

Lecture 12

Scrap Tires

Introduction



- Scrap tire generally refers to an inflatable rubber tubular covering encircling the wheel of a vehicle that has been thrown away because it is no longer suitable for its original intended use due to wear, damage or defect.
- It is often used interchangeably with the term 'waste tire' or 'end-of-life tire'.
- One passenger tire per person is discarded each year in developed countries.
- ~1.5 billion scrap tires are generated globally each year



Introduction



- An estimated 4 billion scrap tires are currently in landfills and stockpiles worldwide.
- Scrap tires are a resource that can be used in place of virgin materials reducing natural resource depletion.
- Can replace traditional fossil fuels and may reduce NO_x, SO_x and CO₂ emissions.
- Can also be used in civil construction projects as ground rubber, and as a substitute for coal in steel plants.
- Their recovery rate is > 84% for Europe, the US & Japan

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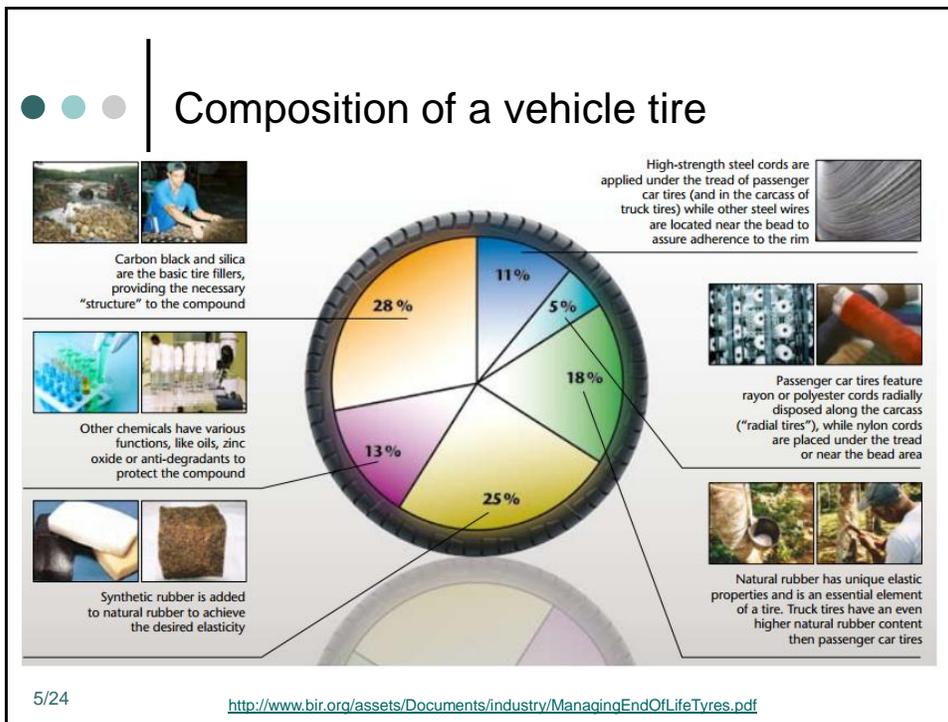


Introduction



- Scrap tires are composed of natural and manufactured synthetic rubbers, along with various additives such as:
 - Synthetic rubber
 - Petroleum waxes
 - Natural rubber
 - Pigments (zinc oxide, titanium dioxide)
 - Sulfur and sulfur compounds
 - Carbon black
 - Silica
 - Fatty acids
 - Phenolic resin
 - Inert materials
 - Oil (aromatic, naphthenic)
 - Steel wire
 - Fabric (polyester, nylon)

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Comparison of material composition

Material	Passenger car	Truck
Rubber /Elastomers	47%	45%
Carbon black*	21,5%	22%
Metal	16,5%	25%
Textile	5,5%	-
Zinc oxide	1%	2%
Sulfur	1%	1%
Additives	7,5%	5%

* Part of the carbon black may be replaced by silica in certain types of tires

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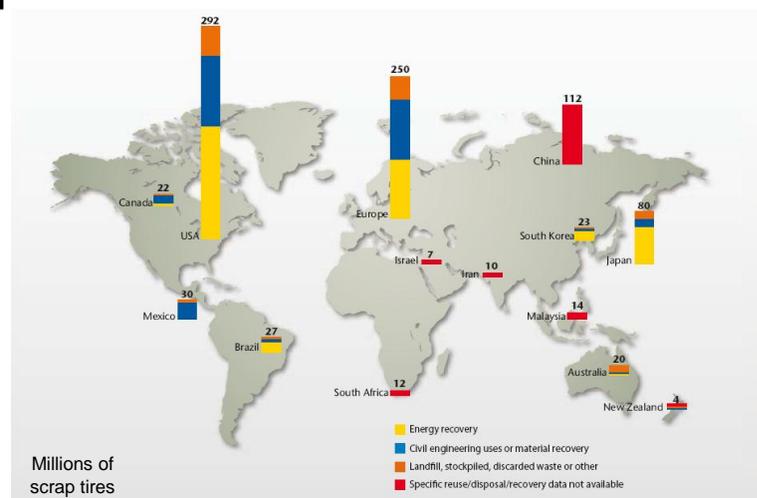
Environmental impact of a tire

- Almost all of the environmental impact of a tire occurs during the use phase, primarily as a result of vehicle fuel use and CO₂ emissions due to rolling resistance.
- Tire wear and road wear debris contribute to a lesser degree to the environmental impact of the use phase.
- Raw materials production and tire manufacturing account for the next greatest impact.
- While recovering and reprocessing scrap tires have a small environmental impact.
- Distribution (transportation) has a small impact.

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Scrap tires generated annually

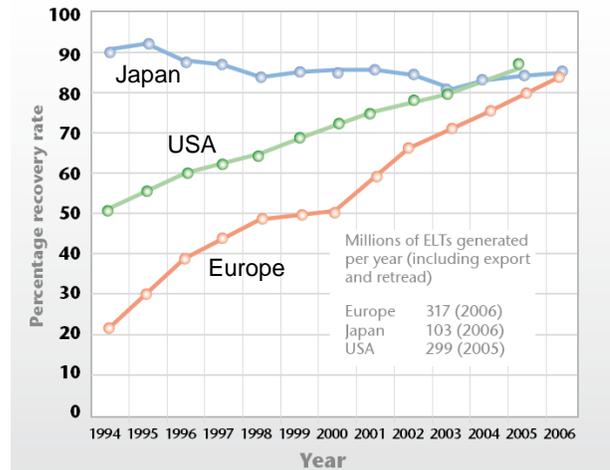


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Source: World Business Council for Sustainable Development, Managing End-of-Life Tires – Full Report, 2008



Recovery rate for scrap tires



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Source: World Business Council for Sustainable Development, Managing End-of-Life Tires – Full Report, 2008

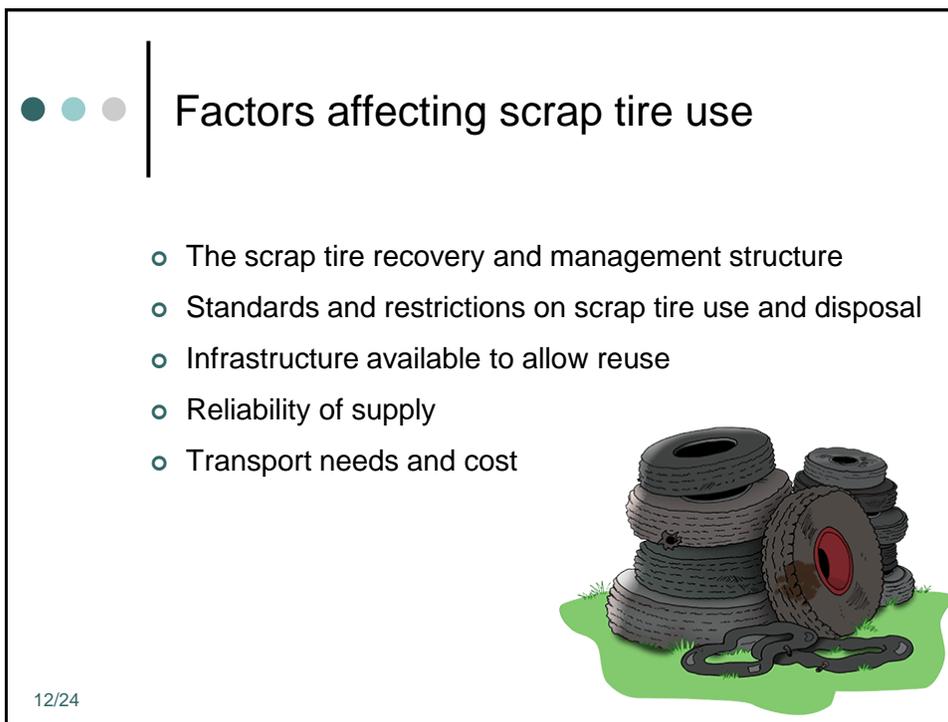


Scrap tires sources



- Scrap tires from cars and trucks can come from many sources, including:
 - Tire retailers
 - Car dealers
 - Auto equipment and auto parts stores
 - Tire wholesalers
 - Tire retread and repair shops
 - Taxi companies and rental car companies
 - Fleet owners, including the government
 - Auto salvage yards
 - Scrap tire stockpile cleanups

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Tire derived fuel (TDF)



- TDF, one of the leading options for scrap tires, is mainly used in cement kilns, but also in thermal power stations, pulp and paper mills, steel mills and industrial boilers.

Table. Scrap tire usage as tire derived fuel (TDF)

	Total ELTs (excluding export and retread)	TDF usage	Facilities with TDF utilization
Europe	250 million	41% (2006)	Cement kilns
Japan	80 million	70% (2006)	Cement kilns, paper mills, tire factories
US	292 million	53% (2005)	Cement kilns, paper/pulp mills, boilers

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Source: European Tire and Rubber Manufacturers' Association, End of life tyres - A valuable resource with growing potential - 2011 edition



Management Systems-EU

- In the EU, landfilling of scrap tires has been prohibited since 2006 following the European directive 1999/31/EC.
- By 2008, the European scrap tires recovery rate had reached an average of 95% across all 27 states.
- Today, 60% of the volume is managed under a Producer Responsibility system, promoted by the tire industry.
- This system endorses its benefits related to sustainability, efficiency and transparency for the consumers, the operators and the administration.

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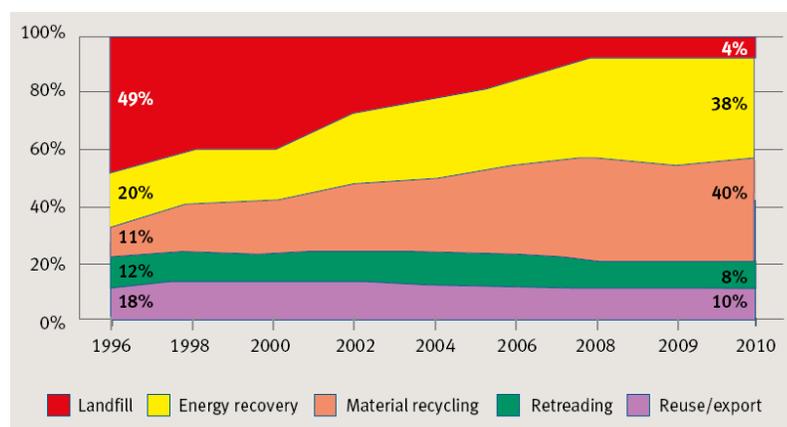
Management Systems-EU

- An environmental fee is charged to the consumers, usually through a separate line on the invoice and independently of the location of the collection point.
- It has been observed that this fee is decreasing overtime.
- Following the new waste framework directive (2008/98/EC), scrap tires-derived products will be studied according to certain criteria.
- They are recognized as a secondary raw material or an alternative energy source and may no longer be considered as a waste in the future.

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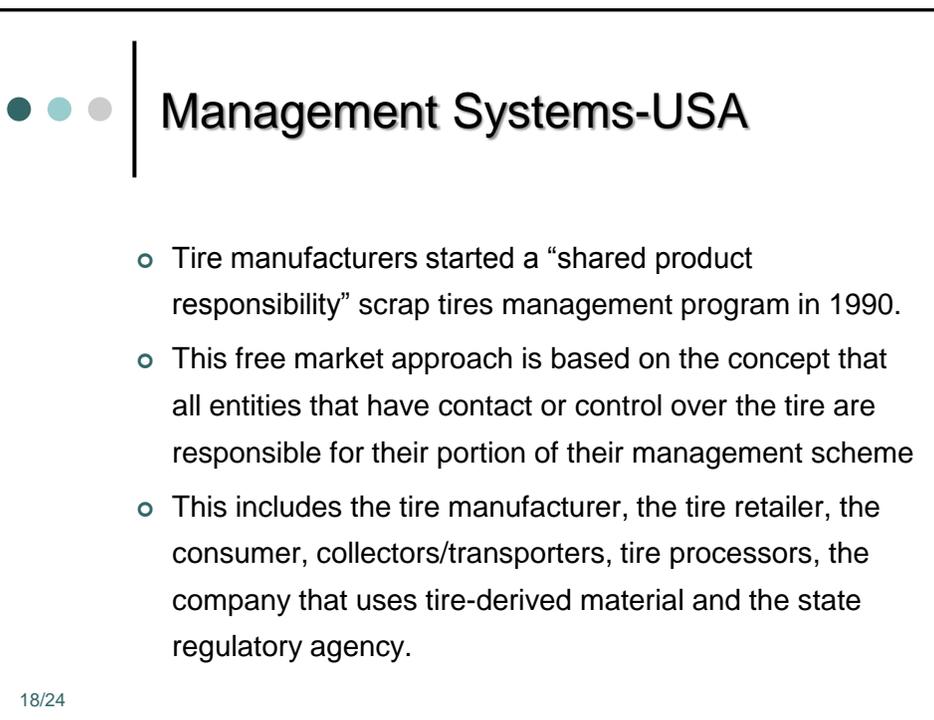
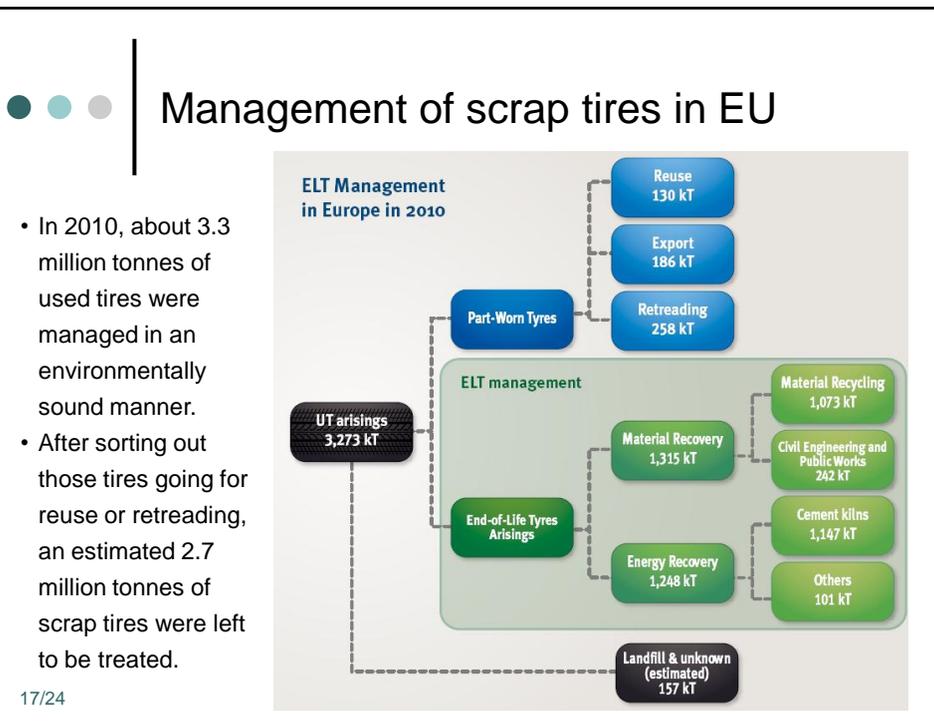


Recovery routes in EU



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Source: European Tire and Rubber Manufacturers' Association, End of life tyres - A valuable resource with growing potential - 2011 edition





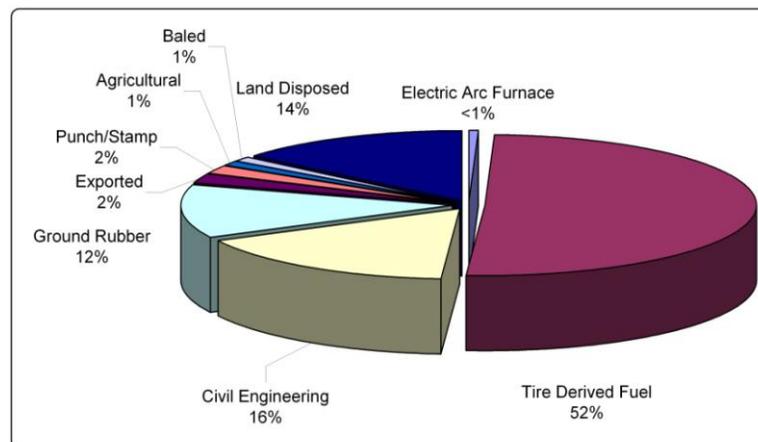
Management Systems-USA

- Scrap tires are not regulated by the federal government, but by individual US states.
- Many states conduct market development activities.
- States have played an integral role in providing funding and management to significantly reduce the number of scrap tires in stockpiles.
- In 1990, >1 billion tires were stockpiled across the US.
- Currently, <130 million scrap tires remain stockpiled.

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Scrap tire disposition in USA

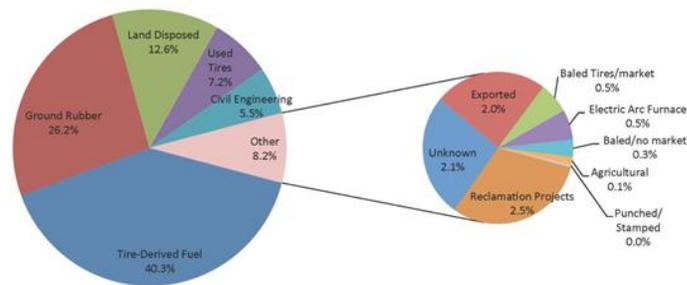


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Scrap tire disposition in USA



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Management Systems-Japan

- In the 1960s, scrap tires had a monetary value in Japan.
- Changed in the 1970s with increasing demand for tires and therefore more scrap tires being generated annually.
- Therefore in the mid-1970s, fees were levied on the collection of scrap tires.
- In the 1980s, increased energy demands boosted scrap tires demand, used as effective alternative fuels because of their high heat potential.
- From the 1990s to the year 2000, the demand of scrap tires has been affected by the changing oil price.

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Management Systems-Japan

- From 2001, the tire industry has begun strengthening tire disposal measures.
- They sought to cultivate large-scale and interregional users, including paper mills, gasification furnaces and biomass power reactors.
- Even in a country where the free market system is used for scrap tires, tire associations and the tire industry needs to cooperate closely to ensure high recovery rates required by governmental regulations.

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Videos-Animations

- Scrap Tires in Missouri
<http://www.youtube.com/watch?v=1W63sFWqTgg>
- Tyre Recycling
<http://www.youtube.com/watch?v=kRTw71dxvnl>
- The Stages of Tire Recycling
<http://www.youtube.com/watch?v=PJHD9teTfo0>
- Tire Recycling Equipment
<http://www.youtube.com/watch?v=0zlvxR-de1w>

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