada.
- Determining whether Canadian markets impact tire markets in the U.S.
- Confirming reuse numbers nationally.
- Better understanding the potential for post-consumer recycled rubber to be incorporated into new tires without dramatically impacting tire performance and safety.

## Endnotes

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[2] Rubber Manufacturers' Association, 2013 U.S. Scrap Tire Management Summary, November 2014.

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[4] *Tire Business, a Crain publication, North American Tire Market Data Book: Tire Facts, February 17, 2014.*

[5] Rubber Manufacturers' Association, 2013 U.S. Scrap Tire Management Summary, November 2014.

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[12] Rubber Manufacturers' Association, 2013 U.S. Scrap Tire Management Summary, November 2014.

[13] Rubber Manufacturers' Association, 2013 U.S. Scrap Tire Management Summary, November 2014.

[14] Rubber Manufacturers' Association, 2013 U.S. Scrap Tire Management Summary, November 2014.

[15] Email communication with John Sheerin, Rubber Manufacturers' Association, January 12, 2015

[16] Producer Responsibility Organization (PRO) is the more commonly used term for stewardship organization in Canada, which also uses Industry Funded Organization (IFO) as well. These terms all mean virtually the same thing – a non-profit organization comprised entirely, or mostly, of producers that fund and manage a government mandated EPR program to fulfill the legal obligations of multiple producers.

[17] Desrosiers Automotive Consultants, Inc., 2006 "Mystery Shopper" Study prepared for the Rubber Association of Canada, May 1, 2006.

[18] Email communication with Jean-Pierre Taverne, European Tyre and Rubber Manufacturers' Association, 2013-10-02_ELT data 2012_Final, January 13, 2015.

[19] Email communication with Jean-Pierre Taverne, European Tyre and Rubber Manufacturers' Association, 2013-10-02_ELT data 2012_Final, January 13, 2015.

[20] European Tyre and Rubber Manufacturers' Association, End of Life Tyres Management in Europe presentation, provided by Jean-Pierre Taverne, January 13, 2015.

[21] *European Tyre and Rubber Manufacturers' Association (ETRMA), Position on the treatment of ELTs from End of Life Vehicles, May 30, 2012.*

[22] *World Business Council for Sustainable Development, Managing End of Life Tires: Full Report, November 2008.*

[23] *European Tyre and Rubber Industry, Statistics: Edition 2014, N.6.*

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[25] European Tyre and Rubber Manufacturers' Association, January 2015.

## IX. APPENDIX A

# PRODUCT STEWARDSHIP AND EXTENDED PRODUCER RESPONSIBILITY: DEFINITIONS AND PRINCIPLES

**Reducing Economic, Environmental, Health, and Safety Impacts from Consumer Products**
**March 21, 2012**

The growing product stewardship movement in the United States seeks to ensure that those who design, manufacture, sell, and use consumer products take responsibility for reducing negative impacts to the economy, environment, public health, and worker safety. These impacts can occur throughout the lifecycle of a product and its packaging, and are associated with energy and materials consumption; waste generation; toxic substances; greenhouse gases; and other air and water emissions. In a product stewardship approach, manufacturers that design products and specify packaging have the greatest ability, and therefore greatest responsibility, to reduce these impacts by attempting to incorporate the full lifecycle costs into the cost of doing business.

The terms product stewardship and extended producer responsibility (EPR) are often used differently by stakeholders involved in the product stewardship movement. The purpose of this document is to harmonize terminology in the U.S. and to guide development of policies, legislation, and other initiatives by governments, companies, and other organizations. By speaking the same language, we can have a constructive public discussion.

We use the following definitions for product stewardship and EPR. Since we define EPR as a legislative approach, we believe it requires further clarification and therefore developed the subsequent *Principles of Extended Producer Responsibility*.

**Product Stewardship** is the act of minimizing health, safety, environmental and social impacts, and maximizing economic benefits of a product and its packaging throughout all lifecycle stages. The producer of the product has the greatest ability to minimize adverse impacts, but other stakeholders, such as suppliers, retailers, and consumers, also play a role. Stewardship can be either voluntary or required by law.

**Extended Producer Responsibility (EPR)** is a mandatory type of product stewardship that includes, at a minimum, the requirement that the producer's responsibility for their product extends to post-consumer management of that product and its packaging. There are two related features of EPR policy: (1) shifting financial and management responsibility, with government oversight, upstream to the producer and away from the public sector; and (2) providing incentives to producers to incorporate environmental considerations into the design of their products and packaging.

**PRINCIPLES OF EXTENDED PRODUCER RESPONSIBILITY**

The following EPR Principles include key elements that should be included in all EPR legislation. Although these Principles will be applied differently by different jurisdictions, they are aspirational and considered best practice to achieve maximum results.

- **Producer Responsibility**
    - Producers are required to design, manage, and finance programs for end-of-life management of their products and packaging as a condition of sale. These programs may or may not use existing collection and processing infrastructure. Programs should cover all products in a given category, including those from companies no longer in business and from companies that cannot be identified.
- **Level Playing Field**
    - All producers within a particular product category have the same requirements, whether they choose to meet them individually or jointly with other producers.
- **Results-based**
    - Producers have flexibility to design the product management system to meet the performance goals established by government, with minimum government involvement.
    - Producer-managed systems must follow the resource conservation hierarchy of reduce, reuse, recycle, and beneficially use, as appropriate.
    - Products must be managed in a manner that is protective of human health and the environment.
    - Producers design and implement public education programs to ensure achievement of performance goals and standards established by government.
    - All consumers have convenient access to collection opportunities without charge.
- **Transparency and Accountability**
    - Government is responsible for ensuring that producer programs are transparent and accountable to the public.
    - Producer programs, including their development and the fate of products managed, provide opportunity for input by all stakeholders.
- **Roles for Government, Retailers and Consumers**
    - Government is responsible for ensuring a level playing field for all parties in the product value chain to maintain a competitive marketplace with open access to all, for setting and enforcing performance goals and standards, for supporting industry programs through procurement, and for helping educate the public.
    - Retailers only sell brands within a covered product category that are made by producers participating in an industry program, and are responsible for providing information to consumers on how to access the programs.
    - Consumers have a responsibility to reduce waste, reuse products, use take-back and other collection programs, and make appropriate purchasing decisions based on available information about product impacts and benefits.