

# Scrap Tire Derived Fuel: Markets and Issues

**John Serumgard**  
**Scrap Tire Management Council**  
**Washington D.C. 20005**

## MARKETS FOR SCRAP TIRES

In the past few years, the scrap tire market has been characterized by a number of factors. The first is the increasing volume of scrap tires being generated in the United States. This is due to a number of factors, including the increasing number of vehicles on the road, the increasing number of miles driven, and the increasing number of vehicles that are scrapped. The second factor is the increasing demand for scrap tires as a source of energy. This is due to the fact that scrap tires can be used as a source of energy in a number of ways, including as a fuel for power plants, as a fuel for industrial processes, and as a fuel for residential heating.

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## INTRODUCTION

More than 250 million scrap tires are generated annually in the United States and their proper management continues to be a solid waste management concern. Sound markets for scrap tires are growing and are consuming an ever increasing percentage of annual generation, with market capacity reaching more than 75 % of annual generation in 1996. Of the three major markets - fuel, civil engineering applications, and ground rubber markets - the use of tires as a fuel is by far the largest market. The major fuel users include cement kilns, pulp and paper mills, electrical generation facilities, and some industrial facilities. Current issues that may impact the tire fuel market include continued public concern over the use of tires as fuel, the new EPA PM 2.5 standard, possible additional Clean Air Act emissions standards, access to adequate supplies of scrap tires, quality of processed tire derived fuel, and the possibility of creating a commodity market through the development of ASTM TDF standards.

Scrap Tires are an ubiquitous by-product of contemporary social and economic society. Our personal mobility is almost entirely dependent on the pneumatic tire, whether in automobiles, buses or even airplanes. The transport and delivery of most goods is also dependent on the pneumatic tire. To recall an old slogan of the American Trucking Association, "If you got it, a truck brought it", and it goes without saying that the truck was riding on pneumatic tires.

Tremendous strides have been made over the last several years in both the durability and the longevity of tires. Auto tires routinely provide 40,000 mile or more of travel, almost four years of life for the average car, and many give 60,000, 80,000 or more miles of life. Medium truck tires, those used on the typical over the road semi-trailer, are heading toward a 500,000 life (with the advantage of one, two or more retreadings). Ultimately however, all tires reach the end of their useful lives as tires and then become a solid waste issue.

In the past there were many poor management practices routinely used for scrap tires, some of which resulted in adverse environmental impacts (and frankly we are still living with the some of those consequences). However, in the last few years much attention has been devoted both to imposing responsible restrictions on the handling of scrap tires and on the development of reuse, recycling and recovery markets for scrap tires. As with any other material being diverted from the solid waste stream, the development of alternative use markets is imperative to making diversion a success.

In 1990, as the Scrap Tire Management Council was being organized, the USEPA estimated the markets for scrap tires as being less than 11% of annual generation. After several years of growing scrap tire markets, the Scrap Tire Management Council estimates that as of the end of 1996, scrap tires markets had the capacity to consume over 75% of annual generation. This is a tremendous expansion of the sound markets for scrap tires and a real life success story for an industry that largely did not exist only seven years ago.

## **ABOUT THE SCRAP TIRE MANAGEMENT COUNCIL**

The Scrap Tire Management Council (STMC) is a non-profit advocacy organization, organized and supported by the North American tire manufacturing industry to be the spear-head of efforts to identify and promote environmentally and economically sound markets for scrap tires. The primary goal of the Council is to assist in the creation of market demand for 100 percent of the annually generated scrap tires in the United States. Based on current market demand and projected market growth, it is envisioned that this goal should be met by the turn of the century.

## **NATIONAL GENERATION RATES**

For the past two years, this country generated approximately 253 million scrap tires, or approximately one scrap tire per capita. This number should increase gradually to approximately 260 to 275 million by the turn of the century.

A question is often raised about the number of tires in stockpiles. As part of the 1994 market update, the Council undertook a survey of all state regulatory agencies to compile the most comprehensive listing of stockpile inventories. According to the data collected, the numbers suggest that there are approximately 700 to 850 million scrap tires in inventory. This is a far cry from the two to four billion number some sources including the United States Environmental Protection Agency have been using.

The significance of this finding is two fold. First, it places into perspective the actual dimensions of the stock pile situation. Second, those scrap tires in stock piles have only two market applications; as tire-derived fuel or in civil engineering applications. If the tires must be shredded, rough shred applications such as lightweight fill, would then become available for these tires.

## **MARKETS FOR SCRAP TIRES**

There are three major markets for scrap tires:

- Tire-derived fuel (TDF), including both whole tires and processed tires;
- Products (including those made from size-reduced rubber and stamped, punched or cut rubber products); and
- Civil engineering applications.

In addition there are other markets for tires, including:

- Export of good used tires and retreadable casings; and
- Agricultural and miscellaneous applications

Over the past six years the number of annually generated scrap tires having markets has increased from 11 percent (25 million units) in 1990, to 38 percent (95 million) in 1992 to almost 56 percent (138 million) in 1994. At the end of 1995, 69 percent (174 million) scrap tires were being sent to markets. And as of the end of 1996, STMC preliminary projections indicate that sound scrap tire markets have the capacity to consume more than 75 % of annually generated scrap tires, or more than 190 million scrap tires (Table 1). While this has been a very dynamic growth rate, current events suggest that it will be unlikely for a continuation of this rate of market expansion.

Table 1: Estimated Scrap Tire Market Capacity at January 1, 1997 (preliminary)  
(Millions of Tires)

Fuel	145.5
Products	
Cut, Punched, Stamped	8.0
Ground Rubber	10.0
Civil Engineering	10.0
Export	15.0
Agriculture & Miscellaneous	2.5
<b>TOTAL:</b>	<b>191.0</b>

Although the Scrap Tire Management Council (STMC) is predicting a slower rate of market growth, the STMC is confident that, ultimately, the market demand for 100 percent of the annually generated scrap tires will be developed.

At present, the markets for scrap tires include the following.

**Tire Derived Fuel** currently consumes 145.5 million scrap tires annually. Tire derived fuel includes both whole tires and processed, or cut up, tires. The principal market segments utilizing tire derived fuel include:

- cement kilns;
- pulp and paper mill boilers;
- utility boilers;
- industrial boilers; and
- dedicated scrap tire to energy facilities.

The newest market to develop is the use of tires in the metal industry, including foundry cupolas. The combined fuel market segment has the ultimate capacity to consume some 250 million scrap tires a year, or nearly all that are generated. The TDF requirements range from whole tires (i.e., as used in cement kilns or dedicated scrap tire to energy facilities), to rough shreds (i.e., as used in cement kilns & dedicated scrap tire to energy facilities) to 1" X 1" to 2" X 2" shreds (i.e., as used in pulp and paper mills, industrial and

utility boilers). The type of TDF necessary for any end-user will be a function of the type of combustion facility, the type of primary fuel used and, the feeding system used.

**Products** include products cut, punched or stamped from tire carcasses (usually only from bias ply tires), and products manufactured using ground crumb rubber produced from scrap tires and other scrap rubber. Cut, punched and stamped products include dock bumpers, heavy duty flooring, muffler hangers and various other industrial and consumer products. Ground rubber is produced by grinding up scrap tires and removing the steel and fiber. Other sources for ground rubber include factory scrap from both tire and non-tire rubber products manufacturing and the rubber buffing dust produced as a by-product of the tire retreading process. Ground rubber is used in some new rubber products such as mats, in asphalt rubber, in friction products, in products produced using a binding agent such as polyurethane, and in sports surfaces.

**Civil engineering** applications include the use of shredded tire material as light weight fill material, as leachate field material in on site septic systems, as alternate daily cover and in leachate layers and gas collection layers in landfill operating and construction, and in such constructions as artificial reefs and floating breakwaters. In these applications the tire derived materials substitute for the materials normally used and bring new engineering value to the application.

## **CHARACTERISTICS OF TIRE-DERIVED FUEL**

Eighty-eight (88) percent of the tire is composed of carbon and oxygen, which accounts for its rapid combustion and relatively high heating value. Tires contain approximately 14,500 - 15,000 BTU's per pound. This compares favorably to coal which, on the average, contain some 12,000 BTU's per pound. Subsequently, when substituting tire-derived fuel (TDF) for coal, a mill operator can reduce coal by 1.25 pounds for every pound of TDF used.

Tire-derived fuel is also a consistent material. Tires, regardless of where they were manufactured, or by whom, typically contain 1.2 - 1.5 percent (by weight) sulfur, 1.5 percent (by weight) zinc, less than one percent moisture, two and one half pounds of high grade steel per passenger car tire and a short list of trace metals. Tires are also very low in nitrogen, relative to other fossil fuels.

The consistent composition, and the relatively low quantities of certain constituents (i.e., sulfur, nitrogen) and the relatively high heating value of TDF are the primary reasons TDF can be used successfully in a wide array of combustion facilities. It is also the reason why TDF can have a positive impact on the emissions from these facilities.

## **CURRENT ISSUES AFFECTING THE TIRE FUEL MARKET**

Even as the use of tire derived fuel is expanding, there are issues that could complicate future expansion, or cause questioning of current uses. In addition, there are steps that can be taken to improve the climate and the market for tire derived fuel. Discussed below are several of these current issues.

### **Continued public concern over the use of tires as fuel**

Whenever a facility proposes to begin using tires or TDF as a supplemental fuel, it may encounter various levels of public concern or opposition. For example, some people may be concerned about black smoke or adverse odors while others may be concerned about possible harmful emissions. Yet another group may oppose the use of tires as fuel because it is not recycling or a higher value reuse.

For many people, the only experience they may have with burning tires is a TV news story about a major tire fire with raging flames and lots of smoke. Or they may have encountered an actual burning tire somewhere in their experience, and it probably wasn't all that pleasant. What they have seen or experienced is the products of incomplete combustion of tires. In fact, when tires are used in a properly controlled combustion environment, such as a fuel boiler or a cement kiln, they make an excellent fuel with no adverse smoke or emissions. And this conclusion has been reached by a number of responsible organizations, including the US EPA and the California Integrated Waste management Board, in a variety of published studies. Usually, the presentation of this evidence to the concerned public will help dampen their concerns.

Likewise there has developed a considerable body of emissions data from facilities that have gone through the fuel permitting process and conducted emissions tests. This data universally demonstrates that tires are generally a better and a cleaner fuel than coal, the fuel it normally replaces. Most facilities seeking to use tires as fuel will have to undergo their own air emissions testing as part of the permit modification process. Again, when this data is presented, reasonable people normally accept that TDF can be used safely in the facility seeking to use it. For those people concerned that using tires as fuel is not the highest value use for tires, the fact that these higher value markets may not exist in the local market area, or may be developing so slowly that they can not begin to consume large volumes of tires in the reasonably foreseeable future. In the meantime, markets are needed for tires.

With the expansion of the TDF market to more than 100 using facilities across the country, and about an equal number in the considering or testing process, the possibility of public opposition seeming more wide spread is apparent. It is to be hoped that continued presentation of the facts, and of sound data derived from emissions testing, will dissuade all but the most irrational opposition. Or in other words, that good science will offset shrill voices.

### The new EPA PM 2.5 standard

The US Environmental Protection Agency has recently issued a new proposed standard to regulate particulate emissions down to the 2.5 micron level. Many industries are deeply concerned about this proposed standard both because in their view there is little evidence of real hazard from particulate of this small size and because of the perceived difficulty in meeting it. To date, facilities using tires as fuel has been able to meet existing particulate standards. In fact, in many applications, the use of TDF fuel results in **reduced** particulate emissions when compared with the baseline fuel. It is to be hoped that this past experience suggests that the PM 2.5 proposed standard will not adversely affect the use of TDF. However, until we have some actual testing results, this will be an area of concern.

### Possible additional Clean Air Act emissions standards

The Clean Air Act of 1990 adds significantly to the range of substances that will eventually be subject to air emissions standards. Of course many of them will not be of any concern for tires. However, tires are composed largely of petrochemical based compounds and thus there may be compounds or substances that could possibly of concern. Until we know the standards which will have to be met, this issue will continue to be an area of concern for the use of TDF.

### Access to adequate supplies of scrap tires

It probably sounds somewhat implausible to discuss the issue of access to supplies of scrap tires when there are around 800 million in stockpiles and probably 60 to 70 million that are not currently going to markets. However, the economics of scrap tire markets limits the distance that tires or even tire derived fuel can be transported. Typically whole tires are limited to around a 150 mile transportation distance before the cost of transportation outweighs the value of the tires. Processed TDF can be transported a longer distance, but that distance is also a function of the value being placed on the TDF as reflected by the amount being paid for it. TDF markets also tend to develop in states where there is an effort being made to develop scrap tire markets. As a result, fuel users could find themselves being in a locally competitive market for tires, even as other parts of the country are finding difficulties in creating scrap tire markets. Some states have developed such a high level of market demand that they are importing scrap tires from other states (i.e. Connecticut, Maine, Illinois and South Dakota).

As for those stock piles, unless there is some funding available to clean them up and process them, either from the stock pile owner or a state agency, they won't make it to any market. The amount a fuel user would be willing to pay for the TDF normally would not be enough to remove tires from a stock pile and process them to the proper size. The economics of scrap tires generally requires both a front end tip fee, usually collected from the original owner of the scrap tire, and the price received when the final scrap tire derived product is sold. Many stock piles have been effectively abandoned by their owners, or the owners have no financial capacity to remediate their piles.

## Quality of processed Tire Derived Fuel

At present, there are more than 500 companies in the latest edition of the Scrap Tire Users Directory who claim to be producing tire derived fuel. It is likely that a significant number of those producers are not capable to producing a quality TDF product on a consistent basis. They can probably produce some good product when their shredder knives are new, and they are operating at a slow enough rate to allow reprocessing of out of spec product. But give them a few weeks or months on the knives, and a processing speed needed to keep up with their tire collections, and the product they are producing might be useful only for civil engineering uses. That would be fine, if that's where they were marketing their product. But some of them seek to market this product to fuel users that other producers may have developed, and the lure is of course price. If the fuel user changes suppliers and then finds that the quality of material being delivered is not up to specification, and is causing problems in the boiler, the user may just stop using TDF. In the long run, we believe that TDF suppliers able to consistently deliver quality product will be the ones who will survive in the market place. Unfortunately, in the meantime, the quality of TDF being supplied to the market will be an issue of concern.

This is not to imply that the fuel user is entirely without blame. It is the basic imperative of the tire fuel market that most fuel users' main motivation for using tires is economic—that is they are seeking reduced fuel costs by replacing a percentage of their basic fuel with TDF. Unfortunately some fuel users believe that they should receive all of the benefits of using TDF, that they should be entitled to squeeze the last cent out of their suppliers. This attitude can be initially productive for the fuel user, but if the TDF processor is not making enough to meet its costs, including maintenance and knife replacement needs, then the quality of the TDF will drop and the user will experience problems. The better scenario will be for the fuel user to be willing to pay a fair price for the TDF, one that will allow the TDF supplier to be competitive for tire supply and to operate in such a fashion as to be a consistent supplier of quality TDF.

## The development of ASTM TDF standards

Most every fuel product has a series of size and quality standards accepted by the fuel market place that allow the fuel product to be bought and sold as a commodity. At present, we do not have such a set of standards, accepted by both TDF suppliers and TDF users, that would allow TDF to be traded as a commodity. The Scrap Tire Management Council is taking an active leadership role is one major effort to develop such a set of standards, just as it has done with the ground rubber market. In the case of the TDF standards, the venue for this activity is the American Society for Testing and Materials (ASTM) and its D34.08 subcommittee. The D34 committee deals with waste management and the D34.08 subcommittee deals with thermal treatment. The STMC is working to develop a draft standard for this committee to consider, and to involve the TDF producer and user communities in this effort. If a standard can be developed, it is



hoped that it would become the basis for efforts to trade TDF as a commodity, such as on the Recyclables Exchange of the Chicago Board of Trade.

## CONCLUSION

All scrap tire markets are expanding, including the use of tire derived fuel. There may come a time when the use of tire as fuel begins to decline as other markets place a higher value on tires and their consumption begins to cut into the supply of tires available. However, this situation is likely to be several years off. In the mean time, the tire derived fuel market must be encouraged and promoted. A significant part of this effort will be to deal with the issues raised in this discussion that could potentially harm the scarp tire fuel market. Everyone interested in the markets for scrap tires should take an active part in the efforts to develop sound scientific information about scrap tire use, and to implement and expand scrap tire fuel markets in a responsible manner.

Advanced Thermal Processing Alternatives

for Tires

W. R. ...  
Camp ...  
10 ...  
Cambridge, MA 02138