

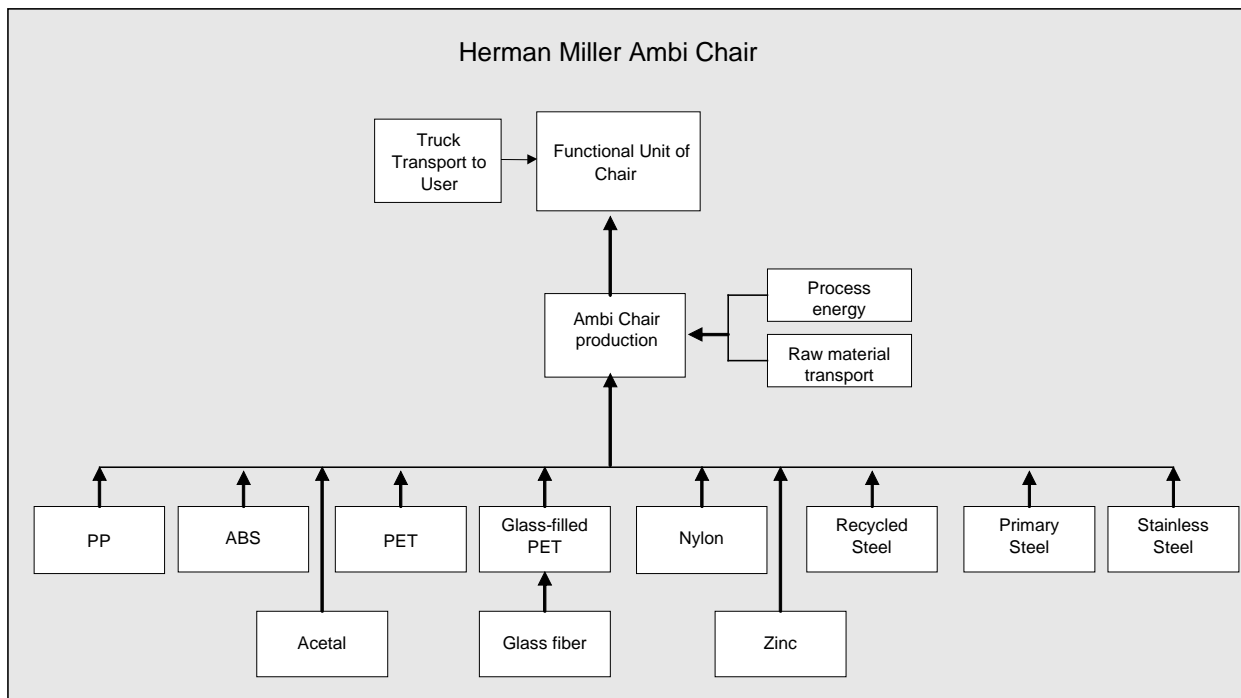
# Herman Miller Ambi and Generic Office Chairs

## Product Selection and Description

Herman Miller is a worldwide producer of office furniture systems, seating, and accessories; filing and storage products for business, home office, and healthcare environments; and residential furniture. The Herman Miller Ambi chair is typical of the industry average office chair, and is used in BEES to represent both itself and a generic office chair.

## Flow Diagram

The flow diagram below shows the major elements of the production of this product, as it is currently modeled for BEES.



*Figure 1: Herman Miller Ambi Chair System Boundaries*

## Raw Materials

The Herman Miller Ambi chair consists of more than 50 different components and subassemblies from more than 15 direct suppliers. The components and subassemblies are constructed from variations of three major materials: plastics, steel, and foams/fabrics. Approximately 20 % of the Ambi chair's weight is made up of recycled steel, polypropylene, nylon, and glass-filled nylon. The mixture of all the constituents in terms of their mass fractions is given in the Table below.

**Table 1: Herman Miller Ambi Chair Major Constituents**

| <b>Constituent</b>                              | <b>Description</b>   |
|---|--|
| Plastics (PP, PVC, nylon, glass-filled polymer) | 33 % for all plastics (24 % for seat shells, 9 % for knobs, levers, bushings, covers)            |
| Steel   | 63 % for tilt assembly and base; 2 % for nuts, bolts, other components                           |
| Foams/fabrics                                   | Less than 4 %; included in open-loop recycling systems   |
| Composite subassemblies                         | 3 % for five casters; 6.7 % for pneumatic cylinder; 6.3 % for moving components of tilt assembly |

Of the plastics and metals in the Ambi chair that are nonrenewable, over two-thirds are made from recycled materials and can be further recycled at end of life.

**Plastic components.** Roughly one-third of the Herman Miller Ambi chair, by weight, is made with polypropylene, PVC, nylon, and glass-filled nylons. The seat shells make up 24 % of the chair's weight. The seat shells, made of polypropylene, contain 10 % post-industrial recycled materials. The remaining plastic components are various knobs, levers, bushings, and covers. These single-material plastic components are identified with International Organisation for Standardization (ISO) recycling symbols and ASTM, International material designations to help channel them into the recycling stream. Data for each of these plastic components comes from American Chemistry Council 2006 data developed for submission to the U.S. LCI Database.

**Steel.** The tilt assembly and base, constituting approximately 63 % of the chair's weight, are largely made of steel stampings and screw-machined components. These steel components are 74 % of the tilt assembly by weight, or 50 % of the weight of the chair. The steel components in the tilt assembly are made from 28 % to 50 % recycled-content materials. The remaining steel materials (less than 2 % of the chair's mass) are nuts, bolts, and other components that require the high-strength properties of steel. The steel components of the Ambi chair can be segregated and entered into the recycling stream.

Production of primary and secondary steel is based on LCI data submitted by the American Iron and Steel Institute (AISI) and the International Iron and Steel Institute (IISI), which represents late 1990s worldwide steel production.

**Foam/Fabric.** Data on synthetic fibers and elastomers come from elements of the U.S. LCI Database and the SimaPro database. These materials are part of an open-loop system; they can be transformed into other products. For example, fabric scraps from Herman Miller's current production facilities are made into automobile headliners and other similar products. Foam scraps are used in carpet padding.

**Composite Subassemblies.** There are three composite subassemblies of multiple material types. They include five casters (3 % of the chair mass), a pneumatic cylinder (6.7 % of the chair mass), and the moving components of the tilt assembly (6.3 % of the chair mass). The pneumatic cylinder can be returned to the manufacturer for disassembly and recycling. All material production data is based on elements of the U.S. LCI Database and the SimaPro database.

## **Manufacturing**

Energy requirements and emissions from chair assembly are included in the model but not shared to protect company-specific confidential data. The energy used for processes that form materials into chair parts (plastic extrusion, steel rolling and stamping, etc.) is included in the product data for the raw materials acquisition life cycle stage.

## **Transportation**

Packaging materials for the Herman Miller Ambi chair include corrugated paper and a polyethylene plastic bag to protect the product from soiling and dust. Each of these materials is part of a closed-loop recycling system. As such, they are not included in the system boundaries. On larger shipments within North America, disposable packaging can be eliminated through use of reusable shipping blankets.

Transportation of the chair by heavy-duty truck to the building is modeled as a variable of the BEES system. Data on diesel trucking is based on the U.S. LCI Database.

## **Use**

The chair is designed for easy maintenance, with many replaceable components. For BEES, however, no parts replacement is assumed; instead, the entire chair is simply replaced at end of life (see End of Life section below).

The plastics in the chair are low-VOC emitting and most painted parts are powder-coated. The small amounts of foam and fabric are insignificant contributors of VOC.

## **End of Life**

The Herman Miller Ambi chair is designed to last at least 12.5 years under normal use conditions. Thus, the chair is assumed to be replaced three times over the 50-year BEES use period. As with all BEES products, life cycle environmental burdens from these replacements are included in the inventory data.

## **References**

### **Life Cycle Data**

National Renewable Energy Laboratory (NREL): *U.S. Life-Cycle Inventory Database*. 2005. Golden, CO.

Found at: <http://www.nrel.gov/lci/database>.

PRé Consultants: *SimaPro 6.0 LCA Software*. 2005. The Netherlands.

<http://www.hermanmiller.com>

## **Industry Contacts**

Gabe Wing, Herman Miller (2001)