

Annotated Bibliography on Mattress Reuse, Remanufacturing, and Recycling

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Allen, Gary L. “Method of Recycling Visco-Elastic Foam and Compressible Cushion Product Formed Thereby.” *United States Patent Application Publication* (2007). Google Scholar. Web. 24 March 2011.

<http://www.freepatentsonline.com/20070022905.pdf>.

Summary: This article gives a good background of visco-elastic (also known as “memory” or “viscofoam”) and how it came into being as a consumer product known as “Tempur-Pedic”. The author addresses recycling scrap visco-elastic product as pet bedding, but provides another proficient and successful use of this material. Allen proposes shredding memory foam into smaller pieces and mixing them with conventional foam of the same size (where the mixture is between 20% and 80% of memory foam) and recycling this new mixture into a liner for an inner cushion resulting in a new product. These new inner cushions can be shipped in a compressed state for reduced volume, and then upon arrival at a manufacturing facility, can be returned to their non-compressed state and inserted into an outer cushion cover for retail sales.

Boone, Arthur R. “Couches and Mattresses: The next recoverable?” *Resource Recycling* (1994): 47.

<http://www.p2pays.org/ref/06/05923.pdf>.

Summary: This article provides a general description of mattress components and the recycling potential of each part, such as steel, wood, foam, and cotton batting. Boone discusses the individual markets for each recyclable resource, and includes a useful table on the second page that shows the monetary profit from each market in terms of materials recovery per mattress. There is a brief description of the logistics involved in product dismantling, as well as basic information about current [1994] mattress and couch collection in the study area. Overall, dismantling is fairly simple and a single worker can process 30 mattresses per day, with steel and wood being the components with the highest rate of recovery and usefulness. Finally, Boone summarizes the economic feasibility of processing mattresses by addressing the problems of labor, fees, business costs, time, and general profitability.

Chang, Mei-Shiang, and Wei-Chih Yang. “Applying Harmony Search to the Bulky Waste Recycling Network Design Problem.” *Proceedings of the World Congress on Engineering* 3 (2010): 2280-2285. Web.

http://www.iaeng.org/publication/WCE2010/WCE2010_pp2280-2285.pdf.

Summary: This article is a technical analysis of bulky waste recycling network design that relies on the use of complicated algorithms. Although the writing is difficult to understand at times, due to a slight language barrier and translation imperfections, there are few paragraphs of information that may be useful. The introduction provides a brief description of bulky waste

disassembly and discusses a few general characteristics. There are also a few flow charts that display the inputs and outputs of other kinds of bulky waste, in addition to mattresses. In general, the focus of the article is on bulky waste recycling and only directly mentions mattresses a few times. Finally, the mathematical formulas and variables are confusing, but can be understood with time and concentration. However, the information provided in the algorithms is only useful to those seeking to improve bulky waste recovery in their area.

Guilfoil, John. M. "The Big, Bulky Truth about Beds." *The Environmental Magazine* 19.5 (2008): 44-45. EBSCOhost. Web. 20 April 2011.

[http://find.galegroup.com/gps/infomark.do?&contentSet=IAC- Documents&type=retrieve&tabID=T003&prodId=IPS&docId=A191392326&source=gale&srcp rod=ITOF&userGroupName=o0001&version=1.0](http://find.galegroup.com/gps/infomark.do?&contentSet=IAC-Documents&type=retrieve&tabID=T003&prodId=IPS&docId=A191392326&source=gale&srcp rod=ITOF&userGroupName=o0001&version=1.0).

Summary: Guilfoil focuses the article on how used mattresses are a problem in the landfill, that there are companies that will recycle used mattresses, and companies that have developed organic mattresses. The author states that used mattresses can fill up a landfill as well as leak unwanted chemicals into the landfill. There is a company in Massachusetts [Conigliaro Industries] that will recycle used mattresses in a process they developed that rips mattresses, box springs, and upholstered furniture apart. This method separates the fabric (cotton and other fibers), wood, polyurethane foam, and steel and also sorts the materials for recycling or for purchase by other companies that want the raw materials. Also mentioned in the article are companies that manufacture mattresses made of non-petroleum products. These natural and organic products include green tea, latex, and sustainable fibers such as cotton and wool.

Kallestad, June. "The Afterlife of a Mattress." *UMN NEWS*. 30 June 2008. MinnPost.com. Web. 7 June 2011.

http://www.minnpost.com/from_our_partners/2008/06/30/2407/umn_news_the_afterlife_of_a_mattress.

Summary: Online newspaper article that was edited from NRRI Now, a publication by the Natural Resources Research Institute. Some data is included as well as story from Duluth, Minnesota.

Lehmann, Steffen. "Resource Recovery and Materials Flow in the City: Zero Waste and Sustainable Consumption as Paradigms in Urban Development." *Sustainable Development Law & Policy* 11.1 (2010): 28-38. Web. 14 April 2011.

<http://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1450&context=sdlp>.

Summary: Lehmann discusses historical waste management methods and identifies the need for new ways of looking at the problem of disposal of trash in urban settings. The article describes the concept of "zero waste" and "closed-loop waste management systems" where energy is kept in the system, resources are used more efficiently, and there is less waste resulting in an end product that is "greener" and more sustainable. Used mattresses are a recyclable product that benefits by "extended producer responsibility" (EPR), also known as "product stewardship," where a manufacturer of a product takes accountability from its creation to its disposal. By

embracing product stewardship, the urban areas will become more sustainable by using their resources wisely and adopting different ways to recycle and reuse products and materials.

Nelles, Barbara. "Mattress recycling: Industry finding useful ways to dispose of used beds." *BedTimes*. Bed Times Magazine, February 2010.

<http://www.bedtimesmagazine.com/Articles/2010/February/MattressRecycling.html>.

Summary: Article discusses the effects of the recession [2010] on recycling markets for mattress components, the problems associated with program funding, examples of current recycling facilities, and positive consumer attitudes towards the process. Since lack of funding can be a problem when running facilities, many programs enact tipping fees of \$6 or \$15 to be paid by the person or company dropping off the mattress. Nelles writes how the recession has negatively impacted the mattress recycling system by lowering both the amount of mattresses received and the prices of scrap parts, thus slowing the momentum of the growth of mattress recycling. Article also highlights an increase in consumer concern about what happens to old mattresses and provides many examples of successful recycling mattress businesses, while comparing the efficiency of various existing and potential recycling processes. One example of a successful promotional program is ISPA Earth, a cradle-to-cradle sustainability initiative of the International Sleep Products Association, which has created the Mattress Disposal Task Force, researched different dismantling methods, and acknowledged the need to develop systems before states mandate costly and impractical options to mattress companies.

PPL Industries. Product Stewardship Institute. *Metro Mattress Recycling Program – Business Plan*. April 2008. Web. 8 June 2011.

http://productstewardship.us/associations/6596/files/metro_mattress_recycling_program_mn_2008.pdf.

Summary: PPL Industries has created a detailed business plan that covers many different aspects needed to establish a mattress recycling program. This article is a good example of how the factors affecting a program's feasibility are identified and addressed. PPL Industries notes the importance of providing job training and work education for its employees. In general, PPL's main goals are to develop new recycling programs in the area, locate markets for recoverable materials, and establish a sustainable work training level with education and social training. The plan includes a good description and graphics about mattress sources and pre-planned mattresses disposal destinations, as well as a table with statistics about mattress generation and potential materials recovery. Furthermore, it lists participating counties with a basic description of location and building design for the facilities. One particularly interesting aspect of the plan is the included budget proposal of required equipment and facility improvements, to be funded by surplus revenue and grants. This is followed by projections of the quantities of materials to be recovered from disassembly. The plan concludes with five year financial projections and a business risk assessment to address potential problems in manufacturing and development, as well as a short contingency plan describing how to maintain profitable production operations.

Rapoport, Irwin. "Mattress recycling in the United States growing." *American Recycler* (December 2007). Web.

<http://www.americanrecycler.com/1207/mattress.shtml>.

Summary: Rapoport's article focuses on general facts about mattress recycling within the United States. There are many statistics about general mattress recycling practices in the country accompanied by a comparison between states of a few existing programs. The article offers a good explanation of tipping fees and why it is necessary to charge for the drop-off and recycling of a mattress. A few photographs that depict mattresses being shredded and deconstructed for processing are featured within the text. Finally, Rapoport addresses some difficulties found in mattress disassembly, which leads to the mention of a few factors that drive the mattress recycling business. One example of such a factor is the inefficiency of sending mattresses to landfills due to their disproportionate amount of space taken up in the landfill compared to their disposal cost, otherwise described as the ratio of weight to volume.

Whistler, John et al (Mattress Disposal Task Force). International Sleep Products Association (ISPA). *Used Mattress Disposal and Component Recycling – Opportunities and Challenges*. 30 September 2004. Web.

<http://www.sleepproducts.org/Sustainability/docs/UsedMattressesDisposalReport.pdf>.

Summary: ISPA's Mattress Disposal Task Force created a detailed report analyzing different aspects of used mattress disposal and component recycling. The report begins with useful background statistics about the mattress industry as well as how the industry would benefit from commercially viable disposal programs. Additionally, the Task Force provides a list of initial conclusions, which address the value of recovered mattresses, the need to find a sustainable income source to supplement scrap revenue, the economic efficiency of recycling mattresses instead of putting them in landfills, the importance of location and security, and the challenge of preparing recovered scrap in saleable form. The list points out the need for a facility to receive consistent product volume in order for dismantling operations to be efficient and notes that low-tech dismantling could be more efficient than automated. The report also highlights the uncontrollable factors in mattress disposal facilities that are directly related to a facility's success or failure. The Task Force's main conclusions were to attempt to eliminate current obstacles to efficient disposal operations and to serve as a clearing house for information that others can use in setting up new efforts. The report further elaborates on these conclusions by providing useful information on collaboration suggestions, difficulties of current disposal processes, and information about mattress composition and the markets for recyclable materials. The end of the report provides a list of factors required for viable disposal operation and elaborates on energy recovery with an interesting comparison to European methods. After a brief analysis of efficiency and viability issues, the report establishes a plan of action for future steps towards creating a national mattress recycling requirement.

Zysman, Simon. "Manufacture of Rebuilt Mattresses and Foundations." *United States Patent Application Publication* (2009). Google Scholar. Web. 24 March 2011.

<http://www.FreePatentsOnline.com/y2009/0077784.pdf>.

Summary: This article describes the reuse of metal innersprings, cushioning, and covering materials from used mattresses and box springs in the rebuilding of another mattress of the same size (twin, double, queen, king). The optimal reused materials are those that are subjected to heating above 230°F for 90 minutes or longer before being dismantled and sorted according to

components such as cushioning, covering, and spring. These components are selected according to the regulatory requirements Regulation 16 CFR 1633 of the Flammable Fabrics Act to insure that reconstructed mattresses and box springs are flame retardant compliant. The spring components are packed flat, the cushioning and foam components are baled, and then they are both transported economically to a selected plant for reassembly.

Examples of Mattress Recycling Facilities:

<http://www.ohiomattressrecovery.com/>

<http://www.conigliaro.com/recycling/mattress.cfm>

<http://www.ninelivesmattressrecycling.com/>

<http://www.svdp.us/what-we-do/recycling-and-manufacturing/mattress-recycling/>

<http://www.nationwidemattressrecycling.com/>