Materials & Chemicals
Cradle to Cradle® Innovations
Rethinking the way we make things

28th June 2018, **fokus**kreislaufwirtschaft, CH-Zürich

EPEA Switzerland GmbH
Albin Kälin

EPEA: KNOWLEDGE TRUSTEE
Environmental Protection Encouragement Agency

EPEA Internationale Umweltforschung GmbH, D-Hamburg

SCIENCE

PROJECTIMPLEMENTATION

EPEA Switzerland GmbH, CH-Bäch/SZ

EPEA Core-Competences:

- Material Assessment
- Search for Material Alternatives
- Focus on Industrial Material Streams
- Network Management
- Supply Chain Management

Roles: Knowledge & Innovation Trustee

EPEA SWITZERLAND TEAM:
FOCUS ALPINE REGION & TEXTILES WORLDWIDE

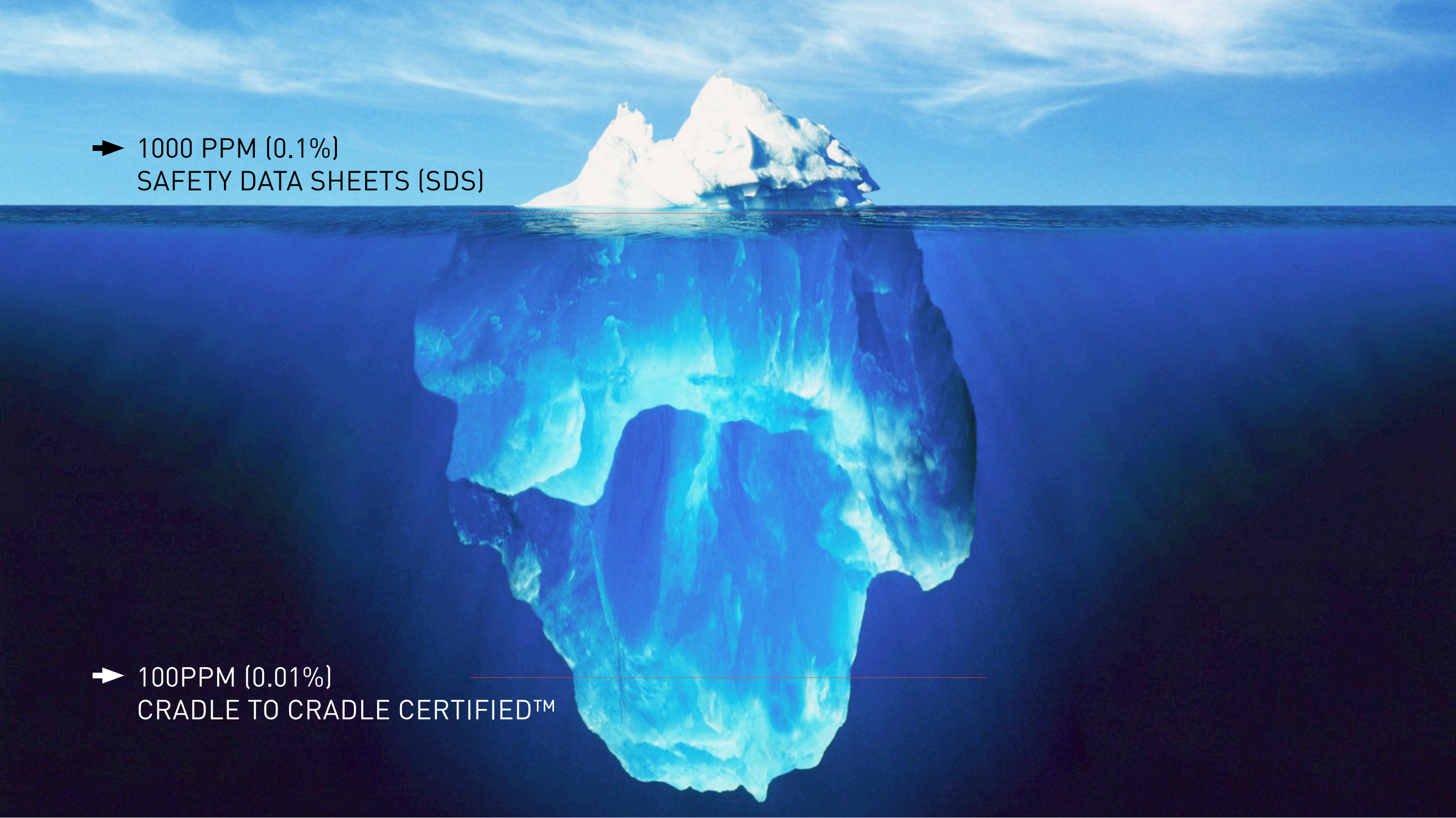
Belgium	Per Bondesen
Germany	Gerhard Havranek
Italy	Fabio Terragni Gianluca Sala Michael Zangara
Japan	Tsuyoshi Kuroda Yutaka Kitamaru
Austria	Lukas Merckens Rainer Rosegger Reinhard Backhausen Tammo Trantow Werner Erhart
Switzerland	Albin Kälin Laurent Maeder Walter Eschenmoser
Slovenia	Marko Krainer
Hungary	Mate Kriza

EPEA
Dataplatform and Expertise

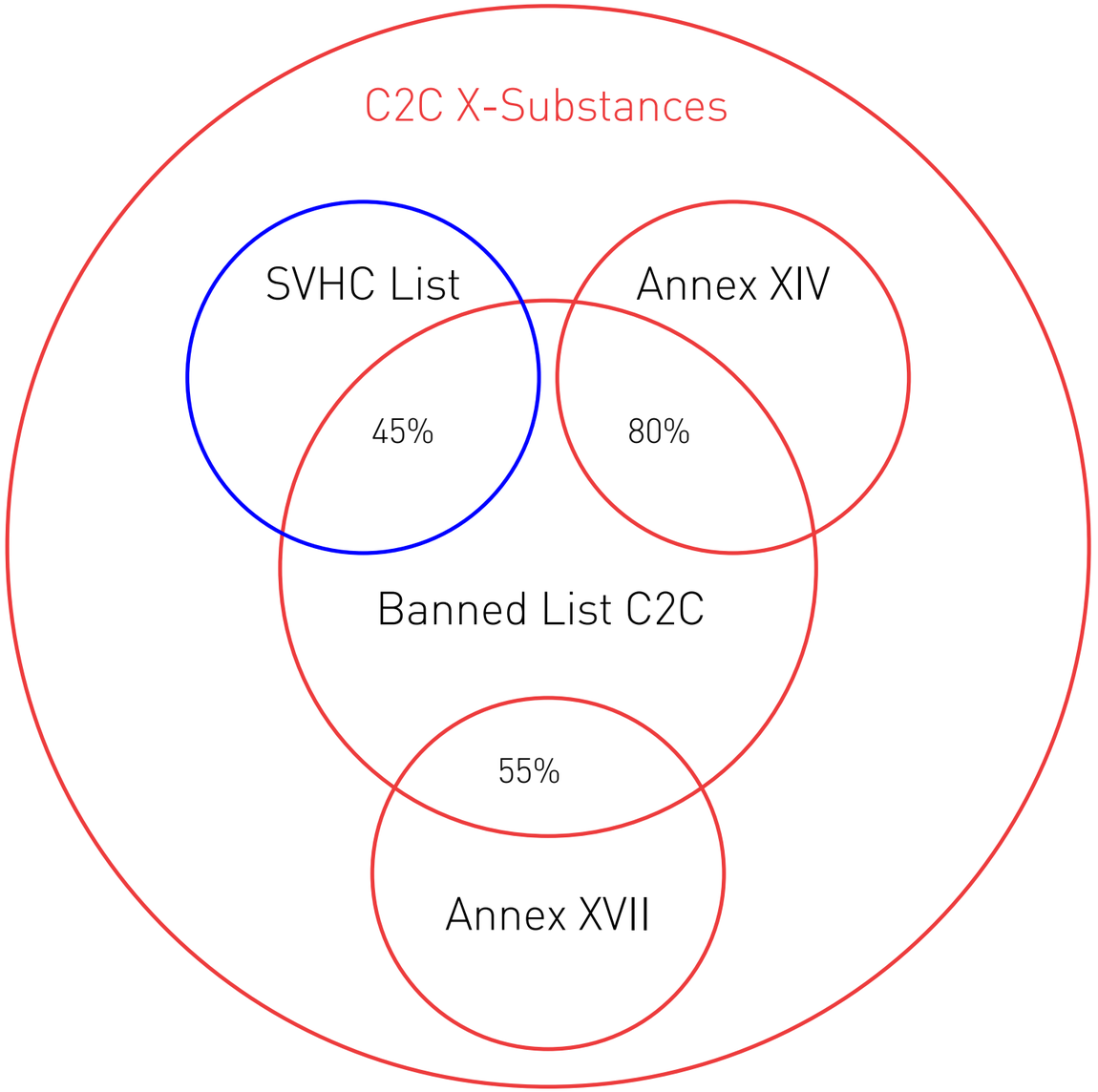
EPEA Dataplatform confidential most under NDA

- app. 200.000 defined chemicals and registered chemicals
- app. 9.500 Products
- continuously updated
- high level of risk prevention related to current scientific results and studies
- more than „compliance“, anticipation of future regulations e.g. REACh

USP: Cradle to Cradle® Assessment view incorporates production and after use phase


1000 PPM (0.1%)
SAFETY DATA SHEETS (SDS)
100PPM (0.01%)
CRADLE TO CRADLE CERTIFIED™

CRADLE TO CRADLE AND REACH



IDENTIFING THE BEST MATERIALS:
ABC-X CATEGORISATION

Goal: Best quality of raw materials, chemicals and ingredients

Category	Description
A	The material is ideal from a Cradle to Cradle perspective for the product in question.
B	The material supports largely Cradle to Cradle objectives for the product.
C	Moderately problematic properties of the material in terms of quality from a Cradle to Cradle perspective are traced back to the ingredient. The material is still acceptable for use.
X	Highly problematic properties of the material in terms of quality from a Cradle to Cradle perspective are traced back to the ingredient. The optimization of the product requires phasing out this ingredient or material.
GREY	This material cannot be fully assessed due to either lack of complete ingredient formulation, or lack of toxological information for one or more ingredients.
Banned	BANNED FOR USE IN CERTIFIED PRODUCTS This material contains one or more substances from the Banned list and cannot be used in a certified product.

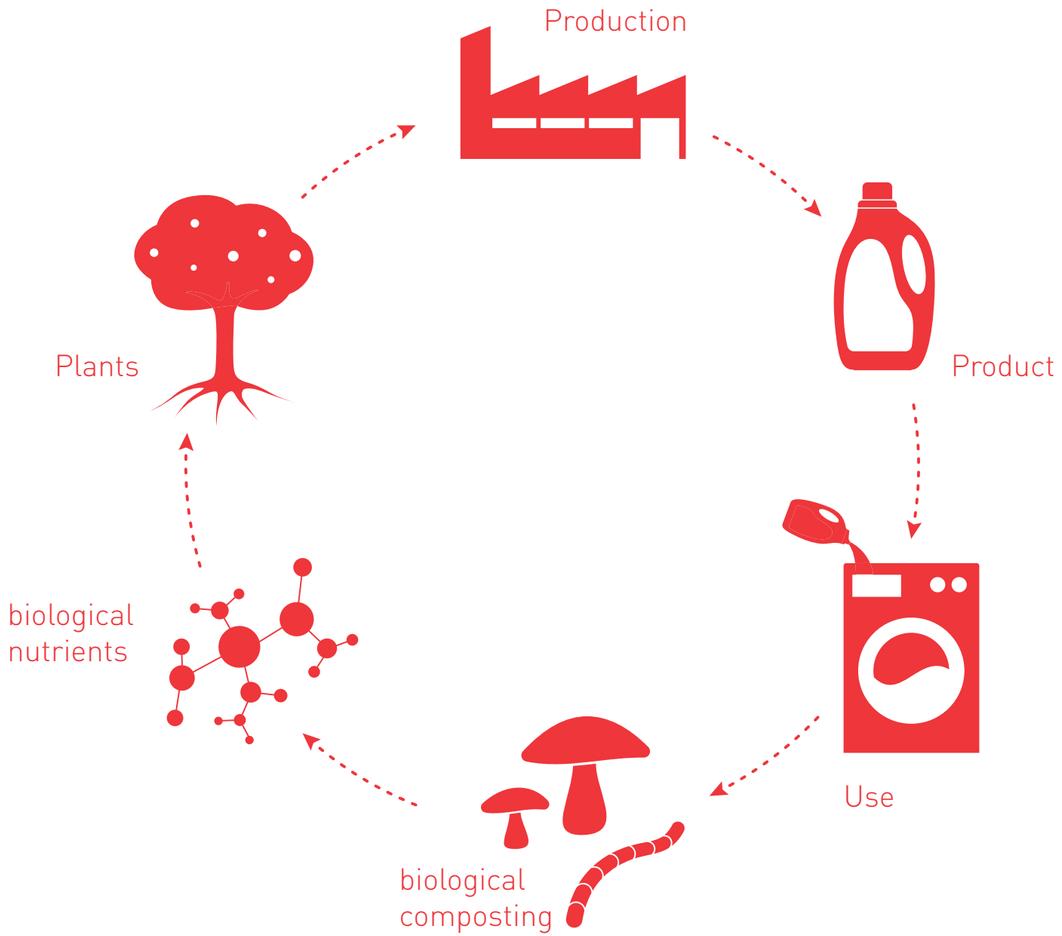
EPEA ASSESSMENT METHODOLOGY

			Green	Yellow	Red	Grey	Some possible sources:
Group I	Carcinogenicity		Not known or suspected; not mutagenic	-	Known or suspected	Not classifiable, No mutagenicity data	MAK, IARC, ACGIH, NTP, EPA, MSDS, IUCLID, EU-Risk phrases, Ecotox, Peer reviewed literature, QSAR, OECD tests
	Mutagenicity		No positive mutagenicity tests in Prokaryotic and Eukaryotic tests	-	Positive mutagenicity tests at Concentration < 0,1 mmol/l	nda(*)	
	Disturbance of fertility and foetal development		Not a known or suspected endocrine disruptor; reproductive toxin or teratogenic substance	Equivocal information	Known to be an endocrine disruptor, a reproductive toxin or a teratogenic substance		
	Chronic toxicity	Terrestrial mammals	NOAEL > 100 mg/kg bw	><	High chronic toxicity		
		Fish	NOEC > 10 mg/l	><	NOEC < 1 mg/l		
		Aquatic invertebrates	NOEC > 10 mg/l	><	NOEC < 1 mg/l		
		Aquatic plants	NOEC > 10 mg/l	><	NOEC < 1 mg/l		
Group II	Irritation of skin/mucous membranes		Mild or no irritant	Mild to moderate irritant	Severe irritation, risk of severe burns and serious damages to eyes		
	Sensitisation		Not sensitising to skin or airways	><	Listed in peer reviewed literature		
	Acute toxicity	Terrestrial mammals	LD50 oral/dermal > 2000 mg/kg bw	><	LD50 oral/dermal < 200 mg/kg bw		
		Fish	LC50 > 100 mg/l	><	LC50 < 10 mg/l		
		Aquatic invertebrates	EC50 > 100 mg/l	><	EC50 < 10 mg/l		
		Aquatic plants	EC50 > 100 mg/l	><	EC50 < 10 mg/l		
Group III	Biodegradation		Readily biodegradable 50% degraded after < 30 days in water or < 90 days in soils	Moderately biodegradable 50% degraded after 30-60 days in water or 90-180 days in soils	Incomplete or no degradation 50% not degraded after > 60 days in water or > 180 days in soils		
	Bioaccumulation		BCF < 30 CT50 < 3 Days Log Kow < 2	><	BCF > 100 CT50 > 6 Days		

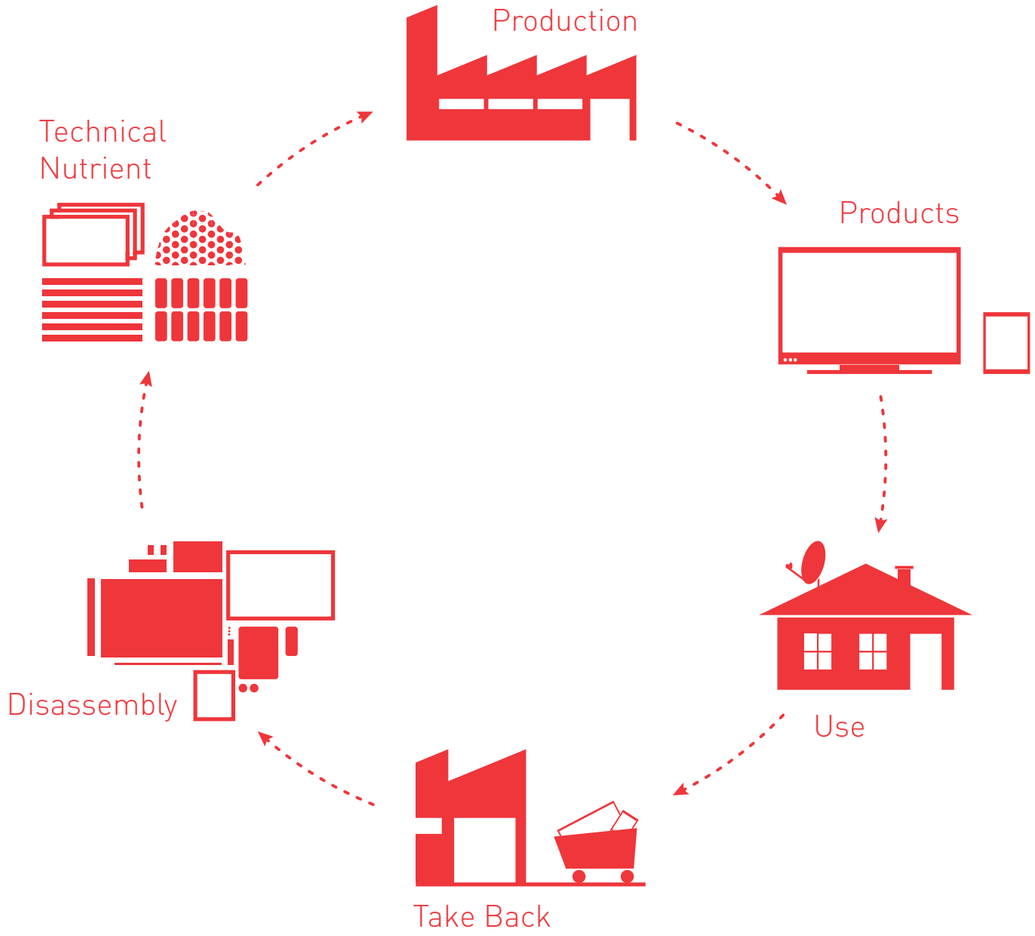
(*): No data available

CLOSING THE LOOP:
DESIGN BEYOND PRODUCTDESIGN

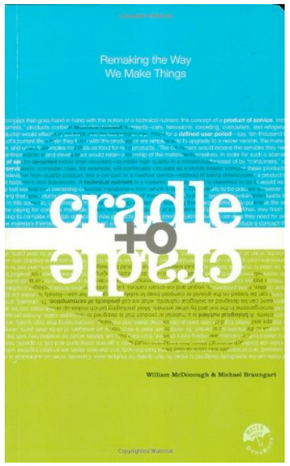
Consumer Goods in BIOLOGICAL SYSTEMS



Service Products in TECHNICAL SYSTEMS



EVOLUTION OF CRADLE TO CRADLE CERTIFIED™



CERTIFIED™
cradletocradle
PRODUCTS PROGRAM

CRADLE TO CRADLE
PRODUCTS
INNOVATION
INSTITUTE

CERTIFIED™
cradletocradle
PLATINUM
GOLD
SILVER
BRONZE
BASIC

2002 — Publication of Cradle to Cradle: Remaking the Way We Make Things

2005 — MBDC creates certification programme **Version 1.0**

2009 — **Version 2.1 launched**

2010 — Institute founded

2012
- Certification Standards Board created
- Additional assement body trained

2013 — **Version 3.0 launched**

2014 — Public standard revision process launched

2018 — **Version 4.0 launch**

CRADLE TO CRADLE CERTIFIED™ CERTIFICATION
CATEGORIES BASED ON PRINCIPLES

EPEA SWITZERLAND

CERTIFIED cradletocradle ACCREDITED ASSESSOR

	Material Health	Material Reutilization	Renewable Energy	Social Fairness	Water Stewardship
	Select safe and healthy materials and chemicals	Eliminate the concept of waste and design for endless re-use	Power operations with abundant clean and renewable energy	Support and celebrate human and natural systems	Protect and steward water as a precious resource
CERTIFIED CM cradletocradle	PRODUCTS PROGRAM				
CERTIFIED TM cradletocradle	BASIC	BASIC	BASIC	BASIC	BASIC
CERTIFIED TM cradletocradle	BRONZE	BRONZE	BRONZE	BRONZE	BRONZE
CERTIFIED TM cradletocradle	SILVER	SILVER	SILVER	SILVER	SILVER
CERTIFIED TM cradletocradle	GOLD	GOLD	GOLD	GOLD	GOLD
CERTIFIED TM cradletocradle	PLATINUM	PLATINUM	PLATINUM	PLATINUM	PLATINUM

CRADLE TO CRADLE CERTIFIED™

- no chemical in product listed on banned list of chemicals
- > 100 ppm Material Health Assessment
- phase out plan for optimization
- > 75 % BRONZE, >95% SLIVER (100% biological cycle), 100 % GOLD, 100% + Process Chemicals PLATINUM

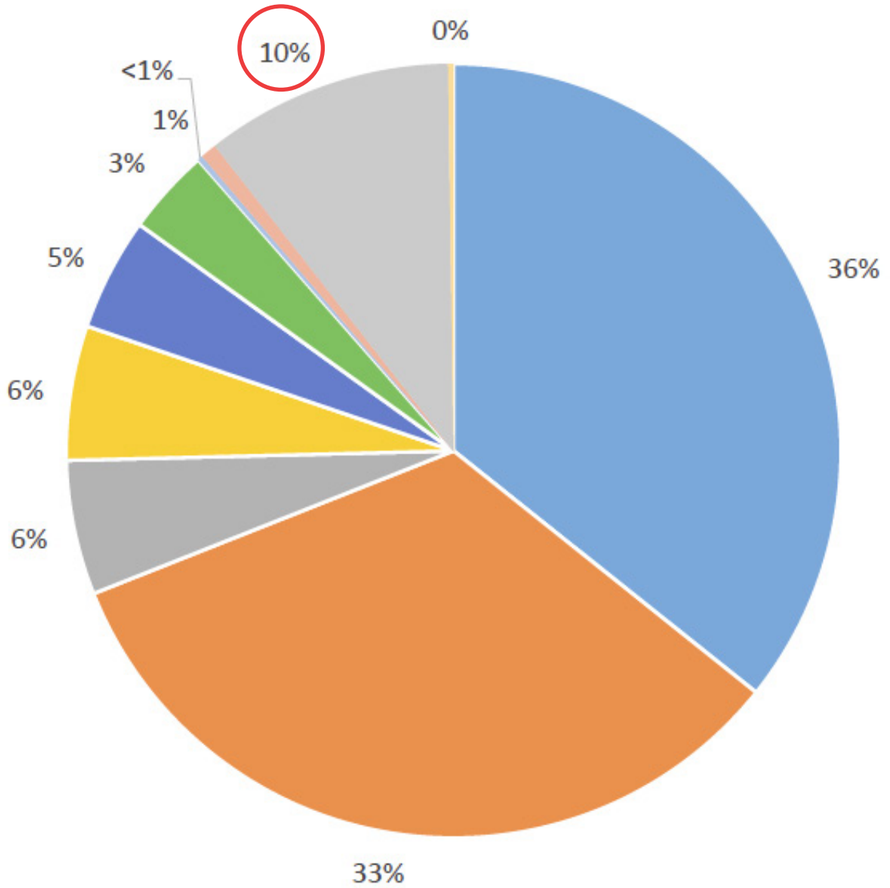
- Products designed for biological or technical cycles
- Products with rapdidly renewable or recycled content
- Material Reutilization Score >35 BRONZE, >50 SILVER, >65 + nutrient management GOLD, 100% PLATINUM

- SILVER 5% renewable energy and carbon CO2 offset
- GOLD 50% renewable energy and carbon CO2 offset
- PLATINUM 100% + 50% supply chain renewable energy and carbon CO2 offset

- 2 years no significant violations with wastewatertreatment BASIC, BRONZE water audit complete
- SILVER process chemicals characterized or 20% tier 1 suppliers + impact strategy
- GOLD all chemicals in effluent optimized. Tier 1 suppliers optimized. PLATINUM drinking water quality

- BASIC streamline self audit, BRONZE UN Global Compact signed
- SILVER 25% certified materials or supply chain relevant issues or innovative social project
- GOLD 2 of the SILVER requirements are complete, PLATINUM all 3 are complete + 3 party audit SA 8000 or other

CRADLE TO CRADLE CERTIFIED:
PRODUCT TYPES



- Building Supply & Materials
- Interior Design & Furniture
- Materials for Product Designers
- Packaging & Paper
- Fashion & Textiles
- Health & Beauty
- Auto & Tires
- Toys
- Home & Office Supply
- Baby

United States
Environmental Protection
Agency

US EPA Recommends C2C Certified product standard

The Cradle to Cradle Certified Product Standard has been recognized by the United States EPA in its new recommendationsof standards and and ecolabels for federal sustainable purchasing.

THE FIRST CRADLE TO CRADLE® PRODUCT

CLIMATEX (1993)

climatex®

CERTIFIED
cradle to cradle
GOLD

CHEMICAL INDUSTRY
TANATEX CHEMICALS

Bleaching	Biopolishing	Vat dyeing	Postscouring	Softening
Stabilizer Detergent	Enzyme	Levelling agent, Sequestrant, Lubricant, Defoamer	Postscouring agent	Softener
	Bleaching	Vat dyeing	Postscouring	Softening
	Stabilizer Detergent	Levelling agent, Sequestrant, Lubricant, Defoamer	Postscouring agent	Softener
			OBA Bleaching	Softening
			Stabilizer, Detergent, OBA	Softener

Cradle to Cradle® system integrated chemical solutions
for cellulosic fibres – vat + reactive dyeing processes


BAUWERK®
Parkett
Bauwerk Parquet is the first Parquet
Cradle to Cradle Certified™ Gold
CERTIFIED
cradletocradle
GOLD

giroflex

Materialvalue
CHF 35
(2010)

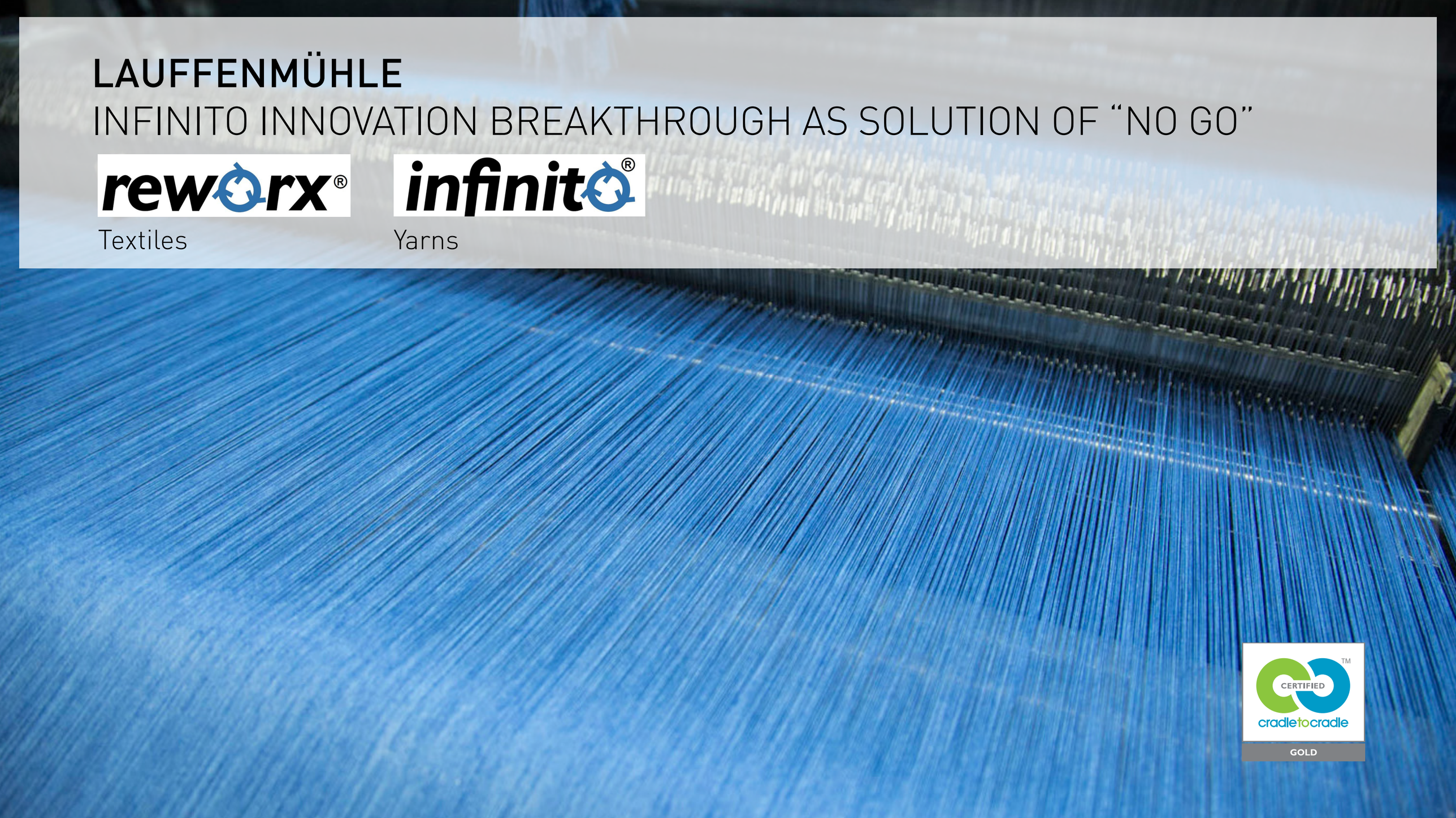
CERTIFIED
cradletocradle
SILVER

LAUFFENMÜHLE

INFINITO INNOVATION BREAKTHROUGH AS SOLUTION OF “NO GO”

reworx®
Textiles

infinito®
Yarns



WOLFORD

Wolford

WOLFORD + TEXTILE CONSORTIUM AUSTRIA
app. 13% of Austrian Textile Industry

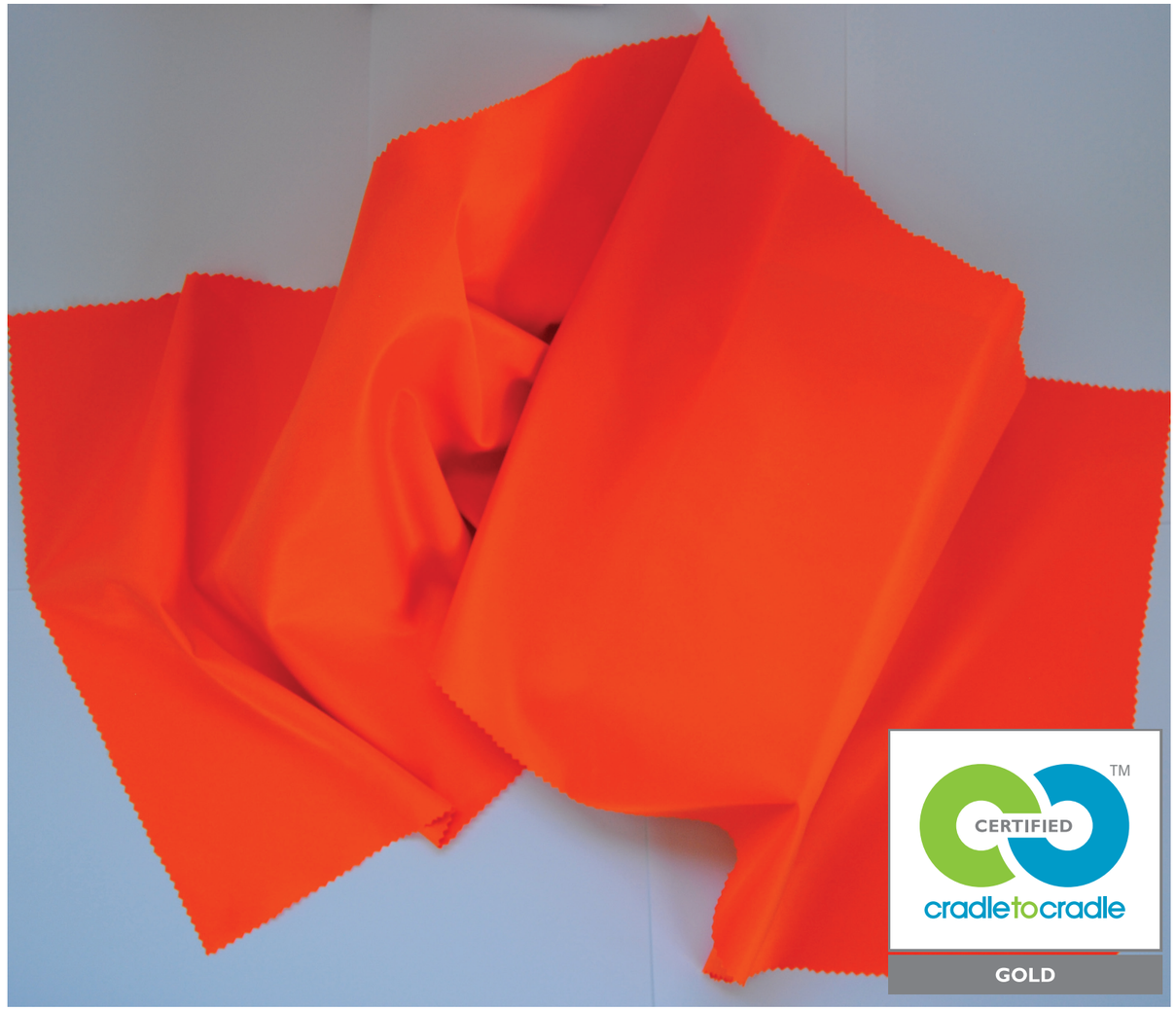
PFISTER: DIGITALIZATION WITHIN A CIRCULAR ECONOMY

Digitalisierung und Kreislaufmanagement der Pfister Vorhang Service AG mit Cradle to Cradle Certified™ GOLD zertifizierten Vorhängen

Funktion	Manuelle Prozesse	Digitalisierung									
Phase 1	**Step 1**		**Step 2**		**Step 3**		**Step 4**			**Step 5**	**Step 6**
Markt-abklärungen durch Konsumenten	Konsumenten Information über Ausstellung, Datenbank, Medien, Werbung. ---------- Konsument zeigt Interesse an Vorhängen		Beratungs-optionen für Konsumenten		Erfassung Kunden-anfrage		Codierung: IT generiert Anfragen im System zentral			Digitale Erstellung Angebot mit Labtop vor Ort beim Kunden mit individuellen Fenstermassen, Sonderwünschen Codierung für Montage bereits erfasst	Digital erstellter Kaufvertrag drucken vor Ort, Unterzeichnung durch Kunden, scannen vor Ort. Rückkaufangebot nach Nutzung integriert
			Optionen		Optionen		Option 1	Option 2	Option 3		
Beratung des Konsumenten			Besuch Pfister Möbelhäuser oder Bestellung Muster online, 24 Std nach Hause		Pfister Verkäufer		Konsument bestellt direkt online	Konsument bestellt direkt im Geschäft	Zuteilung Kunden an regionale Wohnberater		
Kauf-entscheidung			Wünscht Wohnberatung zu Hause		Pfister Wohnberater				Festlegung Beratungstermin - telefonisch - Email SMS, Whatsapp		
			Online		Konsument Online				Beratung vor Ort		
Phase 2	**Step 1**		**Step 2**		**Step 3**		**Step 4**			**Step 5**	**Step 6**
Produktion des Auftrages	Beschaffung		AVOR Produktion des Auftrages		Produktion des Auftrages		Versand und Montage vor Ort			Montage vor Ort	Freigabe Kunde
	Disposition Textilien, Zubehörteile IT generiert		Produktionsauftrag generiert durch IT		Bereitstellung Textilien und Zubehörteile IT Papiere		IT informiert Produkt zum Versand			Bestätigung Montage vor Ort, IT generiert Rechnung an Kunden	Bezahlung Rechnung durch Kunden
	Wareneingang IT generiert		Prüfung und Freigabe durch Produktionsleiter		Codierung Auftrag und alle Materialien		Termindisposition Lieferung und Montage			IT Schnittstelle mit Finanzbuchhaltung	Abbuchung Zahlung Rechnung IT
	Zahlungen Lieferanten IT generiert		Disposition Textilien, Zubehörteile IT - ab Lager - Neubestellung		Produktion der Vorhänge		Montage-informationen beim Kunden übertragen vom Kundenauftrag IT an APP Mobile Montageteam				
	Lagerverwaltung IT		Prüfung Liefertermin IT		Kontrolle der Vorhänge						
	Abbuchung Warenentnahmen IT		Bestätigung Liefertermin an Kunden IT		Kommissionierung des Auftrages						
	Nach-/Neu-bestellung Textilien, Zubehörteile IT		Erstellung Produktionspapiere IT		Freigabe der Vorhänge IT						
	Freigabe Nach-/Neubestellung										
Phase 3	**Step 1**		**Step 2**		**Step 3**		**Step 4**			**Step 5**	**Step 6**
Nutzungsphase und Rückgabe	Kunden-zufriedenheit		After Sales Service Dienstleistungen		Nutzungsphase		Ende Nutzungsphase			Lieferung an Pfister zentrale Stelle	Industrielle Kompostierung -Biogas Erzeugung Humus für Landwirtschaft
	Rückfragen des Kunden		Reinigungs- und Waschservice		Produkte sind im IT System erfasst: Adresse, jedes Fenster, Masse, Artikel		Einlösung des Rückkaufangebotes			Verifizierung und Freigabe für industrielle Kompostierung	Verifizierung und Quittierung IT System
	Reklamationen		Demontage / Montage				Verifizierung und Freigabe IT System			Logistik, Lagerung für industrielle Kompostierung	
			Abholung / Lieferung				Demontage vor Ort				
							Abholung				
							Freigabe Gutschein oder Überweisung IT generiert				
							Überreichung Gutschein oder Überweisung Geld auf Kundenkonto				

LAUFFENMÜHLE INNOVATION:
“VINATUR” OUTDOOR FABRICS (PATENT PENDING)

Lauffenmühle®
textile innovation



BAYONIX:
“BOTTLE, FOOD CONTACT ARTICLES”

FROSCH CLEANING DETERGENT

Pioniers in Europe

Frosch Cleaning Detergents are the first Cradle to Cradle Certified™ Gold Level!

GREEN CARE PROFESSIONAL

Professionelle Cleaning at
Cradle to Cradle Certified™ Gold Level

green care®
PROFESSIONAL

CERTIFIED
cradle to cradle
GOLD

PRODUCT EXAMPLE: JOGHURT PACKAGING

- 150 ingredients at 100 ppm level (0.01%).
- substances detected which are banned in the textile industry for more than 20 years.

Cover

- Aluminium
- Printing Inks
- Top Lacquer
- Ground Lacquer
- Sealing Lacquer
- Binder
- Pigments
- Photoinitiatores
- Additives

Cup

- Plastics
- Additives
- Pigments
- Fillers
- Labels
- Printing Inks

ASSESSMENT EXAMPLE OF ONE COLOR INGREDIENT

BRONZE LEVEL

.	CAS-Number	Description	Function	abcx	abcx comment	Conc %/ ppm
1	7732-18-5	Water		b		65-75
2	0815-55-7	Resin		b	No major concern expected with this polymer.	20-40
3	777-44-2	Lala Acid Ester		c	Moderate to high aquatic toxicity but biodegradable under aerobic and anaerobic conditions. The degradation product might exhibit reproductive toxicity; the issue is currently under regulatory discussion. Causes serious eye damage/eye irritation (H318), moderate skin irritation (H315), moderate oral toxicity -Not expected to reach the environment in this use scenario, minor exposure to end users, and adequate protection of workers.	5-10
4			Pigment	grey	unbekannt	0-3
5			Solvent	grey	unbekannt	0,5-5
6	4711-23-6	Pigment	Pigment	x	Halogenated organic compound, contains copper. Loss of the scarce resource Cu.	1
7	4712-34-1	Colora 5	Pigment	b	Chinacridon-Derivat	2
8	22-33-45454	"1,2-Conservodol	Preservative	c	Generally sensitization potential. Considered EXPOSURE very limited (very small amounts). Severely toxic for aquatic organisms, slowly aerobically biodegradable and not bioaccumulative.	ca. 100 ppm
9	11-22-232	"1-halo-3-phantasto-diol"	Preservative	x	Halogenated preservative. Sensitizer (BfRCat B; Mak Sh), high oral and dermal toxicity. Highly toxic to aquatic organisms, but expected to degrade at low concentrations. High amounts of this preservative are not expected to enter water streams sistematicallyin this use scenario.	200 ppm
10	7777-2-33	Iron (23)-dingstat	Drying accelerators	x	CMR: According to REACH considered reprotoxic(H316).	200 ppm

- Banned List conformity
- < 75% bewertet
- 3 X-assessments, of which 1 CMR

Substitution of laminated packaging

Sustainable pouch packaging

Targets

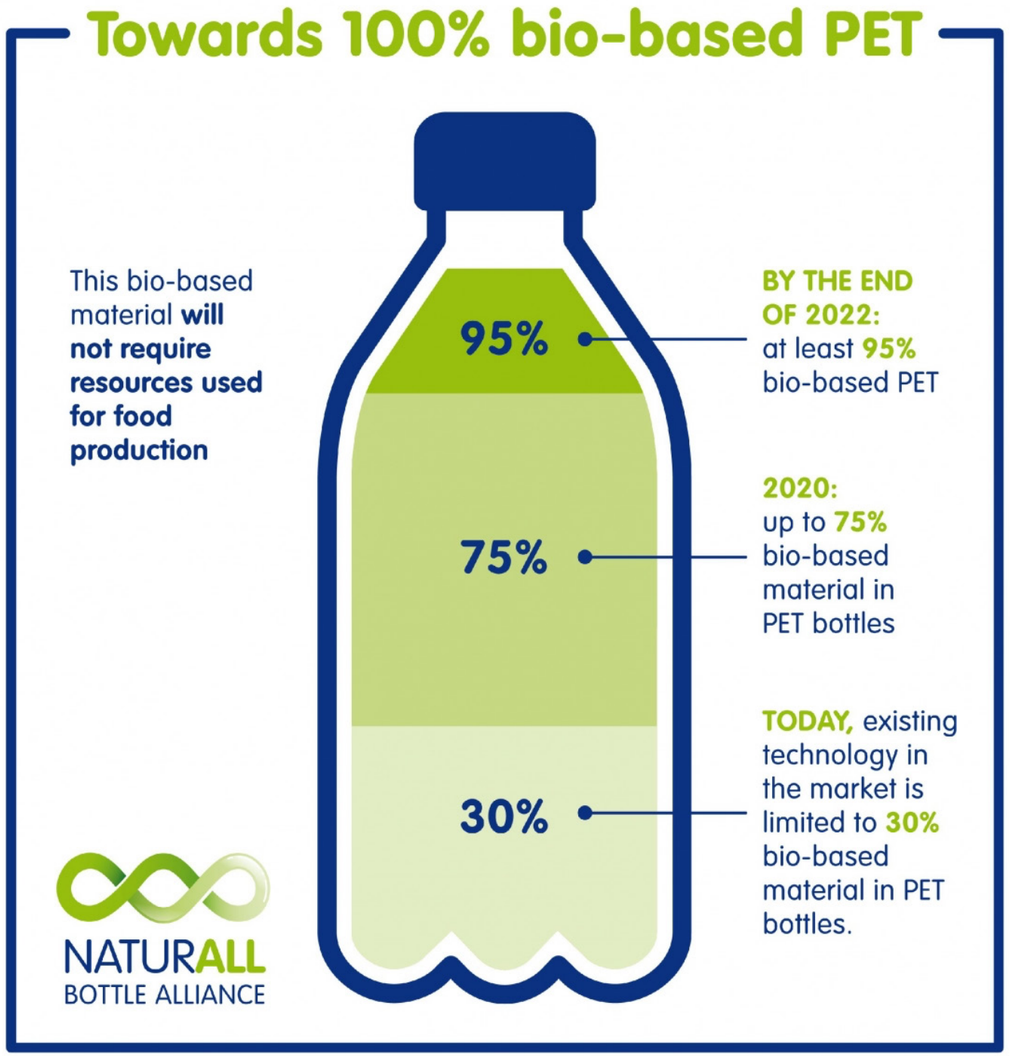
- Development of a verifiable **sustainable and recyclable film materials** suitable for **stand-up pouches**
- Realization of recyclability and **separability** of **pouch material** and **decoration**
- Substitution of existing **laminate**

Status

- Development of a stand-up pouch concept in cooperation with **Mondi Consumer Packaging Technologies GmbH**
- **Cradle-to-Cradle®-approach** supported by **EPEA Switzerland**
- Submission of different **patents**

Trending (7th March 2017):

Danone, Nestlé Move Towards Circularity with Bio-Based PET Bottles



NEWS, JANUARY 16, 2017

Industry endorses plan to recycle 70% of plastic packaging globally.
There could be more plastic than fish in the ocean by 2050.

NEW PLASTICS ECONOMY
CATALYSING ACTION

ELLEN MACARTHUR FOUNDATION

NEW PLASTICS ECONOMY

PRINTING INKS ARE THE GOAL FEASIBILITY ?

Material Health

GOLD

SIEGWERK PRINTING INKS FOR PAPER, PE, PP

SIEGWERK

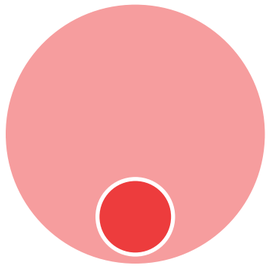
Material Health

GOLD

May 2017

EXPORT OF E-WASTE:
ELECTRONIC GOODS AS TECHNICAL NUTRIENT

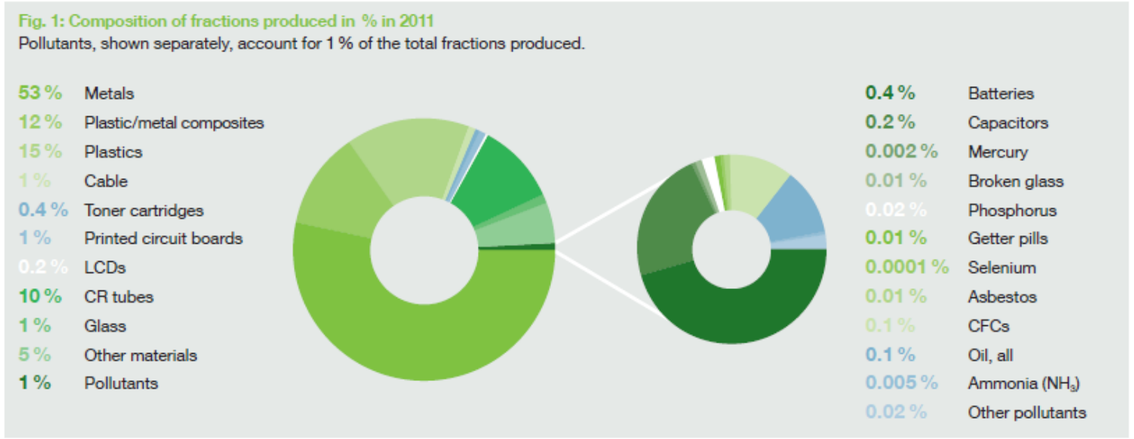
E-Waste generated Worldwide in 2009



53 Mio Tons

13 % were Recycled

e.g. Search Field SENS – Switzerland



The table from the report of the technical inspectorate SENS, SWICO Recycling, SLRS 2011 indicates the complexity of todays systems. 75% materials of electronics and electronic goods are reused. 50% metals, 25% plastics mostly thermal recycled. However 25% of waste remains and offers potential. The Cradle to Cradle approach improves the quality of rawmaterials in the closed loop and has the goal to eliminate waste.

ELECTRONIC GOODS:
TODAY`S RESOURCE CYCLE

SENS eRecycling

Contract
Revision

Import Agent

RETAIL

Manufacturer

Component
Suppliers

Rawmaterial Mining

Material Flow

SENS
Platform

CONSUMER

e-recycling.ch

Collection Point

Recycler

Recycler II

Destruction

Contract
Characteristics
Controling

ELECTRONIC GOODS:
SEARCH FIELD CRADLE TO CRADLE® MATERIAL CYCLE

SENS eRecycling

Education

RETAIL

Contract
Revision

Import Agent

Design- + Processmodificaton

Manufacturer

Component
Suppliers

Rawmaterial Processing

Design- + Processmodificaton

Rawmaterial Mining

Material Flow

SENS
Platform

CONSUMER

e-recycling.ch

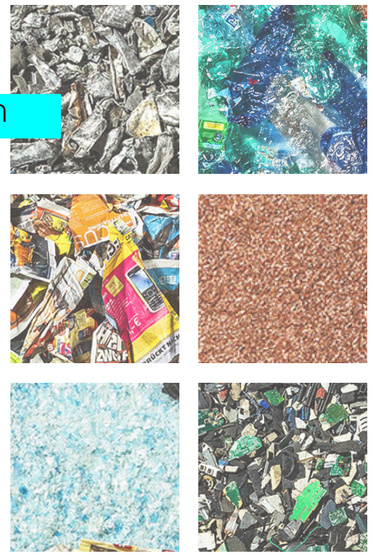
Collection Point

Processmodificaton

Recycler / C2C

Recycler II

Destruction



Contract
Characteristics
Controling

European Commission

01.-02.12.2014

17th European Forum on Eco-innovation

11:30 - 12:45

Session 2: The practical challenges and opportunities of transformation

Keynote presentations highlighting:

- Barriers to be o vercome
- Old industry , new industry and disruptive technologies
- Example of holistic analysis of transf ormation within a sector
- ***Policy and financial supports***

Stéphane Hocquet[6], Deputy Sub-director of Integration of Sustainable Development by economic actors, Ministry of Ecology, Sustainable Development and Energy
Albin Kälin[7], *Chief Executive Officer,* Environmental Protection Encouragement Agency (EPEA) International Research, Switzerland GmbH
Cyril Kretzschmar [8], Vice-president for social and solidarity economy,Rhône-Alpes Region

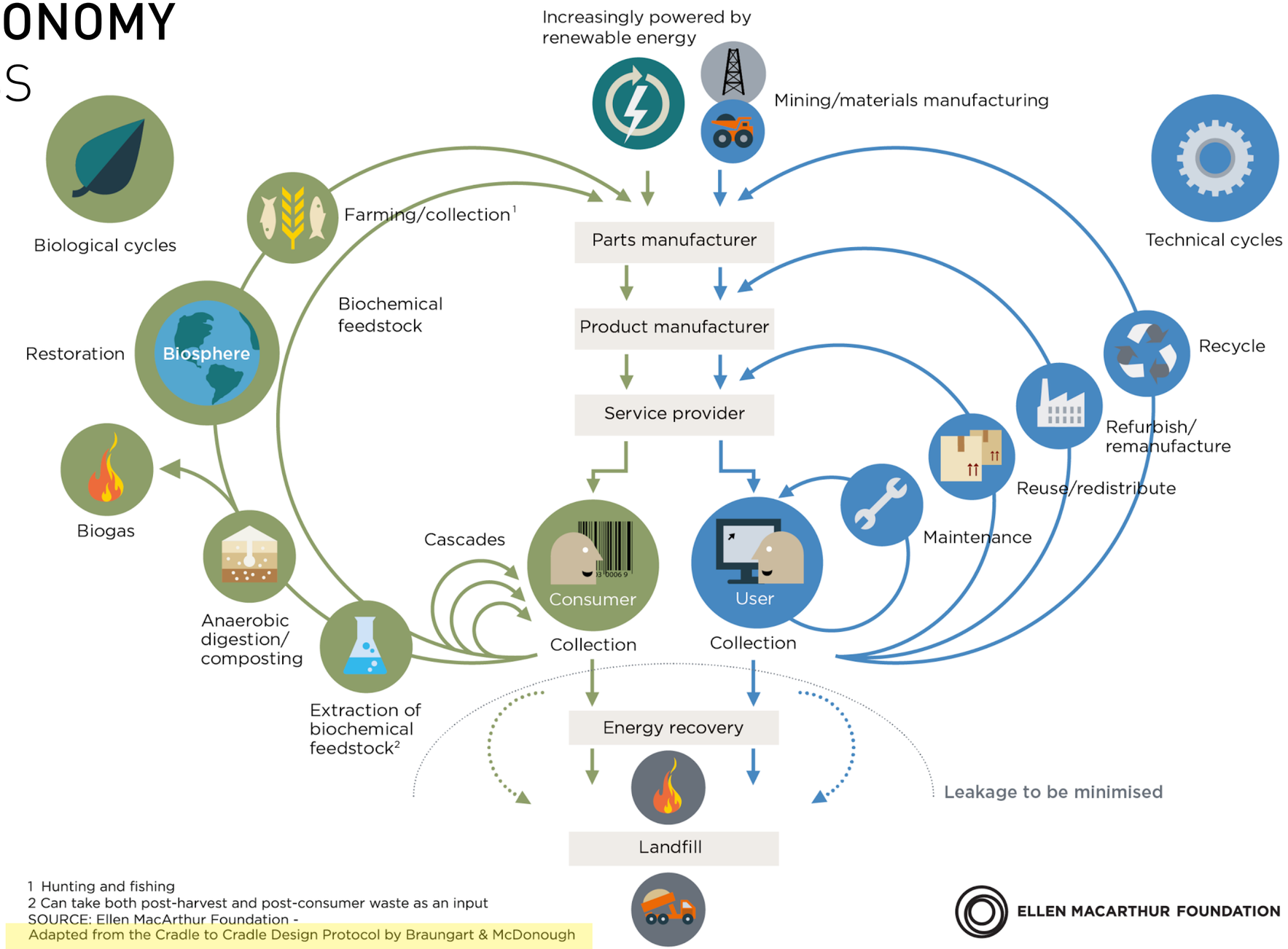
CLOSING THE LOOP
AN EU ACTION PLAN FOR THE CIRCULAR ECONOMY

European Commission

The revised legislative proposals on waste set clear targets for reduction of waste and establish an ambitious and credible long-term path for waste management and recycling. Key elements of the revised waste proposal include:

- A common EU target for recycling 65% of municipal waste by 2030;
- A common EU target for recycling 75% of packaging waste by 2030;
- A binding landfill target to reduce landfill to maximum of 10% of all waste by 2030;
- A ban on landfilling of separately collected waste;
- Promotion of economic instruments to discourage landfilling ;
- Simplified and improved definitions and harmonised calculation methods for recycling rates throughout the EU;
- Concrete measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material;
- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes (eg for packaging, batteries, electric and electronic equipments, vehicles).

CIRCULAR ECONOMY
FOR BUSINESS



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input
SOURCE: Ellen MacArthur Foundation -
Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough

ELLEN MACARTHUR FOUNDATION

EPEA SWITZERLAND GMBH

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Cradle to Cradle® Products Innovation Institute

http://c2ccertified.org