Mohawk Carpet

Product Selection and Description

Mohawk Industries is the second-largest manufacturer of commercial and residential carpets and rugs in the United States and one of the largest carpet manufacturers in the world. Mohawk is involved in all aspects of carpet and rug production, from raw materials development to advanced tufting, weaving, and finishing. The company provided data on two broadloom carpets: Regents Row, a woven commercial carpet, and Meritage, a tufted commercial carpet.

Flow Diagram

The flow diagrams below show the major elements of the production of these products as they are currently modeled for BEES.

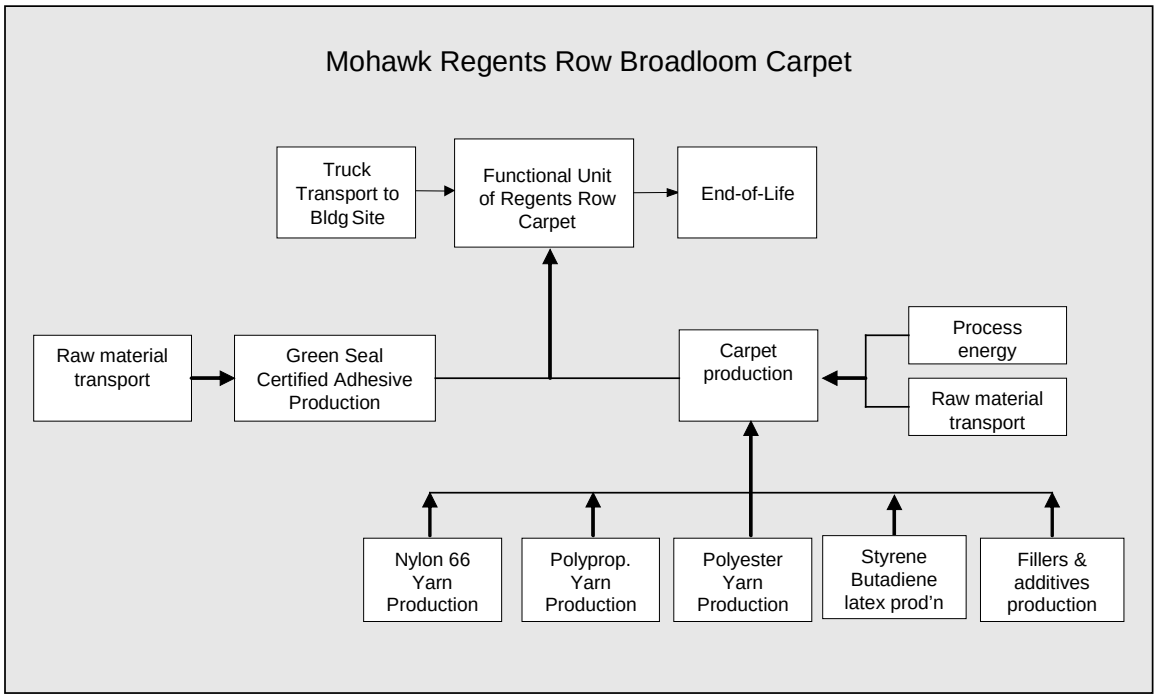

Figure 1: Mohawk Regents Row Broadloom Carpet System Boundaries

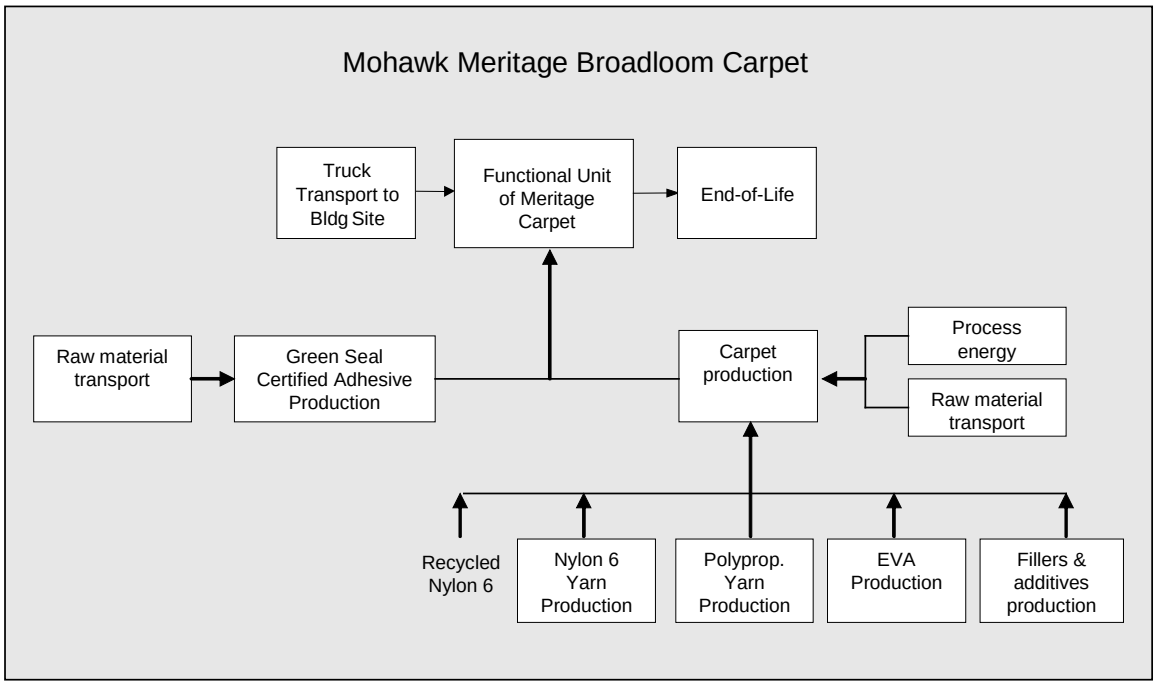

Figure 2: Mohawk Meritage Broadloom Carpet System Boundaries

Raw Materials

The two Mohawk carpets are produced from different materials and have different ratios of backing to yarn. The mixture of the main constituents of each carpet is listed in the Table below.

Table 1: Mohawk Broadloom Carpet Constituents

Constituent	***Regents Row Mass Fraction***	***Meritage Mass Fraction***
Yarn (nylon 6; 50 % recycled)	--	49 %
Yarn (nylon 6,6)	51 %	--
Backing	16 %	9 %
Precoat and other additives	33 %	42 %

The yarn for Regents Row carpet consists of woven nylon 6,6. Data for the production of virgin nylon 6,6 come from EcoInvent, whose data are based on those from Eco-profiles of the European plastics industry (PlasticsEurope). The yarn for Meritage carpet is 50/50 recycled-virgin nylon 6. The virgin nylon 6 is produced from the polymerization of caprolactam; these data, too, came from the PlasticsEurope Eco-profiles data for nylon 6 within the EcoInvent database. While producing the recycled nylon 6 is not accounted for, spinning it into yarn plus its transportation to the manufacturing site are included in the BEES model.

The backing for the Regents Row carpet is a 50/50 mix of polypropylene and polyester fibers. The Meritage carpet only uses polypropylene for the backing material. Data for these backing materials come from the Plastics Division of the American Chemistry Council.[1]

Since the Regents Row carpet is woven, the nylon yarn is back-coated with styrene butadiene latex to provide stability. For the Meritage carpet, Ethylene Vinyl Acetate (EVA) is used to adhere the backing to the tufted

[1] Franklin Associates for the Plastics Division of the American Chemistry Council: *Cradle-to-Gate Life Cycle Inventory of Nine Plastic Resins and Four Polyurethane Precursors* (Prairie Village, KS, 2010).

nylon. Life cycle inventory data for styrene and butadiene are taken from the Plastics Division of the American Chemistry Council, and EVA data come from EcoInvent. A majority of the "other additives" is limestone filler, whose data are based on the U.S. LCI Database. The remaining additives' production data are based on the U.S. LCI, EcoInvent, and SimaPro databases.

Manufacturing

Energy Requirements and Emissions. The manufacturing process for Mohawk Regents Row carpet consists of interlacing face yarns with backing yarns which are then coated with finish chemicals. This process requires both purchased electricity and natural gas. The production of each unit of Regents Row carpet (0.09 m^2, or 1 ft^2) requires 0.4 MJ (0.1 kWh) of electricity and 0.73 MJ (0.20 kWh) of natural gas. The manufacturing process for Meritage consists of tufting the nylon yarn into the backing foundation and coating the fabric with the EVA chemical system. This process requires 0.6 MJ (0.18 kWh) of electricity and 0.71 MJ (0.20 kWh) of natural gas per unit. All energy production and combustion data is based on the U.S. LCI Database.

Transportation. Transportation distances for shipment of the raw materials by diesel truck from the suppliers to the manufacturing plant are provided by Mohawk. Diesel trucking burdens are based on the U.S. LCI Database.

Transportation

The transportation distance from the Mohawk manufacturing plant in South Carolina or Georgia to the building site is modeled as a variable in BEES. Both products are shipped by diesel truck. The quantity of transportation emissions allocated to each product depends on the overall mass of the product, as given in the Table below.

Table 2: Mohawk Carpet Density

Product	***Mass per Applied Area in kg/m^2 (lb/ft^2)***	***Density in kg/ m^3 (lb/ft^3)***
Regents Row	2.34 (0.47)	336.67 (22.27)
Meritage	2.41 (0.48)	346.67 (22.93)

Installation

Both Mohawk carpets are installed using a low-VOC adhesive. The average application requires about 0.04 kg (0.09 lb) of adhesive per unit of carpet (0.09 m^2, or 1 ft^2). For both carpets, approximately 5 % of the carpet and adhesive is wasted during installation; this is incorporated into the BEES product models.

Use

All BEES nylon broadloom carpets are assumed to have lifetimes of 11 years. Thus, both Mohawk broadloom carpets are assumed to be replaced four 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.

End of Life

At end of life, it is assumed that the Mohawk products are sent to the landfill.

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.

EcoInvent Centre: *EcoInvent data v2.0* (Dübendorf: Swiss Centre for Life Cycle Inventories, 2007). Found at: www.ecoinvent.org.

Franklin Associates, a Division of ERG, for the Plastics Division of the American Chemistry Council: *Cradle-*

to-Gate Life Cycle Inventory of Nine Plastic Resins and Four Polyurethane Precursors (Prairie Village, KS, 2010).

Industry Contacts

Frank Endrenyi, Mohawk Industries (2002)