

# Green Chemistry Education Webinar

## Introduction to Life Cycle & Alternatives Assessment

June 18<sup>th</sup>, 2015



# Today's Speakers

Ann Blake



Principal & Founder  
Environmental & Public  
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Thaddeus Owen



Chief Engineer,  
Sustainability  
Herman Miller

Tom Etheridge



Program Manager,  
LCA and CF  
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# Introduction to Alternatives Assessment Practice

Green Chemistry &  
Commerce Council  
Webinar

June 18, 2015

# Introduction to Alternatives Assessment Practice

- What is it?
  - Definition of alternatives assessment/ analysis
  - Why alternatives assessment?
- How do we do it?
  - Frameworks for AA and practical applications
  - Overview of available tools & approaches
- Current practice: evolution & continuing challenges
  - Exposure considerations
  - Decision-making
  - Data gaps



# What's Our Goal?

- Safer chemicals, materials, processes, products
  - Increased supply chain transparency & communication
  - Fill data gaps for robust assessment
  - Improvement in human health and environment as well as the economy
- Triple Bottom Line: people, planet, prosperity



# What is Alternatives Assessment?

- A process for identifying and comparing potential chemical and non-chemical alternatives that can be used as substitutes to replace chemicals or technologies of high concern
- Includes **assessment and evaluation**



# LCA, Risk Assessment, AA: Answering Different Questions

- LCA helps to answer, *“What are the environmental impacts of a product throughout its life cycle?”*
- Risk assessment considers hazard, dose-response, and exposure and helps to answer, *“Is it safe enough?”*
- Comparative chemical hazard assessment helps to answer, *“Which alternative is safer?”*
- Alternatives assessment:
  - chemical hazard assessment, exposure assessment, other assessment approaches in a decision framework

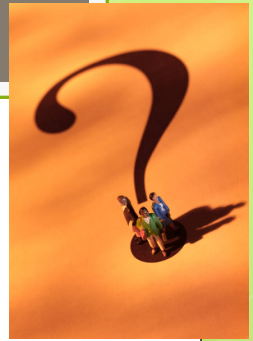
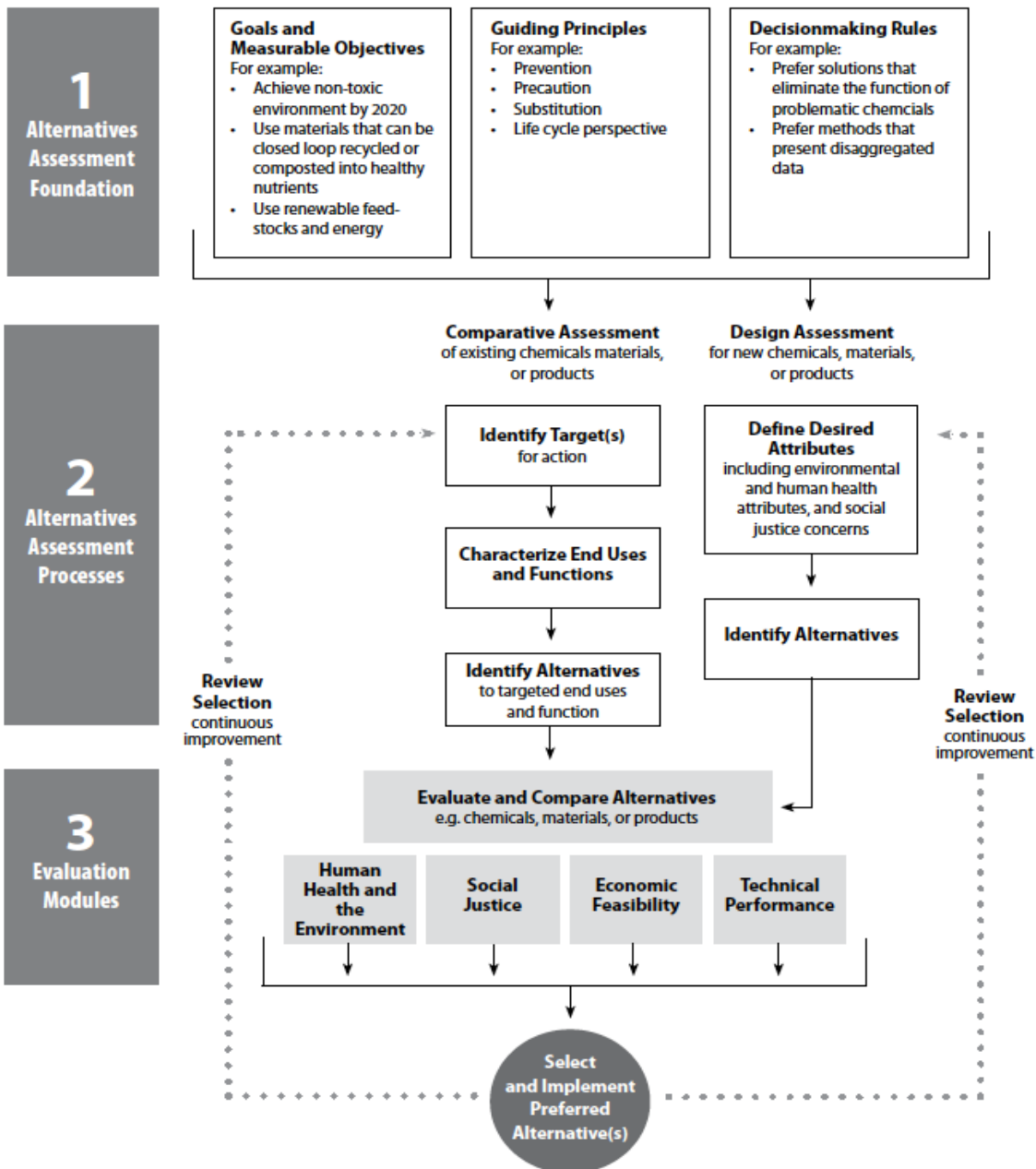


Figure 1 Alternatives Framework: Detailed Summary

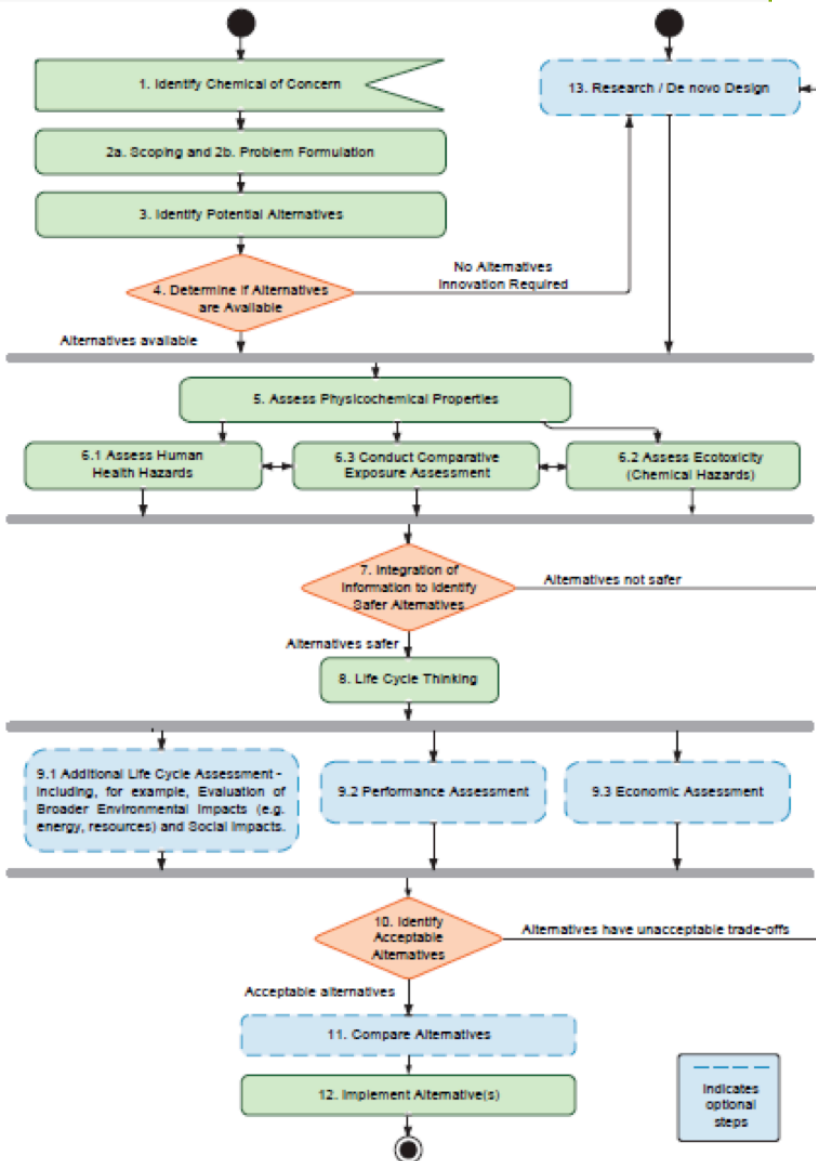






# A Framework to Guide Selection of CHEMICAL ALTERNATIVES

NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES



# Trade offs and Regrettable Substitutions: A Rogues' Gallery

- From one environmental medium to another
  - MTBE as a fuel additive in place of lead
    - Goal: reduce air pollution by enhancing combustion
    - Contaminated surface water
- From one health impact to another:
  - Methylene chloride to nMP in paint strippers
- From the environment to workers
  - n-hexane replacing CFCs in aerosol brake cleaners
- From human health to the ecosystem
  - Copper in brake pads
  - Pyrethroids; improvement for human health; persistent in aquatic sediment
  - Neonicotinoids: better than OP's for humans, deadly for bees via plants; ng/l toxicity
    - Inappropriate ecotoxicity tests; water-soluble!



# What Decision Do you Need to Make?

- Raw material/ component supplier
  - Provide information to downstream user, customer
- Manufacturer/Assembler/ OEM:
  - Choose safer alternative materials/ components for your product
- Retailer
  - Screen products for potentially hazardous chemicals
- Regulator
  - Regulatory framework to drive demand for safer alternatives
  - Find solutions to specific hazards (e.g. Maine deca-BDE AA)





# Types of Available Tools

- Green Screen: benchmarking chemical hazards
- Emerging Hazard/ Alternatives Tools
  - ChemHAT
    - hazard and alternatives information for workers
- Sector tools:
  - CleanGredients, MIQ, Pharos
  - Retailer tools (see GC3 references)
  - Outdoor Industry Association's EcolIndex/ Higg Index
- GoodGuide
  - Safer product choices for consumers
  - Retailer buyer tool
- Company Ranking Tools
  - (GoodGuide)
  - B Corporation's Impact Assessment
- Regulatory Framework for Assessing Safer Alternatives
  - Maine, Washington, California, EU REACH
  - IC2 (Interstate Chemicals Clearinghouse) modular AA guidelines



SAFER  
CONSUMER  
PRODUCTS (SCP)



# Challenges: Exposure Assessment

- The NAS report: Comparative Exposure Assessment
  - Consider the potential for reduced exposure due to inherent properties of the alternative chemicals;
  - Ensure that any substantive changes to the routes and any substantive increases to the levels of exposure are identified; and
  - Allow for consideration of the routes (dermal, oral, inhalation, etc.) , patterns (acute, chronic) and levels of exposure (irrespective of any exposure controls
  - When integrating the evidence related to human and ecological toxicity among alternatives

# Decision-Making: You've got the Data, Now What?

- Decision-Support Tools:
  - Green Screen for Safer Chemicals
- Decision-Making Frameworks:
  - Multi-Criteria Decision Analysis
    - As modeled for the California Safer Consumer Product Regulations
  - Biz-NGO Working Group Alternatives Assessment Protocol
    - Incorporates Green Screen, LCA, risk assessment
- IC2 Framework: allows for different decision processes







NOVEMBER 2014

## GreenScreen® for Safer Chemicals v 1.2 GreenScreen Benchmarks™

# Green Screen Benchmarks

### ABBREVIATIONS

**P** Persistence  
**B** Bioaccumulation  
**T** Human Toxicity  
and Ecotoxicity

Low P\* + Low B + Low T (Ecotoxicity, Group I, II and II\* Human) +  
Low Physical Hazards (Flammability and Reactivity) + Low (additional ecotoxicity  
endpoints when available)

**Prefer—Safer Chemical**



### GS BENCHMARK 3

- Moderate P or Moderate B
- Moderate Ecotoxicity
- Moderate T (Group II or II\* Human)
- Moderate Flammability or Moderate Reactivity



**Use but Still Opportunity for Improvement**

### GS BENCHMARK 2

- Moderate P + Moderate B + Moderate T (Ecotoxicity or Group I, II, or II\* Human)
- High P + High B
- High P + Moderate T (Ecotoxicity or Group I, II, or II\* Human)
- High B + Moderate T (Ecotoxicity or Group I, II, or II\* Human)
- Moderate T (Group I Human)
- Very High T (Ecotoxicity or Group II Human) or High T (Group II\* Human)
- High Flammability or High Reactivity



**Use but Search for Safer Substitutes**

### GS BENCHMARK 1

- PBT = High P + High B + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II\* Human)]
- vPvB = very High P + very High B
- vPT = very High P + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II\* Human)]
- vBT = very High B + [very High T (Ecotoxicity or Group II Human) or High T (Group I or II\* Human)]
- High T (Group I Human)



**Avoid—Chemical of High Concern**

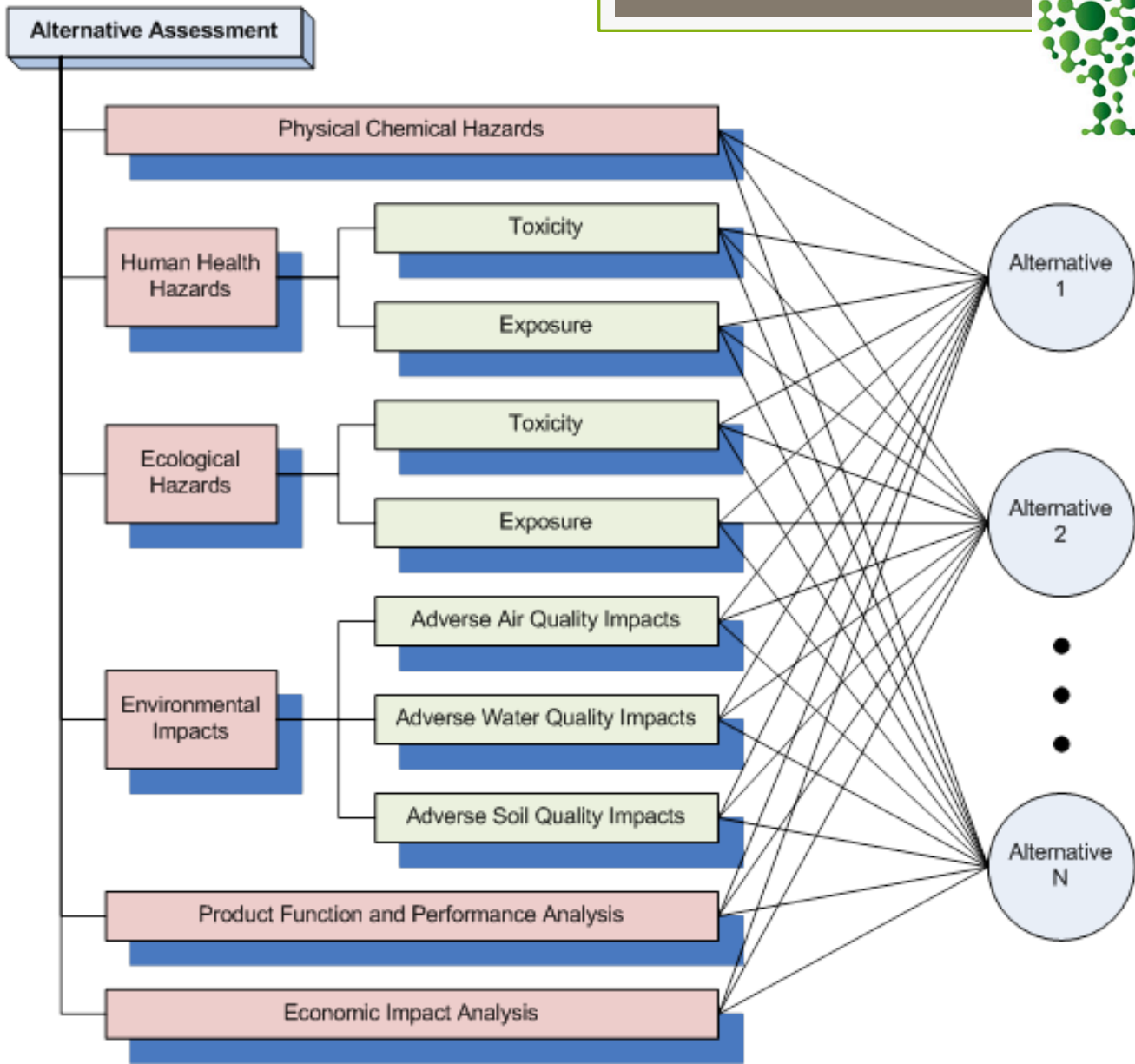
### GS BENCHMARK U

Unspecified Due  
to Insufficient Data

**See Guidance** (GreenScreen for Safer Chemicals Hazard Assessment Procedure) at [www.greenscreenchemicals.org](http://www.greenscreenchemicals.org) for instructions.

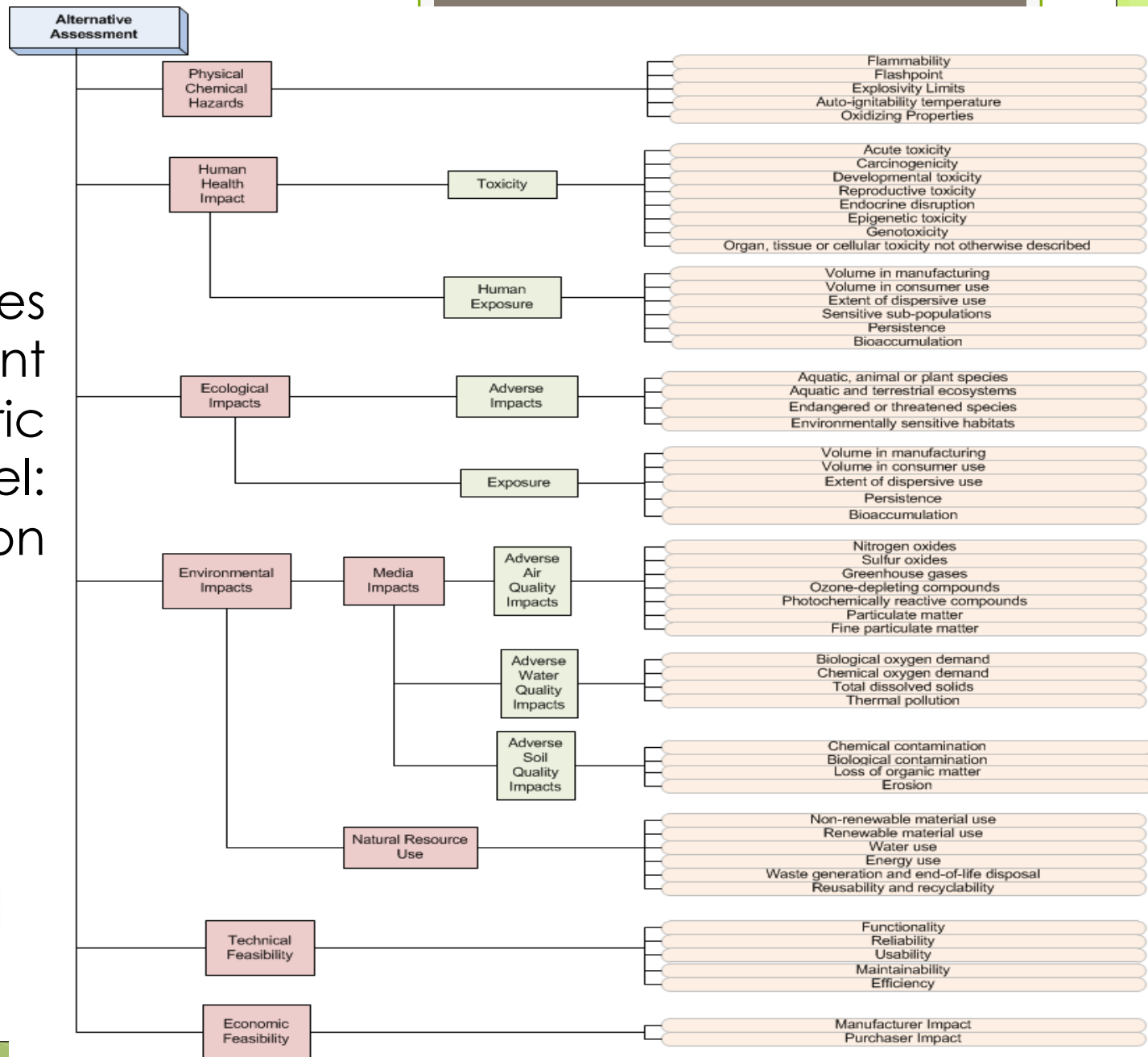
**Group I Human** includes Carcinogenicity, Mutagenicity/Genotoxicity, Reproductive Toxicity, Developmental Toxicity (incl. Developmental Neurotoxicity), and Endocrine Activity. **Group II Human** includes Acute Mammalian Toxicity, Systemic Toxicity/Organ Effects—Single Exposure, Neurotoxicity—Single Exposure, Eye Irritation and Skin Irritation. **Group II\* Human** includes Systemic Toxicity/Organ Effects—Repeated Exposure, Neurotoxicity—Repeated Exposure, Respiratory Sensitization, and Skin Sensitization. Immune System Effects are included in Systemic Toxicity/Organ Effects. **Ecotoxicity** includes Acute Aquatic Toxicity and Chronic Aquatic Toxicity.

\* For inorganic chemicals persistence alone will not be deemed problematic. See Guidance.

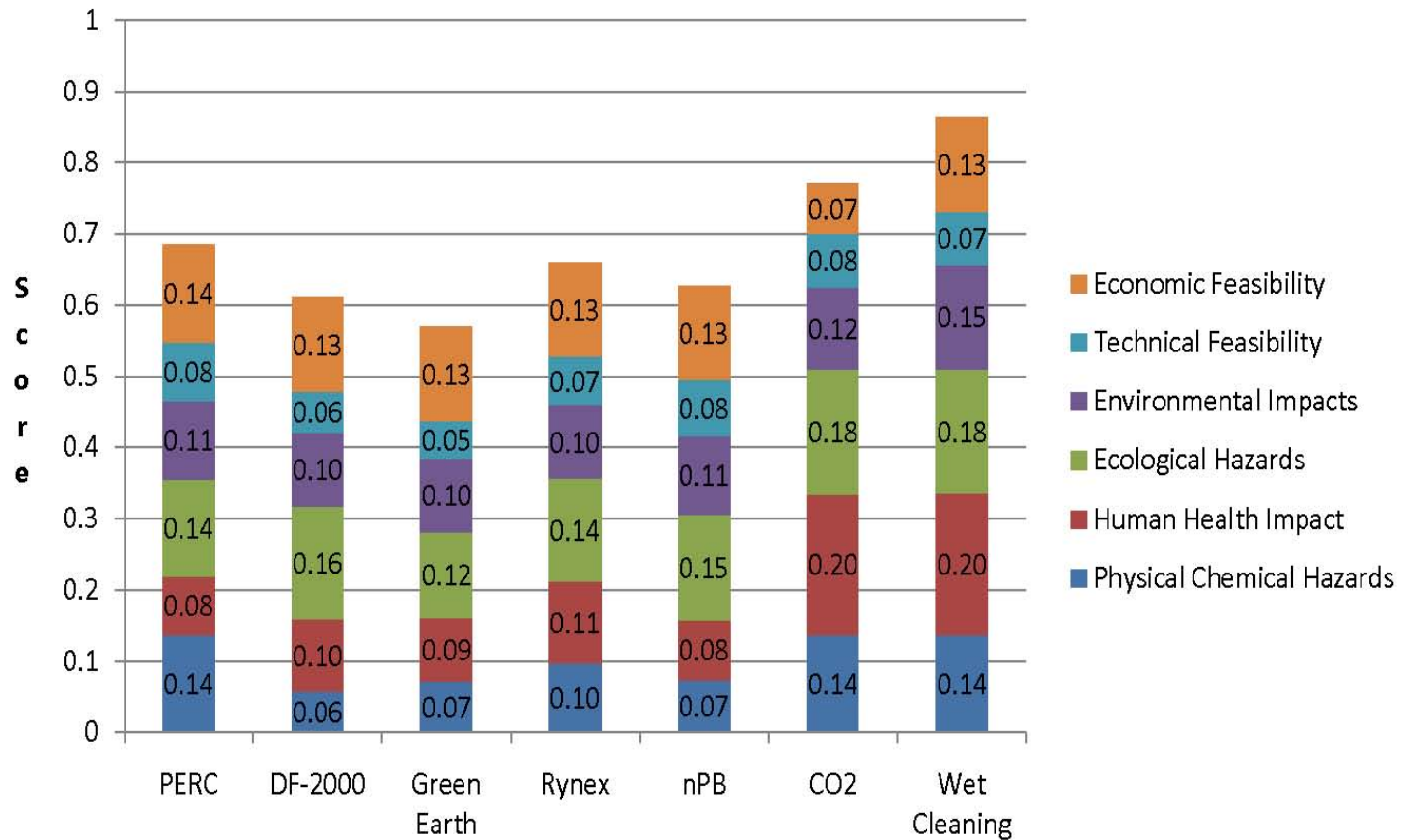




# Alternatives Assessment Generic Model: Final Version



# What's Driving the Decision?





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# Materials Assessment And Alternatives Screening

## Herman Miller's Story



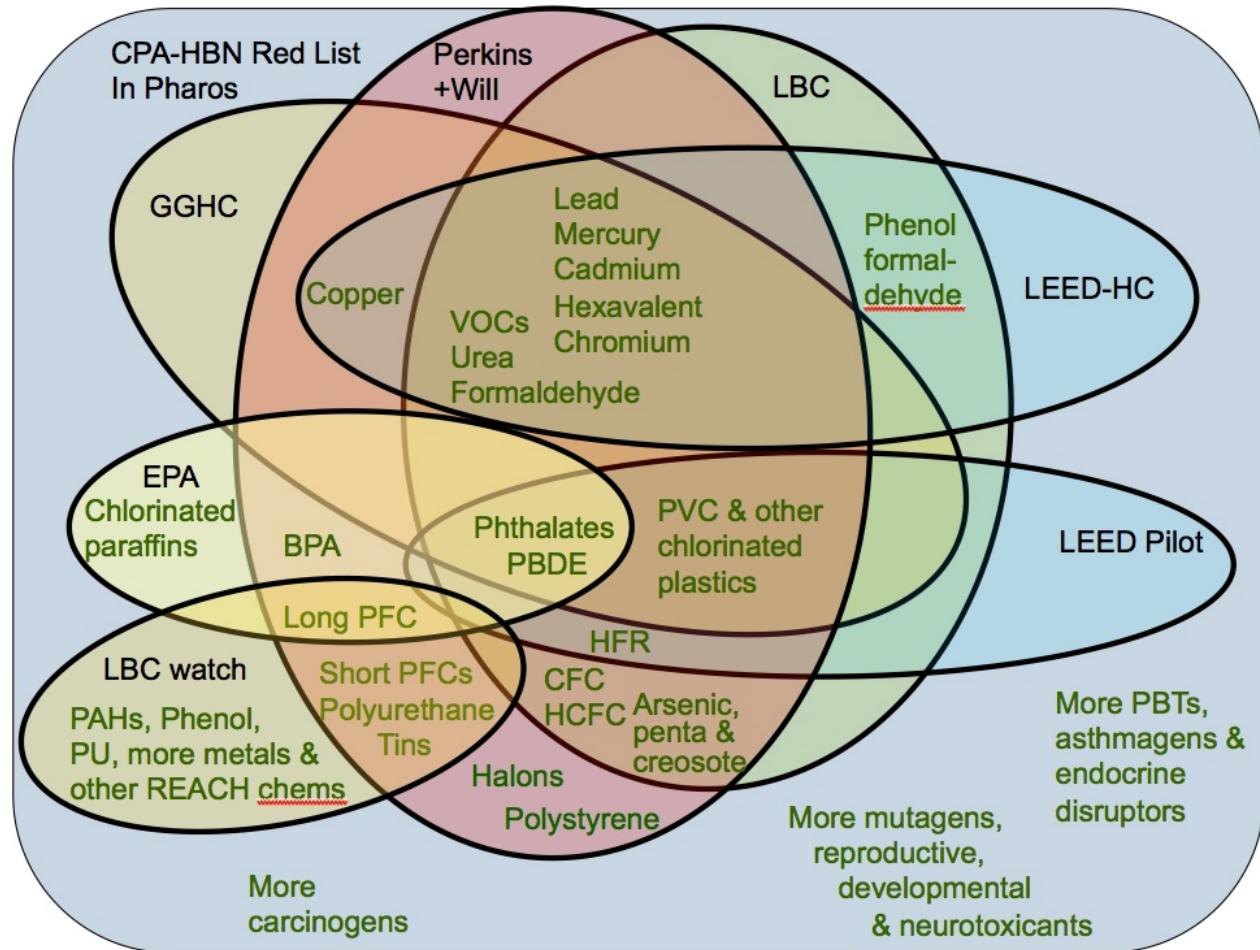
HermanMiller







# Red Lists



*& More beyond!*

Courtesy of Healthy Building Network



# Eco-inspired Design Goals

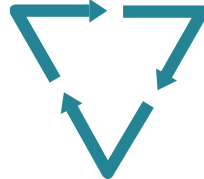
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## Every product is sustainable

100% Safe Chemistry



100% Recycled/Bio-based Materials



100% Closed-Loop Systems



100% Life Cycle Assessment



### 10 YEAR GOALS

100% DfE Approved Products

100% level 3 Certified Products

Takeback 125,000 tons of product





## Eco-Inspired Design

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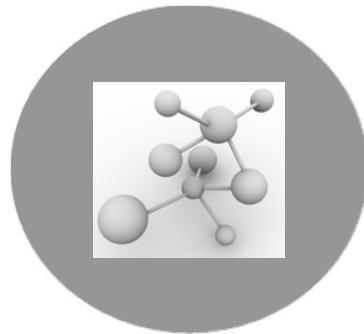
**Chemistry**



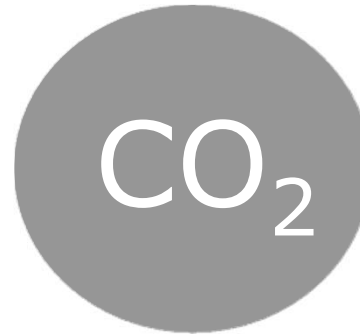
**Disassembly**



**Recyclability**



**Chemical of Concern List**



**Life Cycle Assessment**

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## Start with the Product

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## Generate a Bill of Material (BOM)

Bill of Materials									
BOM Level	Product Part Number	Rev isio	QTY	Material Description	Material - Print	Material ID#	Material -Finish	Tier 1 Supplier	Wt (g.)
	DF.100		1.00	XXX Table Veneer Top					0 g.
1	1CCCS		1.00	ETG Assy				Supplier A	0 g.
2	1B6DD3		1.00	Base Assy					0 g.
3	1B98C6	F	1.00	Base Extrusion	6105 T5 Extruded Aluminum	2559	Polished (no coating applied)	Supplier A	5,008 g.
3	1B9H34	D	2.00	Foot Casting Small	Die Cast 380 Aluminum From Gordon MFG	456	Polished, 91 and 98 white and BK black powder coat	Supplier A	3,112 g.
			2.00	Foot	HDPE Dupont X123	555	None	Supplier A	13 g.
3	1B8PST	F	2.00	Post Extrusion	6061 T6 Aluminum Extrusion	384	Polished, 91 white and BK black powder coat	Supplier A	1,296 g.
3	1B8ZJR	E	2.00	Weldment			Bright Zinc	Supplier B	
4	1B8PXF	E	1.00	Plate connector end	1008/1010 CRS	229	Bright Zinc RoHS Compliant	Supplier B	537 g.
4	1B8YCK	D	1.00	Support plate	1008/1010 CRS	229	Bright Zinc RoHS Compliant	Supplier B	173 g.
4	1B8YCN	E	1.00	washer plate	1008/1010 CRS	229	Bright Zinc RoHS Compliant	Supplier B	36 g.
3	1B89S9	D	4.00	Threaded rod	1018/1020 Steel	598	RoHS Compliant, Zinc coated	Supplier B	526 g.
3	*302818146	AC	8.00	Set Screw	4037 Steel	2598	Black Zinc RoHS Compliant	Supplier B	16 g.
3	*7482031	AK	4.00	Cap	BASF XX123 PP 22% GF	3432	none	Supplier B	
3	1B8PX9	F	4.00	Glide adjustment screw	1008/1010 CRS	229	Bright Zinc RoHS Compliant	Supplier B	11 g.



HermanMiller



DfE 2.0

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- Raw material information needed
  - Datasheets
  - MSDS
  - Full chemical composition disclosure
  - RoHS Compliance

**HermanMiller****Contact Information**

A) Supplier Company Name:

B) Material Manufacturer:  
*(if not 'Supplier Company')*

C) Material Trade Name:

D) Contact Person:

E) Contact Information:

**Materials**

Please provide the following data for all substances/mixtures contained in the product at a concentration of at least 100 ppm (0.01%), including any catalysts, dyes, colorants or residual monomers. Please copy and attach additional sheets, if necessary to outline the complete formulation. For purchased materials/mixtures, please identify the supplier and their product name. For raw materials, please provide CAS data.

#	Substance/mixture identifier (e.g., trade name; product number)	CAS number (Chemical Abstract Service)	Concentration or concentration range (0-1%, 1-5%, 5-15%, 15-50%, 50%+)	Function (within material)	Supplier name (if applicable)	Contact person and contact information
Ex:	C.I. Pigment Blue 15	147-14-8	0.50%	colorant	Acme Products	John Doe, (555)555-1234, jd@acme.net
1)						
2)						
3)						
4)						
5)						
6)						

**Instructions:** Complete all of the required fields (\*) on this form per the product being evaluated for BIFMA Level Certification.

Upon completion, please return the form to the requester.

Some field names contain pop-up help boxes with further instructions. Pop-up boxes will appear when you mouse-over the field name and disappear upon leaving the field.

Please review the BIFMA Annex B (attached) and list the chemicals in the manufacturers formulation that are at a concentration greater than 1,000 PPM.

If a product contains chemicals that are on the Annex B list, please list those chemical, CAS#s and % of the formulation in the chart below.

If the product does not contain any chemicals on the Annex B List, please list this as a note in the comment section of this document.

If applicable, please make comments in the "Comments" field.

Data Submittal Date\*

Supplier Information

Company Name\*

Company Product Description\*

Company Postal Address\*

Contact Name\*

Contact Phone\*

Contact Email\*

Contact Fax

Contact Postal Address\*

Additional Information

Comments

Substance Information

Please Report Substance Information Below

Annex B Chemical *	CAS #* (where available)	% of total material* (up to 3 decimal places)	Description of Use

# RSL ATTESTATIONS

## Minimum requirement from material suppliers



BANNED CHEMICALS OF CONCERN		
Chemical	Group	CAS No.
Bis(tributyltin)oxide (TBTO)	OT	56-35-9
Short chain chlorinated Paraffins	HFR	85535-84-8 108171-26-2
Di(2-ethylhexyl) phthalate (DEHP)	Phth	117-81-7
Di-isobutyl phthalate (DIBP)	Phth	84-69-5
Di-n-butyl phthalate (DBP)	Phth	84-74-2
Butyl Benzyl Phthalate (BBP)	Phth	85-68-7
MethyleneDianiline (MDA)		101-77-9
C.I.Pigment Yellow 34		1344-37-2
Tris (2-Choloroethy) phosphate (TCEP)	HFR	115-96-8
2,4 Dinitrotoluene		121-14-2
HBCD (HBCDD)	HFR	25637-99-4
Trichloroethylene		79-01-6
Phthalates	Phth	
Lead Compounds	Pb	
Chrome VI Cmpds	Chr	
Halogenated FRs	HFR	1163-19-5
Bis(2-methoxyethyl) phthalate (DEMP)	Phth	117-82-8
Di-n-octyl phthalate (DnOP)	Phth	117-84-0
Di-n-pentyl phthalate (DnPP)	Phth	131-18-0
Asbestos		1332-21-4
tris (1,3 dichloro-2-propyl)phosphate (TDCP)	HFR	13674-87-8
Lead (II) bis (methanesulfonate)	Pb	17570-76-2
Diisononyl phthalate (DINP)	Phth	28553-12-0 68515-48-0
HBCD	HFR	3194-55-6
Halogenated FRs	HFR	32534-81-9
Halogenated FRs	HFR	32536-52-0





## Materials and Mechanical Properties Database

Compare

Return to Search

Exit

Detail	Color Score	Print Specification
	Yellow	PUR - Foamex Natural
	Yellow	PUR - High Density Polyurethane
	Yellow	TPU - Polyurethane
	Yellow	TPU - Laiton 3855
	Yellow	TPU - Laiton 185
	Orange	PUR - 2082 Isocyanate
	Red	Adhesive - polyurethane reactive easy adhesive 1200
	Red	PUR - 5538R/ 5116T
	Red	PUR - 4
	Red	PUR - Specialty Composites Isc
	Red	TPU - Polyurethanes TPU
	Not Assessed	Adhesive - Polyurethane Multipurpose Adhesive, white
	Not Assessed	Adhesive - Polyurethane Reactive Adhesive TS-115 HGS
	Not Assessed	Adhesive - (TM) Polyurethane Reactive (PUR) Easy 250 Adhesive E2250120
	Not Assessed	Adhesive - Diversitak CI-6631 Two Component water Based Spray Adhesive
	Not Assessed	FR- Gulbrandsen CP2 Fire Retardant Additive
	Not Assessed	Finish - Superior Finishes Sequoia 444-Clear-XX WB Polyurethane Clear Coat
	Not Assessed	Finish - ICA OP385 Polyurethane Black for Noguchi Topcoat
	Not Assessed	Finish - ICA PC34 Paste for Polyurethane Black for Noguchi Topcoat
	Not Assessed	ISO- Bayer Mondur TD Isocyanate PUR component
	Not Assessed	Iso - BASF Lupranate T80 Type 1 (TD1)

DfE 2.0

## Material Chemistry

- **Green**  
Little or no hazard; acceptable for use; reviewed by MBDC. No Banned RSLs.
- **Yellow**  
Low to moderate hazard; acceptable for use; reviewed by MBDC. No Banned RSLs,
- **Purple**  
Full formulation and RSL/BIFMA Annex B attestations. Internal review. No Banned RSLs.
- **Red**  
High hazard; should be phased out as soon as possible.
- **Orange**  
Incomplete data; no indication it is problematic but a complete assessment is not impossible





Material Description	Material - Print	Material ID#
XXX Table Veneer Top		
ETG Assy		
Base Assy		
Base Extrusion	6105 T5 Extruded Aluminum	2559
Foot Casting Small	Die Cast 380 Aluminum From Gordon MFG	456
Foot	HDPE Dupont X123	555
Post Extrusion	6061 T6 Aluminum Extrusion	384
Weldment		
Plate connector end	1008/1010 CRS	229
Support plate	1008/1010 CRS	229
washer plate	1008/1010 CRS	229
Threaded rod	1018/1020 Steel	598



## Screening - 1<sup>st</sup> Look for Banned Substances

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- RSL Attestation signed
- No Banned restricted substance groupings
  - Halogenated Flame Retardants (HFRs)
  - Heavy Metals (Arsenic, Cadmium, Cobalt, Chrome VI, Mercury, Lead)
  - Phthalates



## Screen Against Lists

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TM  
the BIFMA sustainability standard

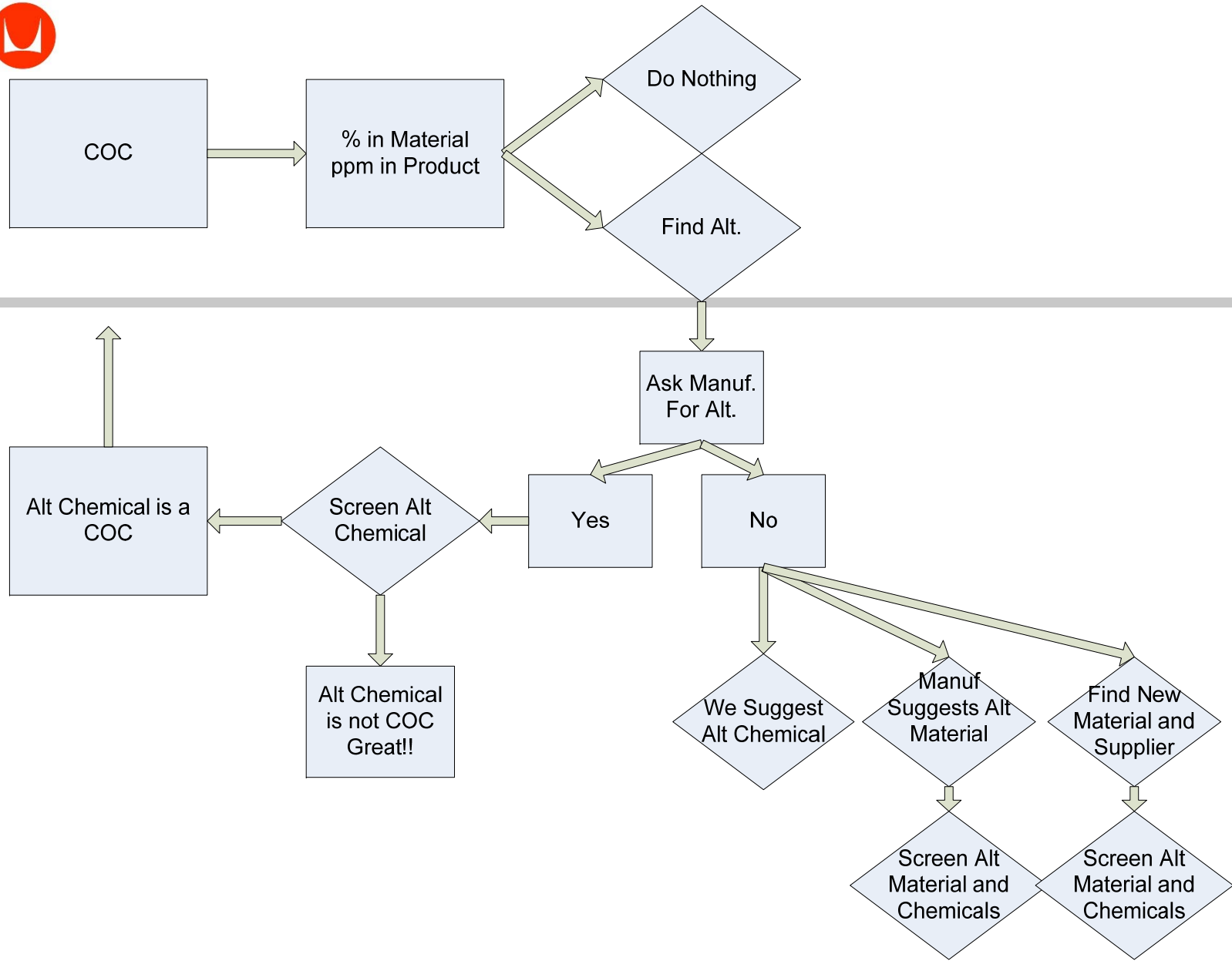




## Screen with 3<sup>rd</sup> Party Assessors – Optional

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## Decisions

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- Based on risk and exposure process
- Based on knowledge
- Based on feedback from Consultants
- Based on BIFMA Chemical of Concern risk/exposure study



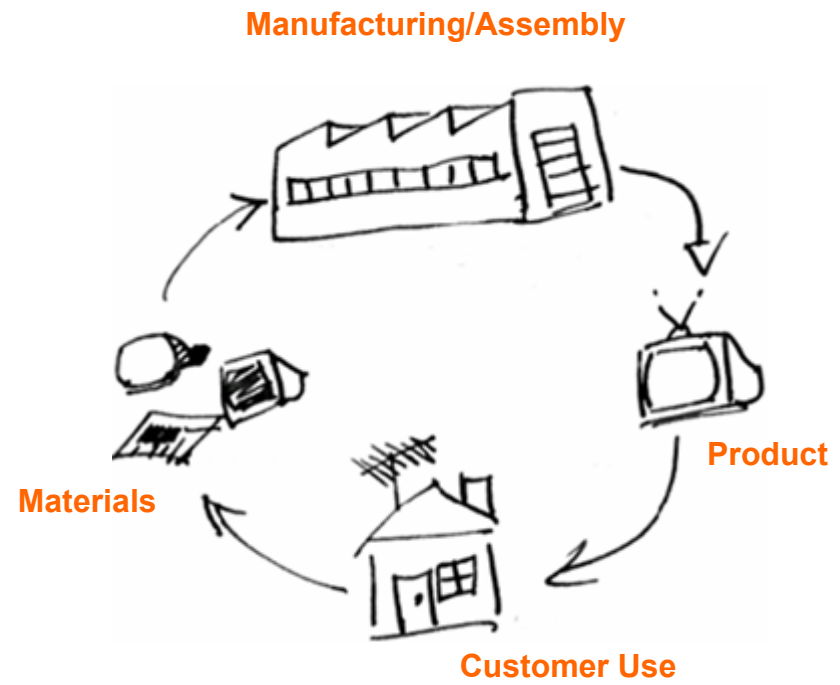
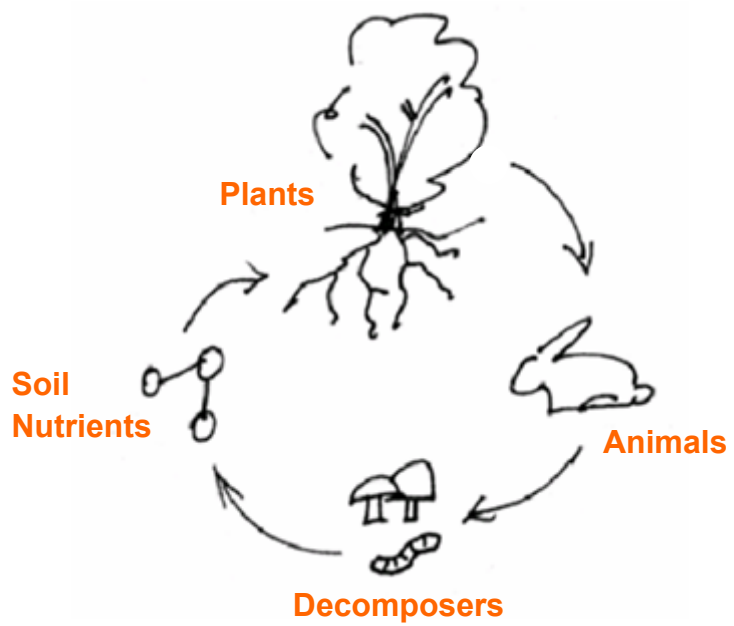
# Products Designed “Free Of” Not Enough

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 BPA Free





# Fiberglass

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## Products Made to Last

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# **A Modular Approach to LCA: The Process and Results Applied to HP's Imaging Products**



Tom Etheridge, PhD

WW LCA and CF Program Manager, HP

# The Motivation

Why assess environmental impacts of HP's Imaging Products Portfolio?

## 1. Product Improvement

- Help HP scientists focus development on environmental performance early in the design process with guidance from environmental analysis that spans the product line

## 2. Produce EPDs

## 3. Earn 3 critical EPEAT 1680.2 optional points

## 4. Proactive approach to potential regulatory and ecolabel requirements

## 5. Customer demand

- Match customer needs with the appropriate printing devices
- Understand how optimizing printing habits can lower personal environmental impacts (duplex printing, reduced power consumptions, etc.)



# The Challenge

How to get solid environmental information that spans HP's multi-billion dollar Imaging portfolio?

## Breadth of portfolio

- 10,000+ Imaging products from consumer-level InkJet printers to department class, high-speed LaserJet multifunction devices.

## Complexity

- Ever evolving portfolio due to customer and regulatory demand. Complex devices, sold in more than 100 countries with global supply-chain of components.

## Expense

- Prohibitively expensive to do an LCA from scratch for even a representative cross-section of the portfolio.

## Leverage

- Need a flexible and modular model that could cover other imaging products (e.g., InkJet and scanners).



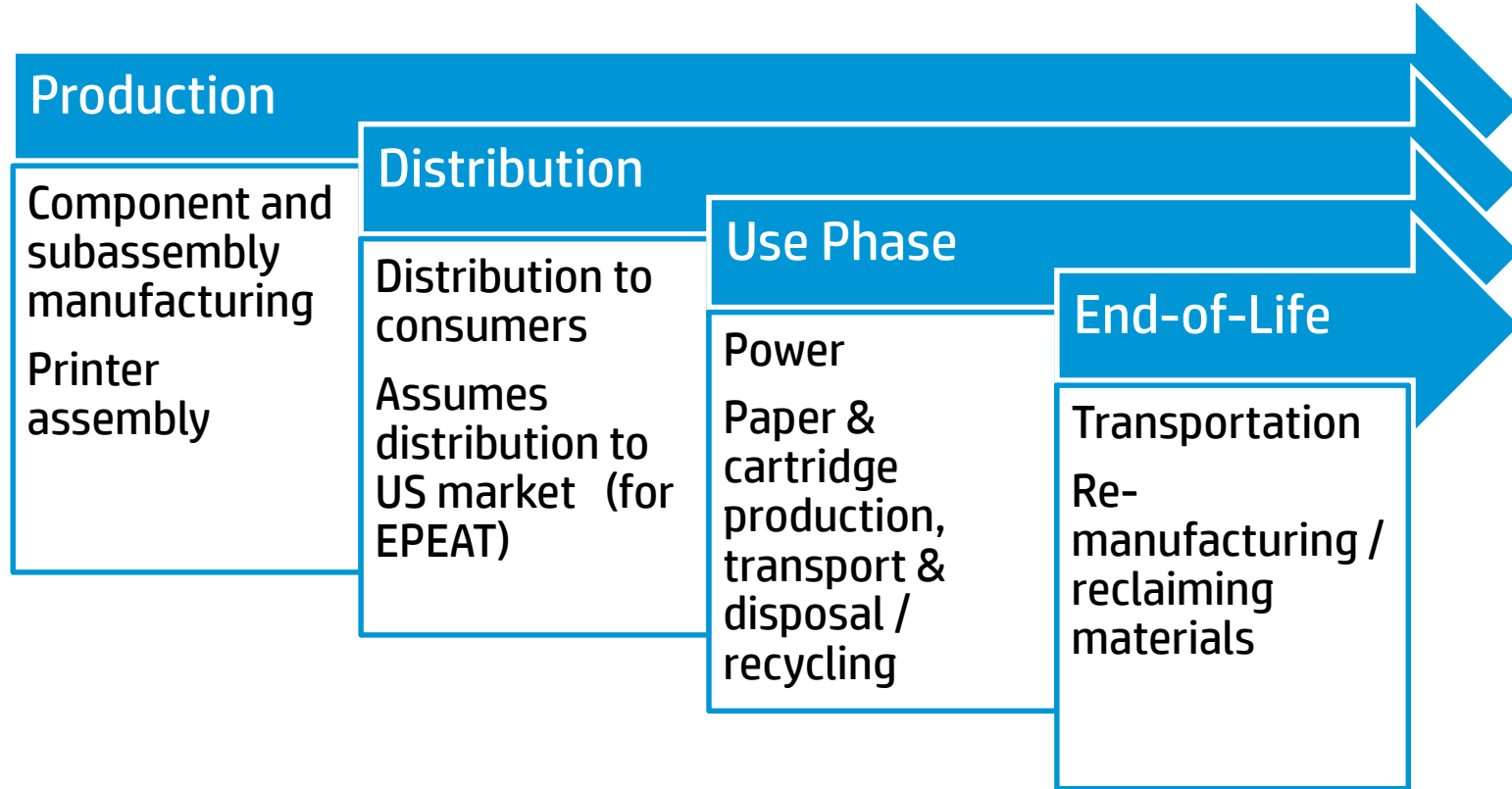


# What is LCA

- **LCA is a robust, rigorous, ISO-recognized tool for assessing the environmental impact of a product over its entire lifecycle**
- **Incorporates input from all stages of a product's life**
  - Materials
  - Manufacturing processes
  - Distribution routes
  - Energy consumption
  - Consumables
  - Disposal
- **Requires defining a Functional Unit**
  - For HP's imaging products the functional unit is 1000 printed pages



# Model Structure – From Cradle to Grave



# One LCA to Rule Them All

Completed an extensive LCA that defines the process for all printers

Hewlett-Packard

## LCA of LaserJet Printers for EPEAT Verification

Background report

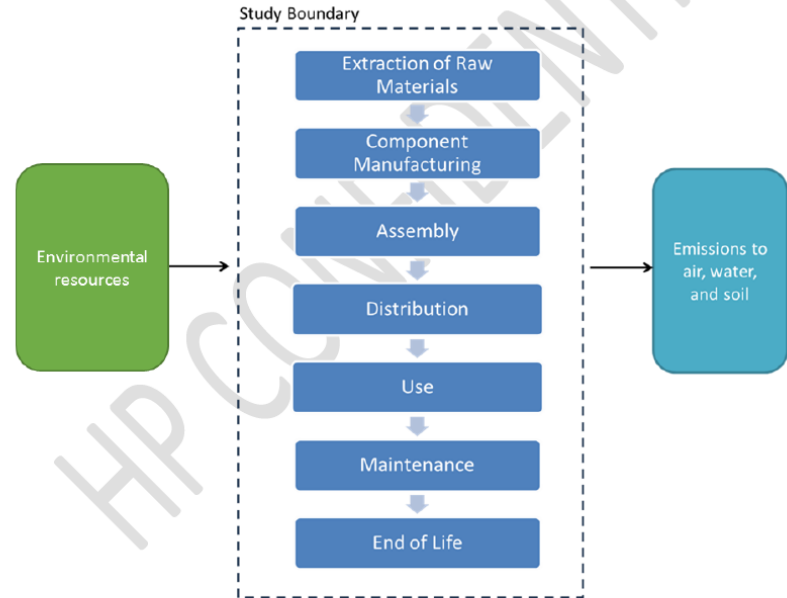


Figure 2-3: LaserJet LCA Study Boundary



# The Challenge at the Printer Level: Product Complexity

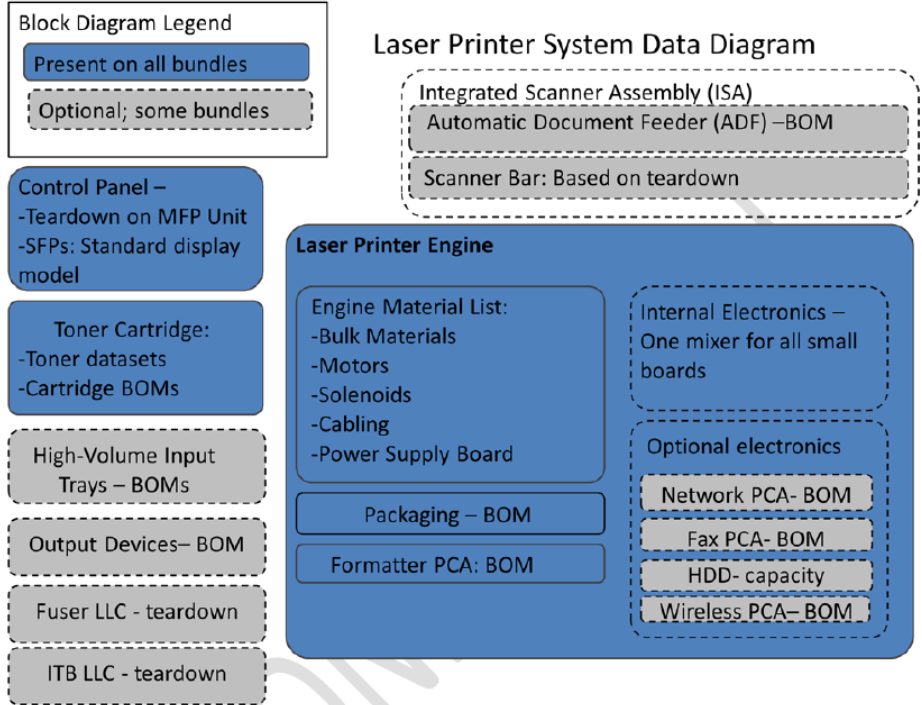


Figure 3-1: GaBi Model Overview of Printer Life Cycle System

# The Solution = A Modular Approach

## Initial Models Built for LaserJets

### Hardware

LES Print engine

Skins

Paper handling

Scanner

Fax

Wireless

Power supply

Keypad

Document feeder

PC boards

Etc.

### Consumables

Paper

Cartridges

Fuser

ITB

Energy

### Other

Transport (all nodes)

Packaging

End-of-life

Functional Unit

LCA-specific life phases



## Models Added for InkJets

Printheads

Cartridges

Printbar (Pagewide Array)

Printhead assembly

Ink delivery system

# The GaBi Envision Tool: Design for Environment

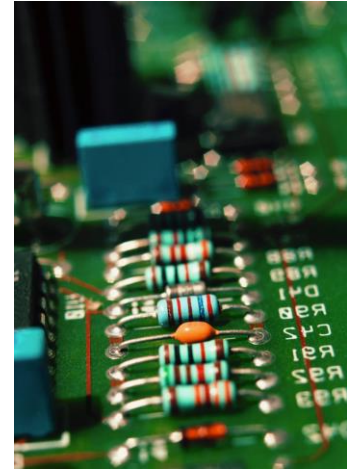
*A web-based tool that allows the user to modify input parameters for all components*

- Covers all printer components, consumables & inputs
- Includes all LCA phases
- Generates ISO-compliant Environmental Product Declarations (EPDs)
- Flexible! Allows modules to be added for future products

The screenshot shows the GaBi Envision tool interface for editing a template for an HP Laserjet Model. The workspace title is "HP Laserjet Model 2012\_11\_12\_SecondWave\_JackalJaz". The main window is titled "Edit template: HP Laserjet Model" and has tabs for "Properties", "Scenario Settings", and "Text Variables". The "Scenario Settings" tab is active, showing a tree editor view of the product structure. The tree is organized into categories: Electromechanics components, Substrate, Passive Components, Active Components, Accessories, Packaging, TRANSPORT TO CUSTOMER, USE PHASE (expanded), Cartridges (expanded), Black Cartridges (expanded), Color Cartridges (expanded), Fusor, ITB, Power consumption, End of Life, and Functional Unit. The right side of the interface shows a list of parameters: "Parameter", "Jackal xh", "Jackal dn", "Mamba fskm", and "Mamba f".

# Model – Best available background data

- Collection of BOM information on
  - Mechanical parts
  - Electrical components
  - Electro-mechanical systems
- Mapping of observed components to existing datasets
- Modeling with representative components (127 datasets) based on size, materials and production processes



# The Environmental Product Declaration (EPD)

A document that summarizes the LCA output in a standardizes format

Reports 9 ReCiPe (H) midpoints

Results presented graphically and in tabular form

Life cycle phases are broken out in the appendix

Intended to allow relatively quick comparison among products

## ENVIRONMENTAL PRODUCT DECLARATION



Hewlett Packard  
Laser Printer M775z+

Page 2  
Issued on March 22, 2013

Declaration 11CA41590.157.1  
According to ISO 14025

### Product Description

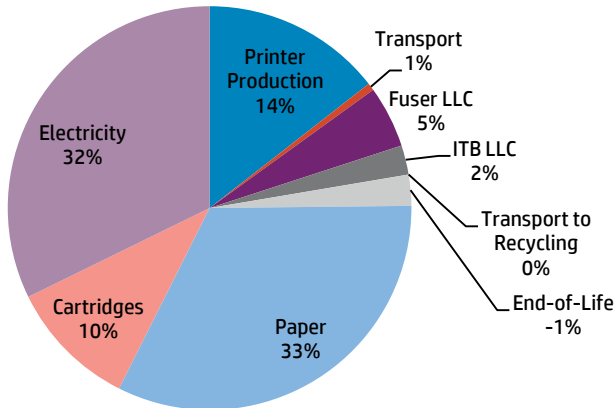
<b>Product Type</b>	Multi-function color laser printer for large departments
<b>Print Speed (mono)</b>	30 ppm
<b>Intended use</b>	Office Use
<b>Product Lifetime</b>	5 years
<b>Range of applications</b>	High-volume printing and faxing of documents in color
<b>Product Specifications</b>	NA
<b>Introduction Date</b>	11/1/2012
<b>Functional Unit</b>	The functional unit has been defined as printing 1000 pages in accordance with the Energy Star Typical Electricity Consumption test procedure and the reference PCR.
<b>Scope of Validity / Applicability</b>	The EPD is representative for the HP laser printer model M775z+ sold as a stand-alone unit (not as part of managed print services), and reflecting default out-of-box settings for duplexing, energy savings, and print quality. This EPD and the reference PCR are applicable for printer sale and use in the North American market. Differences between product environmental product declarations are not guaranteed as valid basis for comparison between products of different manufacturers.
<b>Product System Description</b>	This EPD describes the lifetime use of the laser printer, including production of all materials and components, assembly in the final configuration, delivery to the customer, use of the product, and expected end-of-life scenarios. All packaging, in-box accessories, and all consumables (paper, toner cartridges, replacement parts) are considered, including associated end-of-life treatment. Printing is considered the main function of the product, and the impacts of other functions (scanning, copying, etc.) are not considered.



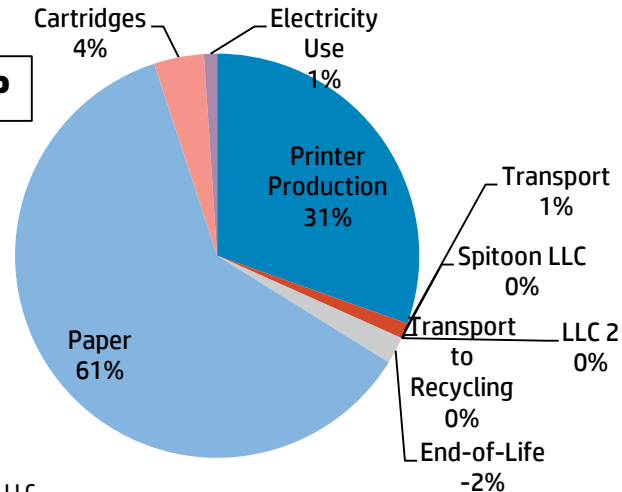


# Comparison of OJ Pro X576dw With Comparable Laser Printers: Fractional View Assuming 100k page life

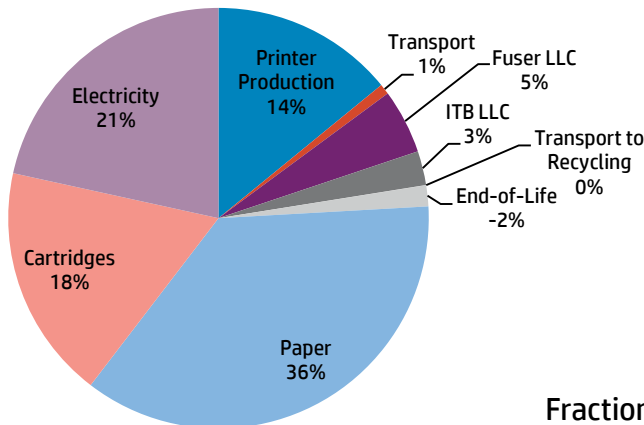
**M570dn Color Laser MFP**



**OJ Pro X576dw Color Ink MFP**



**M551dn Color Laser SFP**



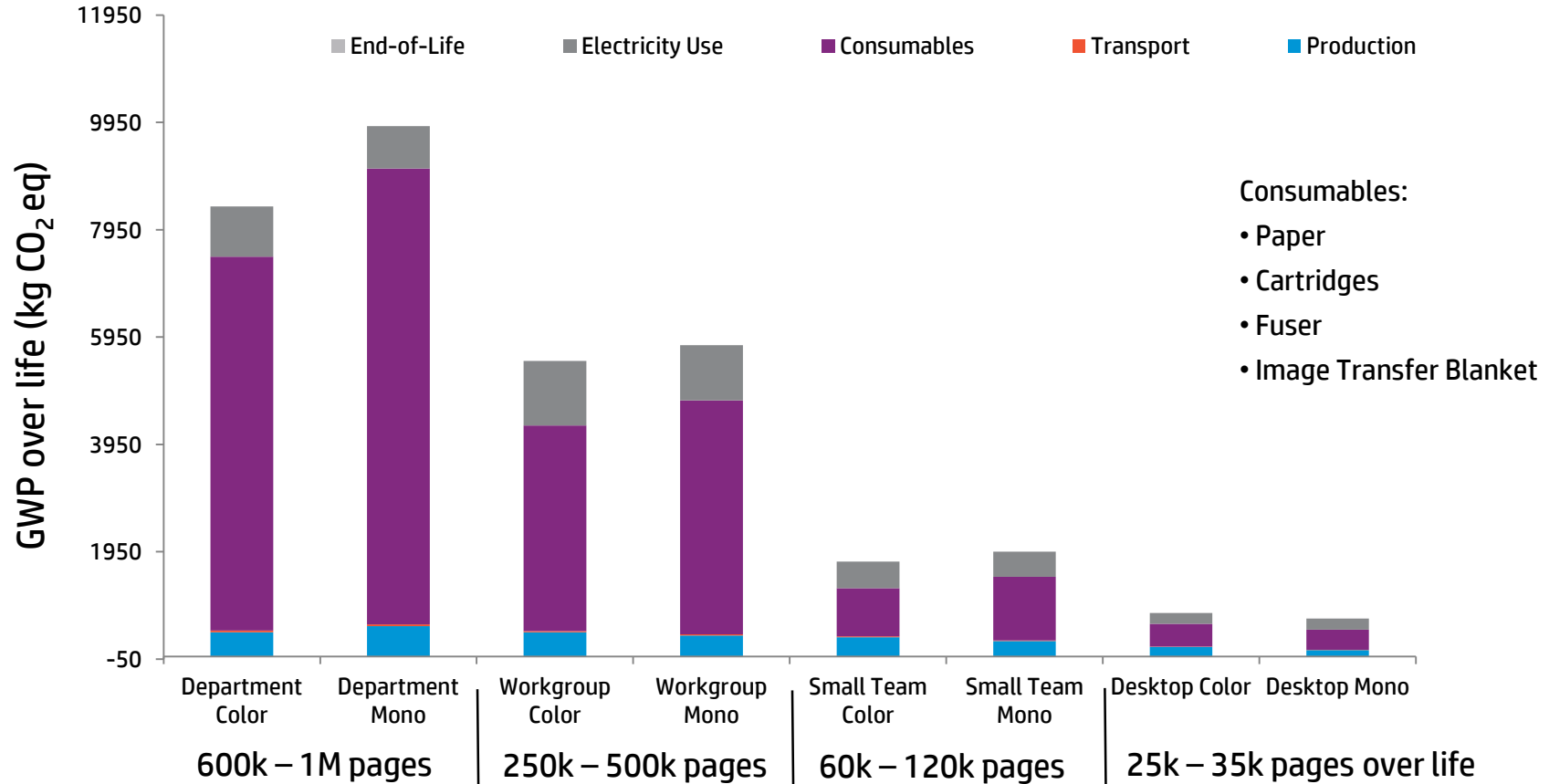
## Bottom Line

The printing contribution for the comparable LES products remains at least 64% of the total carbon footprint of the page

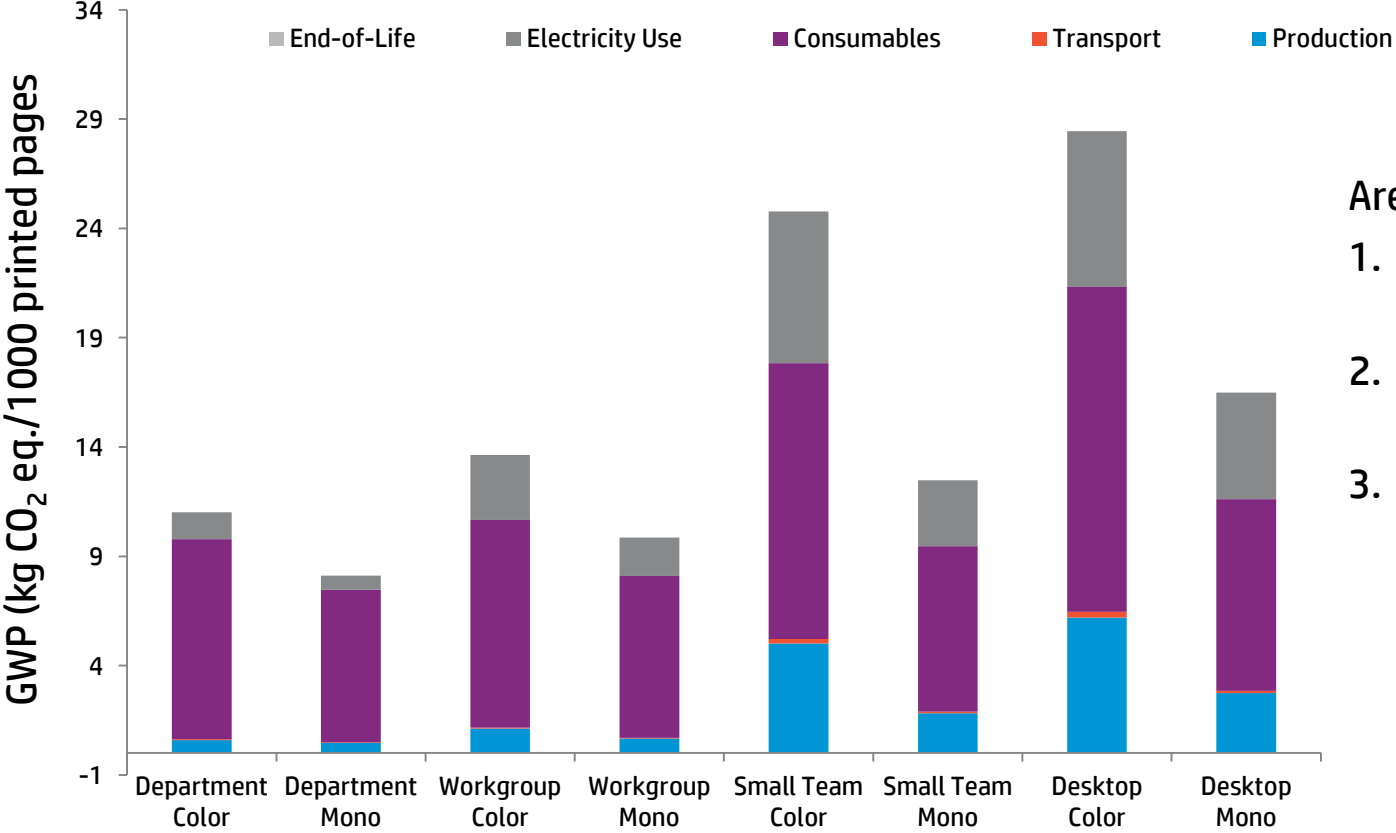
Fractional contribution to carbon footprint per 1000 pages printed



# Results – Lifetime GWP for LaserJet Portfolio



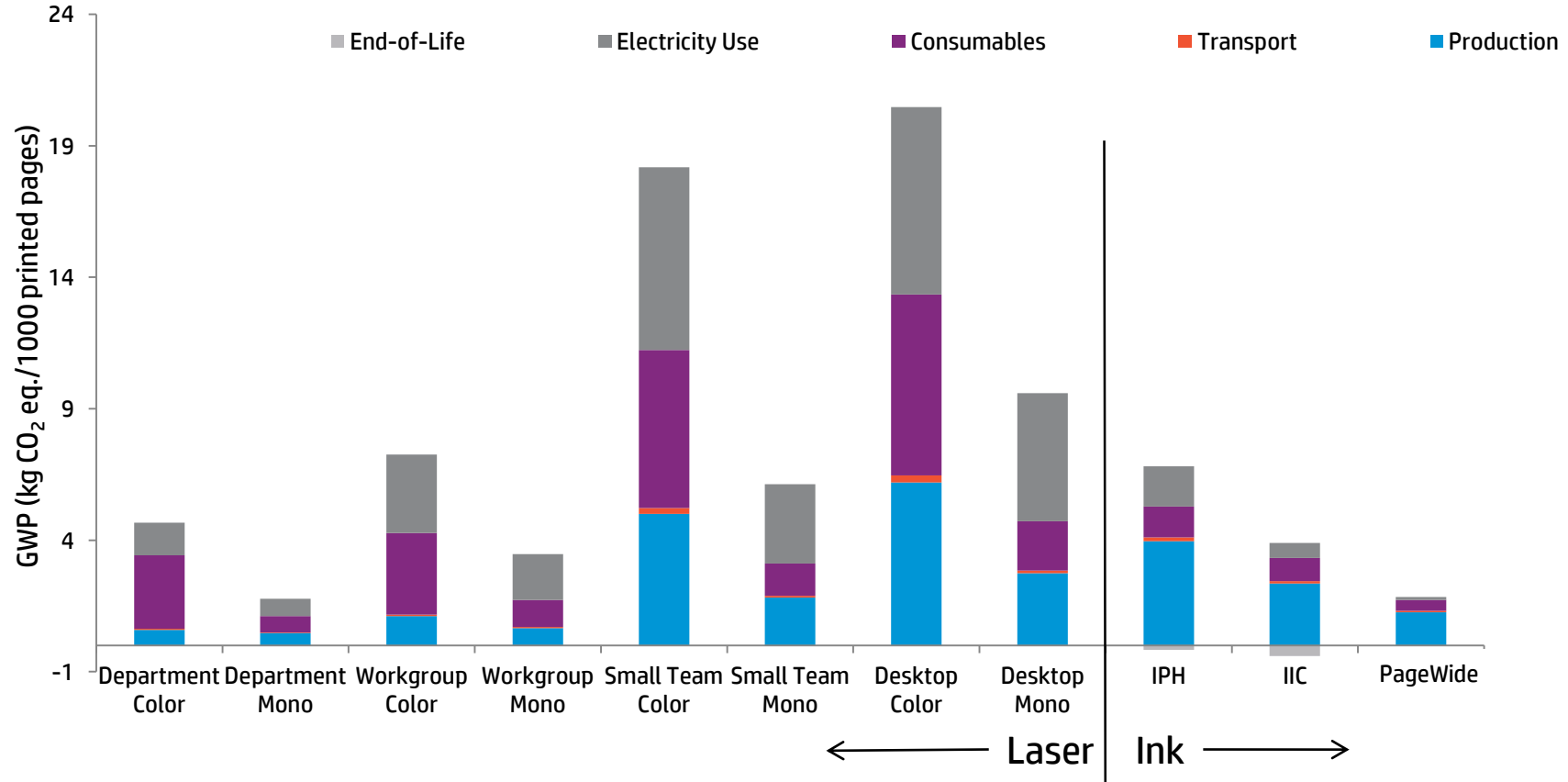
# Results – GWP per 1000 Printed Pages for LaserJet



- Areas of focus:
1. Consumables for all classes
  2. Power for Small Team and Desktop Classes
  3. Production for Small Team and Desktop color models



# The HP Printing Fleet (excluding paper)



# Benefits – Progress and Learning To Date

## Progress

- **Completed LCAs:**
  - 156 LaserJet products spanning the entire portfolio
  - 18 InkJet products spanning the entire print engine portfolio
  - 5 Scanner products spanning the entire portfolio

## Learning

- **Consumables remain the greatest source of environmental impact for printing**
  - Work with customers to help them print more efficiently - duplexing
  - Work to reduce cartridge impacts through material design and reduction where practical
- **Power consumption and production are still significant impacts for lower-end LaserJet products**
- **InkJet portfolio has lower impact than LaserJet overall**



# Benefits Overall

LCAs enabled HP to become the first IT company to publish its complete carbon footprint

Opens the door to comprehensive design for the environment

Cut cost and time to produce EPDs and earn EPEAT credits with modular approach

Meet customer demand



# Corporate-Level Environmental Reporting

<http://www8.hp.com/us/en/hp-information/global-citizenship/reporting.html>

# HP 2014 Living Progress Report

[Governance](#)  
see page 8

[Human Progress](#)  
see page 23

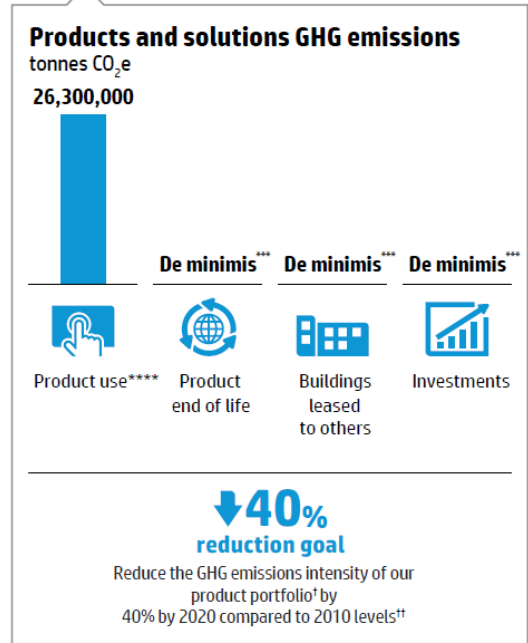
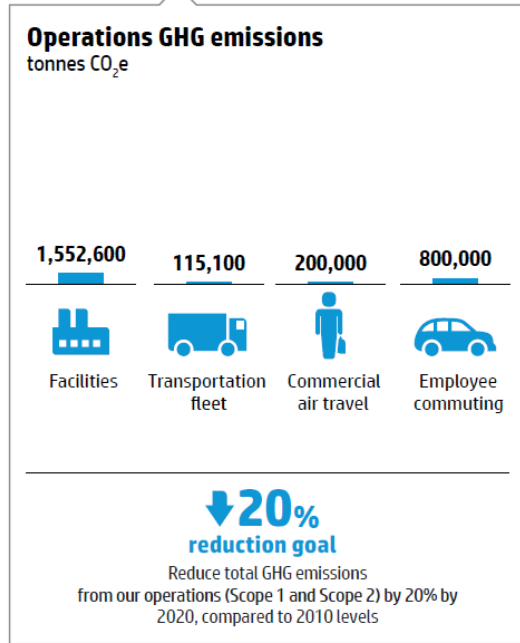
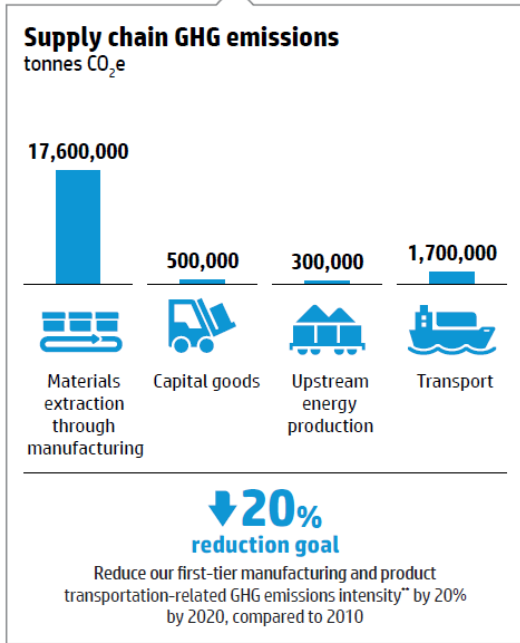
[Economic Progress](#)  
see page 58

[Environmental Progress](#)  
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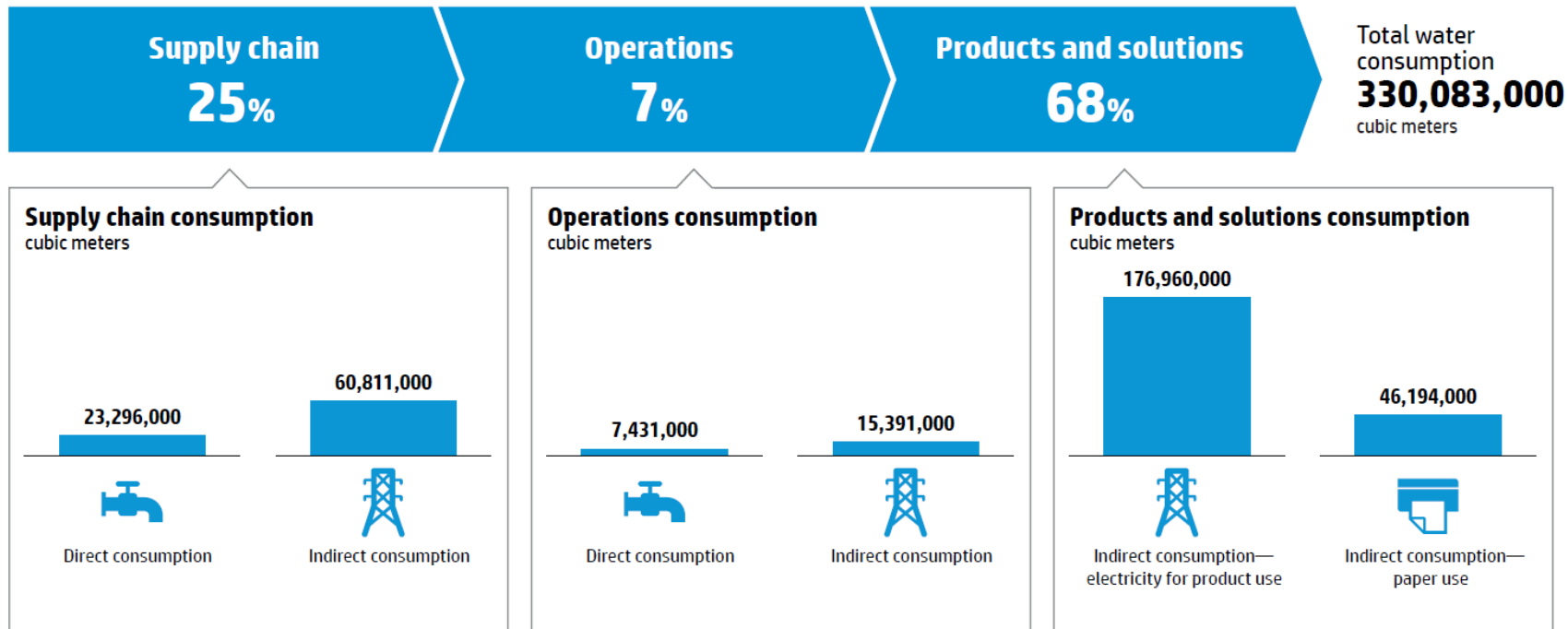


# Our Carbon Footprint, 2014





# Our Water Footprint, 2014



# Thank you

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# Thanks for joining us!

For more information about the GC3:  
[www.greenchemistryandcommerce.org](http://www.greenchemistryandcommerce.org)

